United States Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine

Importation of Guava, *Psidium guajava*, from Mexico into the United States

A Pathway-initiated, Commodity Risk Analysis

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Executive Summary

The first part of this document presents results of an analysis of the risks associated with the importation, from Mexico into the United States, of fresh fruit of guava, *Psidium guajava* L. A search of the scientific literature, other sources of information, and APHIS, PPQ port interception records identified 26 quarantine pests of *P. guajava* that occur in Mexico and that could be introduced into the United States in consignments of that commodity.

The *Consequences of Introduction* were estimated 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. The *Likelihood of Introduction* was estimated 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. The two values were summed to estimate an overall *Pest Risk Potential*, which is an estimation of 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.

Risks associated with the introduction of quarantine pests of guava from Mexico.

Pest	**Consequences of Introduction**	**Likelihood of Introduction**	**Pest Risk Potential**
Acari—Tetranychidae			
Oligonychus biharensis (Hirst)	High	Medium	Medium
Oligonychus psidium Estébanes & Baker	Medium	Medium	Medium
Coleoptera—Curculionidae			
Conotrachelus dimidiatus Champion	Low	Medium	Medium
Conotrachelus psidii Marshall	Low	Medium	Medium
Diptera—Tephritidae			
Anastrepha bahiensis Lima	Medium	High	High
Anastrepha fraterculus Wiedemann	High	High	High
Anastrepha ludens (Loew)	High	High	High
Anastrepha obliqua (Macquart)	High	High	High
Anastrepha serpentina (Wiedemann)	High	High	High
Anastrepha striata Schiner	High	High	High
Ceratitis capitata (Wiedemann)	High	High	High
Homoptera			
Aleyrodidae			
Aleurodicus dispersus Russell	High	Medium	Medium
Aleurodicus maritimus Hempel	Medium	Medium	Medium
Aleurodicus pulvinatus (Maskell)	Medium	Medium	Medium
Tetraleurodes truncatus Sampson & Drews	Low	Medium	Medium

Pest	**Consequences of Introduction**	**Likelihood of Introduction**	**Pest Risk Potential**
Coccidae			
Coccus viridis (Green)	High	Medium	Medium
Pseudococcidae			
Dysmicoccus neobrevipes Beardsley	High	Medium	Medium
Maconellicoccus hirsutus (Green)	High	Medium	Medium
Nipaecoccus viridis (Newstead)	High	Medium	Medium
Phenacoccus psidiarum Cockerell	Low	Medium	Medium
Planococcus minor (Maskell)	High	Medium	Medium
Pseudococcus solenedyos Gimpel & Miller	Medium	Medium	Medium
Lepidoptera—Tortricidae			
Gymnandrosoma aurantianum Lima	High	High	High
Fungi			
Mycovellosiella psidii Crous	Low	Medium	Medium
Pestalotiopsis psidii (Pat.) Mordue	Medium	Medium	Medium
Sphaceloma psidii Bitancourt & Jenkins	Medium	Medium	Medium

Having identified the pest risks involved in the importation of guava fruit from Mexico, the document proceeds to a discussion of risk management options. Following are some mitigatory measures that may be considered to reduce the potential risks associated with the quarantine pests of concern:

- production of guava for export within pest-free areas or areas of low pest prevalence in the states of Aguascalientes and Zacatecas only
- mechanical, chemical, and cultural pest control programs in guava orchards
- program oversight by U.S. officials
- field and phytosanitary inspection, sampling, and testing procedures during the production season
- packinghouse procedures and quarantine treatments to disinfest fruit
- consignments traceable to place of origin
- point-of-entry sampling and inspection
- limits on distribution and transit within the United States

This document identifies and evaluates risks and discusses known risk mitigations. It does not seek to prescribe specific measures or a particular systems approach, as would be outlined in a formal work plan, nor does it attempt to assess the adequacy of a particular measure or systems approach in reducing risk in the present case.

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1. Introduction

This risk assessment has been prepared by the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), Center for Plant Health Science and Technology (CPHST), Plant Epidemiology and Risk Analysis Laboratory (PERAL) to examine plant pest risks associated with importation into the United States of fresh fruit of guava, *Psidium guajava* L., from Mexico. Estimates of risk are expressed in terms of high, medium, or low. The risk assessment is *pathway-initiated* in that it is based on the potential pest risks associated with the commodity as it enters the United States.

The International Plant Protection Convention (IPPC) of the United Nations Food and Agriculture Organization (FAO) provides guidance for conducting pest risk analyses. The methods used to initiate, conduct, and report this pest risk analysis are consistent with guidelines provided by the FAO (IPPC, 1996a). Biological and phytosanitary terms (e.g., *introduction*, *quarantine pest*) conform with those outlined in International Standards for Phytosanitary Measures Publication No. 5, "Glossary of Phytosanitary Terms" (IPPC, 2002a).

The IPPC defines *pest risk assessment* as "Determination of whether a pest is a quarantine pest and evaluation of its introduction potential;" *quarantine pest* is defined as "A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled" (IPPC, 1996a). Thus, pest risk assessments should consider both the consequences and likelihood of introduction of quarantine pests. These issues are addressed in this document.

Pest risk assessment is one component of an overall pest risk analysis. The IPPC describes three stages in pest risk analysis (IPPC, 1996a): initiation, risk assessment, and risk management. This document satisfies the requirements of all three stages. Details of the methodology and rating criteria used in this document can be found in the publication "Guidelines for Pathway-Initiated Pest Risk Assessments, Version 5.02" (USDA, 2000).

Guava is believed to be native to the American tropics, the original distribution extending from southern Mexico into or through Central America (Morton, 1987). It is one of the leading fruits produced in Mexico. Production in 2000 totaled about 250,000 tonnes (González et al., 2002). In Mexico, the fruit is produced commercially in several states, including Aguascalientes, Colima, Guanajuato, Guerrero, Jalisco, México, Michoacán, Nayarit, Querétaro, Tabasco, and Zacatecas.

In the continental United States, guava is produced mainly in southern Florida (USF, 2000). There is also some production in California (Degner et al., 1997). Currently, about 120 ha are planted to guava in south Florida (Degner et al., 2002). International trade is limited to processed guava products (CABI, 2003).

Figure 1. Map of Mexico showing guava-producing states (source: http://www.lib.utexas.edu/maps/americas/ mexico_pol97.jpg).

2. Risk Assessment

2.1. Initiating Event: Proposed Action

This risk assessment was developed in response to a request by the México Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA) for USDA authorization to permit imports of fresh guava from Mexico into the United States. 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 Guava (*Psidium guajava* L.)

This step examines 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 guava.

Commodity: Guava (*Psidium guajava* L.) (Myrtaceae)

Phase 1: Guava is exotic to the United States. It is naturalized in Florida, Hawaii, Puerto Rico, the Virgin Islands (USDA, 2004a), and California (Morton, 1987). There are about 220 and 120 ha of commercial guava planted in Hawaii (NASS, 2004) and Florida (Degner et al., 2002), respectively.

Phase 2: Is the species listed in:

Yes	*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	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, 2003)
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: *Psidium guajava* is listed by Holm et al. (1979) as a weed of unknown importance in the United States. Randall (2002) lists *P. guajava* as a weed of the following statuses: *weed*, *sleeper weed*, *noxious weed*, *naturalized*, *introduced*, *garden escape*, *environmental weed*, and *cultivation escape*. However, the species is naturalized and is grown as a crop in Hawaii and Florida. Since guava already is established in the United States, the importation of fresh fruit from Mexico should not increase the plant’s weed potential beyond that existing at present. A pest-initiated pest risk assessment therefore is not necessary.

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

2.3.1. Decision History for *Psidium guajava* from Mexico and Central America

1991 – Deny entry from Mexico for lack of approved treatment for *Anastrepha* spp. and *Ceratitis capitata*.
1989 – Deny entry from Costa Rica for lack of approved treatment for *Anastrepha striata*.
1935 – Deny entry from Central American countries “as a matter of form to confirm and record a long established policy with respect to the entry of guavas.”

Currently, guava imports from Mexico are not authorized by 7 CFR §319.56. Pest interceptions at U.S. ports-of-entry on *Psidium guajava* from Mexico are summarized in Table 2.

Table 2. Pest interceptions on *Psidium guajava* from Mexico (1984-2004) (PestID, 2008).

Organism	**Plant Part Infested**	**Location of Interception**	**Purpose**	**Interceptions (no.)**
ACARI				
Tarsonemidae				
Tarsonemus sp.	Fruit	Baggage	Consumption	113
Tetranychidae				
Oligonychus sp.	Leaf	Baggage	Consumption	1
Tetranychus sp.	Fruit	Baggage	Consumption	5
COLEOPTERA				
Apionidae				
Apion sp.	Fruit	Baggage	Consumption	1
Bruchidae				
Zabrotes sp.	Fruit	Baggage	Consumption	1
Chrysomelidae				
Cerotoma atrofasciata Jat.	Fruit	Baggage	Consumption	2
Chrysomelidae, species of	Fruit	Baggage	Consumption	1
	Leaf	Baggage	Consumption	2
Curculionidae				
Anthonomus sp.	Fruit	Baggage	Consumption	1
Conotrachelus sp.	Fruit	Baggage	Consumption	441
		General cargo	Consumption	1
		Permit cargo	Consumption	2
	Root	Baggage	Consumption	1
Conotrachelus dimidiatus Champion	Fruit	Baggage	Consumption	20
		Permit cargo	Consumption	1
Curculionidae, species of	Fruit	Baggage	Consumption	20
			Propagation	1
Pandeleteius sp.	Fruit	Baggage	Consumption	8
Scolytidae				
Chaetophloeus sp.	Fruit	Baggage	Consumption	1
Tenebrionidae				
Blapstinus sp.	Fruit	Baggage	Consumption	1
DIPTERA				
Cecidomyiidae				
Craneiobia lawsonianae De Meijere	Fruit	Baggage	Consumption	1
Chloropidae				
Chloropidae, species of	Fruit	Baggage	Consumption	1
Lonchaeidae				
Lonchaeidae, species of	Fruit	Baggage	Consumption	1

Organism	**Plant Part Infested**	**Location of Interception**	**Purpose**	**Interceptions (no.)**
Tephritidae				
Anastrepha sp.	Fruit	Baggage	Consumption	1668
		Mail	Consumption	1
		General cargo	Consumption	1
		Permit cargo	Consumption	7
Anastrepha ludens (Loew)	Fruit	Baggage	Consumption	5
Anastrepha serpentina (Wiedemann)	Fruit	Baggage	Consumption	1
Ceratitis capitata (Wiedemann)	Fruit	Baggage	Consumption	4
Dacus sp.	Fruit	Baggage	Consumption	1
Rhagoletis sp.	Fruit	Baggage	Consumption	1
Tephritidae, species of	Fruit	Baggage	Consumption	28
		Mail	Consumption	1
		Permit cargo	Consumption	1
HETEROPTERA				
Lygaeidae				
Ozophora sp.	Fruit	Baggage	Consumption	1
Prytanes sp.	Fruit	Baggage	Consumption	1
Miridae				
Miridae, species of	Fruit	Baggage	Consumption	4
	Leaf	Baggage	Consumption	5
Pentatomidae				
Chlorocoris atrispinus Stål	Fruit	Baggage	Consumption	1
Tingidae				
Tingidae, species of	Leaf	Baggage	Consumption	1
HOMOPTERA				
Aleyrodidae				
Aleurocanthus woglumi Ashby	Leaf	Baggage	Consumption	1
Aleurodicus sp.	Leaf	Baggage	Consumption	2
Aleurodicus linguosus Bondar (= *A. maritimus* Hempel)	Fruit	Baggage	Consumption	1
Aleuroplatus sp.	Leaf	Baggage	Consumption	1
Aleuroplatus cococolus Quaintance & Baker	Leaf	Baggage	Consumption	2
Aleurothrixus sp.	Leaf	Baggage	Consumption	1
Aleurotrachelus sp.	Leaf	Baggage	Consumption	2
Aleurotuberculatus psidii (Singh)	Leaf	Baggage	Consumption	1
Aleyrodidae, species of	Fruit	Baggage	Consumption	2
	Leaf	Baggage	Consumption	7
		General cargo	Consumption	1
	Plant	Baggage	Propagation	3
Bemisia tabaci (Gennadius)	Leaf	Baggage	Propagation	1

Organism	**Plant Part Infested**	**Location of Interception**	**Purpose**	**Interceptions (no.)**
Paraleyrodes sp.	Leaf	Baggage	Consumption	1
			Propagation	3
Tetraleurodes sp.	Leaf	Baggage	Consumption	6
Tetralicia sp.	Fruit	Baggage	Consumption	7
	Leaf	Baggage	Consumption	33
			Propagation	14
		Permit cargo	Consumption	1
	Plant	Baggage	Consumption	1
Trialeurodes sp.	Leaf	Baggage	Consumption	1
		Propagation	Consumption	1
Trialeurodes vitrinellus (Cockerell)	Leaf	Baggage	Consumption	4
Aphididae				
Aphididae, species of	Fruit	Baggage	Consumption	2
	Leaf	Baggage	Consumption	1
Therioaphis sp.	Leaf	Baggage	Consumption	1
Asterolecaniidae				
Asterolecanium sp.	Fruit	Baggage	Consumption	1
Cicadellidae				
Cicadellidae, species of	Fruit	Baggage	Consumption	3
	Leaf	Baggage	Consumption	6
Coccidae				
Ceroplastes sp.	Leaf	Baggage	Consumption	1
	Plant	Baggage	Propagation	1
Ceroplastes rubens Maskell	Fruit	Baggage	Consumption	1
Coccus sp.	Fruit	Baggage	Consumption	1
	Leaf	Baggage	Consumption	2
Coccus viridis (Green)	Leaf	Baggage	Consumption	2
Coccidae, species of	Fruit	Baggage	Consumption	13
	Leaf	Baggage	Consumption	6
Pulvinaria sp.	Leaf	Mail	Propagation	1
Diaspididae				
Acutaspis albopicta (Cockerell)	Fruit	Baggage	Consumption	14
	Leaf	Baggage	Consumption	4
Aulacaspis tubercularis Newstead	Fruit	Baggage	Consumption	1
Diaspididae, species of	Fruit	Baggage	Consumption	11
	Leaf	Baggage	Consumption	1
Hemiberlesia sp.	Fruit	Baggage	Consumption	4
Hemiberlesia diffinis (Newstead)	Fruit	Baggage	Consumption	9
Parlatoria ziziphi (Lucas)	Fruit	Baggage	Consumption	1

Organism	Plant Part Infested	Location of Interception	Purpose	Interceptions (no.)
Pseudaonidia trilobitiformis (Green)	Fruit	Baggage	Consumption	80
		Permit cargo	Consumption	1
	Leaf	Baggage	Consumption	7
Margarodidae				
Icerya sp.	Leaf	Baggage	Consumption	1
Margarodidae, species of	Fruit	Baggage	Consumption	1
	Leaf	Baggage	Consumption	2
Membracidae				
Membracidae, species of	Leaf	Baggage	Consumption	3
Pseudococcidae				
Dysmicoccus sp.	Fruit	Baggage	Consumption	4
Dysmicoccus neobrevipes Beardsley	Fruit	Baggage	Consumption	4
Ferrisia sp.	Fruit	Baggage	Consumption	1
Paracoccus sp.	Fruit	Baggage	Consumption	14
Phenacoccus sp.	Leaf	Baggage	Consumption	1
Planococcus sp.	Fruit	Baggage	Consumption	5
Planococcus lilacinus (Cockerell)	Fruit	Baggage	Consumption	1
Planococcus minor (Maskell)	Fruit	Baggage	Consumption	3
Pseudococcus sp.	Fruit	Baggage	Consumption	10
	Leaf	Baggage	Consumption	1
Pseudococcidae, species of	Fruit	Baggage	Consumption	49
		Mail	Consumption	1
	Leaf	Baggage	Consumption	10
Puto sp.	Fruit	Baggage	Consumption	2
	Leaf	Baggage	Consumption	1
Puto mexicanus (Cockerell)	Fruit	Baggage	Consumption	1
HYMENOPTERA				
Apidae				
Apis mellifera L.	Fruit	Baggage	Consumption	1
Formicidae				
Crematogaster sp.	Fruit	Baggage	Consumption	2
		General cargo	Consumption	1
	Leaf	Baggage	Consumption	1
	Stem	Baggage	Consumption	1
Pheidole sp.	Fruit	Baggage	Consumption	1
Pogonomyrmex sp.	Stem	Baggage	Consumption	1
LEPIDOPTERA				
Arctiidae				
Arctiidae, species of	Fruit	Baggage	Consumption	1
	Leaf	Baggage	Consumption	5
			Propagation	1

Organism	Plant Part Infested	Location of Interception	Purpose	Interceptions (no.)
Argyresthiidae				
Argyresthia sp.	Fruit	Baggage	Consumption	2
Argyresthiidae, species of	Fruit	Baggage	Consumption	2
Cochylidae				
Cochylidae, species of	Fruit	Baggage	Consumption	2
Coleophoridae				
Coleophora sp.	Fruit	Baggage	Consumption	1
Cosmopterigidae				
Cosmopterigidae, species of	Fruit	Baggage	Consumption	1
Crambidae				
Crambidae, species of	Fruit	Baggage	Consumption	1
Gelechiidae				
Gelechiidae, species of	Fruit	Baggage	Consumption	26
		Permit cargo	Consumption	2
Hesperiidae				
Hesperiidae, species of	Leaf	Baggage	Consumption	2
			Propagation	2
Lymantriidae				
Lymantriidae, species of	Fruit	Baggage	Consumption	1
	Leaf	Baggage	Consumption	1
Noctuidae				
Noctuidae, species of	Fruit	Baggage	Consumption	2
	Leaf	Baggage	Consumption	1
Oecophoridae				
Cerconota anonella (Sepp)	Fruit	Baggage	Consumption	8
Oecophoridae, species of	Fruit	Baggage	Consumption	2
Pterophoridae				
Pterophoridae, species of	Leaf	Baggage	Consumption	1
Pyralidae				
Neoleucinodes elegantalis (Guenée)	Fruit	Baggage	Consumption	1
Pyralidae, species of	Fruit	Baggage	Consumption	2
Pyraustinae, species of	Fruit	Baggage	Consumption	3
Saturniidae				
Saturniidae, species of	Fruit	Baggage	Consumption	1
Scythrididae				
Scythridinae, species of	Fruit	Baggage	Consumption	1
Tortricidae				
Amorbia sp.	Fruit	Baggage	Consumption	97
			Propagation	1
		General cargo	Consumption	1
		Permit cargo	Consumption	2

Organism	Plant Part Infested	Location of Interception	Purpose	Interceptions (no.)
Argyrotaenia sp.	Fruit	Baggage	Consumption	1
Gymnandrosoma aurantianum Lima	Fruit	Baggage	Consumption	1
Olethreutinae, species of	Fruit	Baggage	Consumption	6
Platynota sp.	Fruit	Baggage	Consumption	22
Talponia sp.	Fruit	Baggage	Consumption	1
Tortricidae, species of	Fruit	Baggage	Consumption	30
	Cut flower	Baggage	Consumption	1
Tortricinae, species of	Fruit	Baggage	Consumption	37
	Leaf	Baggage	Consumption	1
ORTHOPTERA				
Tettigoniidae				
Conocephalus sp.	Fruit	Baggage	Consumption	1
THYSANOPTERA				
Phlaeothripidae				
Phlaeothripidae, species of	Fruit	Baggage	Consumption	2
Thripidae				
Odontothrips karnyi Priesner	Fruit	Baggage	Consumption	1
BACTERIUM				
Xanthomonas axonopodis pv. *citri* (Hasse) Vauterin *et al*.	Fruit	Baggage	Consumption	1
FUNGI				
Ascochyta sp.	Fruit	Baggage	Consumption	9
Cercospora sp.	Fruit	Baggage	Consumption	4
	Leaf	Baggage	Consumption	2
Cladosporium sp.	Fruit	Baggage	Consumption	14
Cladosporium oxysporum Berk & Curtis	Fruit	Baggage	Consumption	2
Colletotrichum sp.	Fruit	Baggage	Consumption	35
	Leaf	Baggage	Consumption	1
Coniothyrium sp.	Fruit	Baggage	Consumption	3
Cylindrosporium sp.	Fruit	Baggage	Consumption	1
Diplodia sp.	Fruit	Baggage	Consumption	3
Elsinoë sp.	Fruit	Baggage	Consumption	1
Fusicoccum sp.	Fruit	Baggage	Consumption	1
Gloeosporium sp.	Fruit	Baggage	Consumption	1
Lophodermium sp.	Fruit	Baggage	Consumption	2
Macrophoma sp.	Fruit	Baggage	Consumption	1
Microsphaeropsis sp.	Fruit	Baggage	Consumption	2
Monochaetia sp.	Fruit	Baggage	Consumption	5
Monochaetinula sp.	Fruit	Baggage	Consumption	15
Monochaetinula terminaliae (Batista & Bezerra) J. Muthumary et al.	Fruit	Baggage	Consumption	14

Organism	Plant Part Infested	Location of Interception	Purpose	Interceptions (no.)
		Permit cargo	Consumption	1
Mycosphaerella sp.	Fruit	Baggage	Consumption	1
Pestalotiopsis sp.	Fruit	Baggage	Consumption	139
Pestalotiopsis podocarpi (Dennis) Sun & Ge	Fruit	Baggage	Consumption	6
	Leaf	Baggage	Consumption	1
Pestalotiopsis psidii (Pat.) Mordue	Fruit	Baggage	Consumption	2669
		General cargo	Consumption	1
		Permit cargo	Consumption	1
	Leaf	Baggage	Consumption	11
	Cutting	Baggage	Consumption	2
Pestalozzina unicolor (Berk. & M.A. Curtis) Sacc.	Fruit	Baggage	Consumption	1
Phoma sp.	Fruit	Baggage	Consumption	140
		Permit cargo	Consumption	1
		Miscellaneous	Consumption	1
		Stores	Non-entry	1
Phomopsis sp.	Fruit	Baggage	Consumption	190
		Mail	Consumption	1
		Permit cargo	Consumption	1
	Leaf	Baggage	Consumption	2
	Stem	Baggage	Consumption	1
Phomopsis psidii Nag Raj & Ponnappa	Fruit	Baggage	Consumption	10
Phyllosticta sp.	Fruit	Baggage	Consumption	4
Phyllosticta guajavae Viégas	Fruit	Baggage	Consumption	1
Pleospora sp.	Fruit	Baggage	Consumption	1
Puccinia sp.	Fruit	Baggage	Consumption	1
	Leaf	Baggage	Consumption	2
Pyrenochaeta sp.	Leaf	Baggage	Propagation	1
Septoria sp.	Fruit	Baggage	Consumption	10
Sphaceloma psidii Bitancourt & Jenkins	Fruit	Baggage	Consumption	3
Truncatella sp.	Fruit	Baggage	Consumption	9
Verticillium sp.	Fruit	Baggage	Consumption	1

2.4. Pest Categorization: Identification of Quarantine Pests

Pests associated with guava that also occur in Mexico are listed in 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-host association, and pertinent references for pest distribution and biology.

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

Table 3. Pests in Mexico associated with guava (*Psidium guajava*).

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
ARTHROPODS					
ACARI					
Tarsonemidae					
Tarsonemus sp.	MX	F	Yes	Yes	PestID, 2008
Tenuipalpidae					
Brevipalpus californicus (Banks)	MX, US	F, L, S	No	Yes	CABI, 2003
Brevipalpus obovatus Donnadieu	MX, US	L, S	No	No	CABI, 2003; Jeppson et al., 1975; Rosas & Sampedro, 2000; UH-CTAHR, 2004
Brevipalpus phoenicis (Geijskes)	MX, US (DC, FL, HI)	F, L, S	No	Yes	CABI, 2003; Hill, 1983; Rosas & Sampedro, 2000
Tetranychidae					
Oligonychus sp.	MX	L	Yes	No	PestID, 2008
Oligonychus biharensis (Hirst)	MX, US (HI)	F, L	Yes	Yes	Bolland et al., 1998; Gould & Raga, 2002
Oligonychus psidium Estébanes & Baker	MX	F, L	Yes	Yes	Gould & Raga, 2002
Oligonychus yothersi (McGregor)	MX, US (FL, HI)	L	No	No	Bolland et al., 1998; Flechtmann, 1976; Nishida, 2002; Schaffer et al., 1986
Tetranychus sp.	MX	F	Yes	Yes	PestID, 2008
Tetranychus mexicanus (McGregor)	MX, US (FL)	F, L, S	No	Yes	Bolland et al., 1998; Quiros-Gonzalez, 2000; USDA, 1980
Tetranychus urticae Koch	MX, US	L	No	No	Bolland et al., 1998; CABI, 2003
COLEOPTERA					
Apionidae					
Apion sp.	MX	F	Yes	Yes	PestID, 2008

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Bruchidae					
Zabrotes sp.	MX	F	Yes	Yes	PestID, 2008
Cerambycidae					
Trachyderes (= *Dendrobias*) *mandibularis* Dupont	MX, US	S[4]	No	No	MacGregor & Gutiérrez, 1983; Turnbow & Thomas, 2002
Chrysomelidae					
Cerotoma atrofasciata Jat.	MX	F	Yes	No[5]	PestID, 2008
Promecosoma fervidum Lefèvre	MX	L[6]	Yes	No	MacGregor & Gutiérrez, 1983
Curculionidae					
Anthonomus sp.	MX	F	Yes	Yes	PestID, 2008
Conotrachelus sp.	MX	F	Yes	Yes	PestID, 2008
Conotrachelus aguacatae Barber	MX	F, L	Yes	No[7]	CABI, 2003; PestID, 2008
Conotrachelus dimidiatus Champion	MX	F	Yes	Yes	Gould & Raga, 2002
Conotrachelus psidii Marshall	MX	F	Yes	Yes	Sanchez, 2000
Pandeleteius sp.	MX	F	Yes	Yes	PestID, 2008
Pandeleteius vitticollis Champion	MX	L	Yes	No	Gould & Raga, 2002
Pantomorus albosignatus Boheman	MX	L	Yes	No	Gould & Raga, 2002
Pantomorus cervinus (Boheman)	MX, US	L	No	No	CABI, 2003; Gould & Raga, 2002
Scarabaeidae					
Cotinis mutabilis (Gory & Percheron)	MX, US	F, L	No	No[8]	Evans, 2000; Hill, 1983; MacGregor & Gutiérrez, 1983
Cyclocephala lunulata Burmeister	MX	F, L, R	Yes	No[9]	González et al., 2002; Gould & Raga, 2002
Euphoria sp.	MX	F, R	Yes	Yes	Gould & Raga, 2002
Onthophagus belorhinus Bates	MX	?	Yes	No[10]	CABI, 2003; Moron, 1987
Scolytidae					
Chaetophloeus sp.	MX	F	Yes	Yes	PestID, 2008

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Tenebrionidae					
Blapstinus sp.	MX	F	Yes	Yes	PestID, 2008
DIPTERA					
Cecidomyiidae					
Craneiobia lawsonianae De Meijere	MX	F, Sd	Yes	No[11]	Coutin, 1976; PestID, 2008
Tephritidae					
Anastrepha sp.	MX	F	Yes	Yes	PestID, 2008
Anastrepha bahiensis Lima	MX	F	Yes	Yes	Hernández-Ortiz & Pérez-Alonso, 1993; Sommeijer, 1975
Anastrepha bezzii Lima	MX	F, Sd	Yes	No[12]	CABI, 2003; Santos et al., 1993
Anastrepha chiclayae Greene	MX, US (TX)	F	No	No[13]	Aluja et al., 2000; CABI, 2003; Foote et al., 1993
Anastrepha fraterculus (Wiedemann)	MX	F	Yes	Yes	Aluja et al., 1987; CABI, 2003
Anastrepha ludens (Loew)	MX, US (TX)	F	Yes	Yes	CABI, 2003; Gould & Raga, 2002
Anastrepha obliqua (Macquart)	MX	F	Yes	Yes	Aluja et al., 1987
Anastrepha serpentina (Wiedemann)	MX	F	Yes	Yes	CABI, 2003; Gould & Raga, 2002
Anastrepha striata Schiner	MX	F	Yes	Yes	Aluja et al., 1987
Ceratitis capitata (Wiedemann)	MX[14], US (HI)	F	Yes	Yes	CABI, 2003; PPQ, 1999
Dacus sp.	MX	F	Yes	Yes	PestID, 2008
Rhagoletis sp.	MX	F	Yes	Yes	PestID, 2008
HETEROPTERA					
Coreidae					
Leptoglossus concolor (Walker)	MX, US (FL)	F	No	Yes	CABI, 2003; Gould & Raga, 2002; Mitchell, 2000
Leptoglossus gonagra (F.)	MX, US (FL, LA, MO, TX)	F	No	Yes	CABI, 2003; Mitchell, 2000
Leptoglossus phyllopus (L.)	MX, US	F, S	No	Yes	Mitchell, 2000

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
Leptoglossus zonatus (Dallas)	MX, US	F, I, L	No	Yes	Mitchell, 2000
Lygaeidae					
Ozophora sp.	MX	F	Yes	Yes	PestID, 2008
Prytanes sp.	MX	F	Yes	Yes	PestID, 2008
Pentatomidae					
Chlorocoris distinctus Signoret (= *C. atrispinus* Stål)	MX, US (AZ, NM)	F	No	Yes	Froeschner, 1998; PestID, 2008
Piezodorus guildinii (Westwood)	MX, US (FL, GA, NM, SC)	I, L, Sd	No	No	CABI, 2003; Panizzi & Slansky, 1985
HOMOPTERA					
Aleyrodidae					
Aleurocanthus woglumi Ashby	MX, US (FL, HI, TX)	F, L, S	[Yes] [45]	No[44]	CABI, 2003; Culliney et al., 2003; Gould & Raga, 2002
Aleurodicus sp.	MX	L	Yes	No	PestID, 2008
Aleurodicus cocois (Curtis)	MX	L	Yes	No	CABI, 2003; Mound & Halsey, 1978
Aleurodicus dispersus Russell	MX, US (FL, HI)	F, L	[Yes][45]	Yes	CABI, 2003; Evans, 2002; Gould & Raga, 2002
Aleurodicus maritimus Hempel	MX	F, L	Yes	Yes	Gould & Raga, 2002; Mound & Halsey, 1978
Aleurodicus pulvinatus (Maskell) (= *A. iridescens* Cockerell)	MX	F, L	Yes	Yes	Gould & Raga, 2002; Martin & Watson, 1998
Aleuroplatus sp.	MX	L	Yes	No	PestID, 2008
Aleuroplatus cococolus Quaintance & Baker	MX	L	Yes	No	PestID, 2008
Aleurothrixus sp.	MX	L	Yes	No	PestID, 2008
Aleurothrixus floccosus (Maskell)	MX, US	F, I, L, S	No	Yes	CABI, 2003
Aleurotrachelus sp.	MX	L	Yes	No	PestID, 2008
Aleurotuberculatus psidii (Singh)	MX	F, L	Yes	No[15]	Gould & Raga, 2002; PestID, 2008
Bemisia tabaci (Gennadius)	MX, US	L	No	No	CABI, 2003; Mound & Halsey, 1978

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
Dialeurodes citri (Ashmead)	MX, US	L	No	No	CABI, 2003; Yunus & Ho, 1980
Hexaleurodicus ferrisi Sampson & Drews	MX	L	Yes	No	Evans, 2002; Sampson & Drews, 1941
Paraleyrodes sp.	MX	L	Yes	No	PestID, 2008
Tetraleurodes sp.	MX	F, L	Yes	Yes	PestID, 2008
Tetraleurodes truncatus Sampson & Drews	MX	F, L	Yes	Yes	Gould & Raga, 2002; Mound & Halsey, 1978
Tetralicia sp.	MX	F, L	Yes	Yes	PestID, 2008
Trialeurodes sp.	MX	L	Yes	No	PestID, 2008
Trialeurodes floridensis (Quaintance)	MX, US (AZ, FL, TX)	F, L, S	No	Yes	Gould & Raga, 2002; Mound & Halsey, 1978
Trialeurodes vaporariorum (Westwood)	MX, US	F, I, L, S	No	Yes	CABI, 2003; Mound & Halsey, 1978
Trialeurodes vitrinellus (Cockerell)	MX	L	Yes	No	Mound & Halsey, 1978; PestID, 2008
Aphididae					
Aphis craccivora Koch	MX, US	F, L, S	No	Yes	Blackman & Eastop, 1994; CABI, 2003; Gould & Raga, 2002
Aphis gossypii Glover	MX, US	F, I, L, S	No	Yes	CABI, 2003; Gould & Raga, 2002
Aphis spiraecola Patch	MX, US	F, I, L, S	No	Yes	Blackman & Eastop, 1994; CABI, 2003
Myzus ornatus Laing	MX, US (CA)	L, S	No	No	Blackman & Eastop, 1994; Gould & Raga, 2002; Leonard et al., 1971; Pinto & Cardenas, 1990
Myzus persicae (Sulzer)	MX, US	F, I, L, S	No	Yes	CABI, 2003; Gould & Raga, 2002
Therioaphis sp.	MX	L	Yes	No	PestID, 2008
Toxoptera aurantii (Boyer de Fonscolombe)	MX, US	I, L, S	No	No	Blackman & Eastop, 1994; CABI, 2003
Asterolecaniidae					
Asterolecanium sp.	MX	F	Yes	Yes	PestID, 2008
Coccidae					
Ceroplastes sp.	MX	L	Yes	No	PestID, 2008

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
Ceroplastes cirripediformis Comstock	MX, US	L, S	No	No	Ben-Dov, 1993; Kosztarab, 1996
Ceroplastes floridensis Comstock	MX, US	F, L, S	No	Yes	CABI, 2003
Ceroplastes rubens Maskell	MX, US (FL, HI)	F, L, S	[Yes][45]	No[16]	Ben-Dov, 1993; Gould & Raga, 2002; USDA, 2004b
Ceroplastes sinensis Del Guercio	MX, US (CA, NC, VA)	L, S	No	No	Ben-Dov, 1993; Kosztarab, 1996
Coccus sp.	MX	F, L	Yes	Yes	PestID, 2008
Coccus hesperidum L.	MX, US	F, L, S	No	Yes	CABI, 2003; Gould & Raga, 2002
Coccus longulus (Douglas)	MX, US	L, S	No	No	Ben-Dov, 1993; Chang et al., 1982; Dale et al., 1976
Coccus viridis (Green)	MX, US (FL, HI)	F, L, S	[Yes][45]	Yes	CABI, 2003; Gould & Raga, 2002
Eucalymnatus tessellatus (Signoret)	MX, US	F, L, S	No	Yes	Gould & Raga, 2002; USDA, 2004b
Kilifia acuminata (Signoret)	MX, US	F, L, S	No	Yes	Ben-Dov, 1993; Gould & Raga, 2002
Milviscutulus (= *Protopulvinaria*) *mangiferae* (Green)	MX, US (FL, TX)	F, L, S	No	Yes	Ben-Dov, 1993; MacGregor & Gutiérrez, 1983; Pantoja et al., 2002
Parasaissetia (= *Saissetia*) *nigra* (Nietner)	MX, US	F, L, S	No	Yes	Gould & Raga, 2002; MacGregor & Gutiérrez, 1983; USDA, 2004b
Parthenolecanium corni (Bouché)	MX, US	L, S	No	No	CABI, 2003; Prinsloo, 1983
Parthenolecanium persicae (F.)	MX, US	L	No	No	CABI, 2003; Hill, 1983; Salazar & Solis, 1990
Philephedra crescentiae (Cockerell)	MX	L	Yes	No	USDA, 2004b; Vasquez et al., 2002
Philephedra tuberculosa Nakahara & Gill	MX, US (FL, TX)	F, L, S	No	Yes	Ben-Dov, 1993; Pantoja et al., 2002
Protopulvinaria pyriformis Cockerell	MX, US	F, L, S	No	Yes	Gould & Raga, 2002; USDA, 2004b

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
Pulvinaria sp.	MX	L	Yes	No	PestID, 2008
Pulvinaria floccifera (Westwood)	MX, US	L, S	No	No	Kosztarab, 1996; USDA, 2004b
Pulvinaria psidii Maskell (= *Chloropulvinaria psidii* [Maskell])	MX, US	F, L, S	No	Yes	Gould & Raga, 2002; USDA, 2004b
Saissetia coffeae (Walker)	MX, US	F, L, S	No	Yes	Gould & Raga, 2002; USDA, 2004b
Saissetia miranda (Cockerell & Parrott)	MX, US	F, L, S	No	Yes	Ben-Dov, 1993; Gould & Raga, 2002
Saissetia neglecta De Lotto	MX, US (FL, HI, LA)	F, L, S	No	Yes	Ben-Dov, 1993; Gould & Raga, 2002
Saissetia oleae (Olivier)	MX, US	F, L, S	No	Yes	Gould & Raga, 2002; USDA, 2004b
Diaspididae					
Acutaspis albopicta (Cockerell)	MX, US (CA, TX)	F, L	No	Yes	PestID, 2008; USDA, 2004b; Vasquez et al., 2002
Aonidiella aurantii (Maskell)	MX, US (AZ, CA, FL, TX)	F, L, S	No	Yes	CABI, 2003
Aonidiella citrina (Coquillett)	MX, US (CA, FL, TX)	F, L	No	Yes	USDA, 2004b
Aonidiella orientalis (Newstead)	MX, US (FL)	F, L, S	No	Yes	CABI, 2003
Aspidiotus destructor Signoret	MX, US (CA, FL, HI)	F, L, S	No	Yes	CABI, 2003
Aspidiotus nerii Bouché	MX, US	F, L, S	No	Yes	Kosztarab, 1996; USDA, 2004b
Aulacaspis tubercularis Newstead	MX, US (FL)	F, L, S	[Yes][45]	No[17]	CABI, 2003; Hamon, 2002; PestID, 2008
Chrysomphalus aonidum (L.)	MX, US	F, L, S	No	Yes	CABI, 2003; Gould & Raga, 2002
Chrysomphalus dictyospermi (Morgan)	MX, US	F, L, S	No	Yes	CABI, 2003; Gould & Raga, 2002
Hemiberlesia sp.	MX	F	Yes	Yes	PestID, 2008
Hemiberlesia diffinis (Newstead)	MX	F, L, S	Yes	Yes	Miller & Davidson, 1998; Gould & Raga, 2002

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Hemiberlesia lataniae (Signoret)	MX, US	F, L, S	No	Yes	CABI, 2003
Hemiberlesia palmae (Cockerell)	MX, US (CA, FL)	F, L, S	No	Yes	Gould & Raga, 2002; USDA, 2004b
Hemiberlesia rapax (Comstock)	MX, US	L, S	No	No	CABI, 2003; Gould & Raga, 2002
Howardia biclavis (Comstock)	MX, US	L, S	No	No	Nagarkatti & Sankaran, 1990; USDA, 2004b
Ischnaspis longirostris (Signoret)	MX, US	F, L, S	No	Yes	Kosztarab, 1996; USDA, 2004b
Lepidosaphes beckii (Newman)	MX, US	F, L, S	No	Yes	CABI, 2003; El-Minshawy et al., 1971
Lepidosaphes gloverii (Packard)	MX, US	F, L	No	Yes	USDA, 2004b
Lindingaspis rossi (= *Chrysomphalus*) (Maskell)	MX, US (CA)	L	No	No	Nair, 1975; USDA, 2004b
Morganella longispina (Morgan)	MX, US (FL, HI)	S	No	No	USDA, 2004b
Parlatoria pergandii Comstock	MX, US	F, L, S	No	Yes	CABI, 2003; Gould & Raga, 2002
Parlatoria ziziphi (Lucas)	MX, US (FL, HI, MS)[18]	F, L, S	[Yes] [45]	No[19]	CABI, 2003; PestID, 2008
Pinnaspis aspidistrae (Signoret)	MX, US	F, L, S	No	Yes	Kosztarab, 1996; USDA, 2004b
Pseudaonidia trilobitiformis (Green)	MX, US (FL)	F, L, S	[Yes][45]	Yes	Hill, 1983; Nakahara, 1982; PestID, 2008
Pseudischnaspis acephala Ferris	MX	L	Yes	No	Miller et al., 1984; USDA, 2004b
Pseudischnaspis bowreyi (Cockerell)	MX, US (FL, MO, NY)	F, L, S	No	Yes	Gould & Raga, 2002; USDA, 2004b
Pseudoparlatoria parlatorioides (Comstock)	MX, US	F, L, S	No	Yes	Gould & Raga, 2002; USDA, 2004b
Selenaspidus articulatus (Morgan)	MX, US (CA, FL)	L	No	No	CABI, 2003; Gould & Raga, 2002; USDA, 2004b
Unaspis citri (Comstock)	MX, US (CA, FL, GA, LA)	F, L, S	No	Yes	CABI, 2003

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
Margarodidae					
Icerya sp.	MX	L	Yes	No	PestID, 2008
Icerya purchasi Maskell	MX, US	L, S	No	No	CABI, 2003
Pseudococcidae					
Dysmicoccus sp.	MX	F	Yes	Yes	PestID, 2008
Dysmicoccus bispinosus Beardsley	MX	R, S	Yes	No	Ben-Dov, 1994; Garcia, 1995; Panis et al., 1974
Dysmicoccus brevipes (Cockerell)	MX, US (CA, FL, HI, LA)	F, L, R, S	No	Yes	CABI, 2003
Dysmicoccus neobrevipes Beardsley	MX, US (FL, HI)	F	[Yes][45]	Yes	Miller & Miller, 2002; PestID, 2008; USDA, 2004b
Ferrisia sp.	MX	F	Yes	Yes	PestID, 2008
Ferrisia virgata (Cockerell)	MX, US	F, L, S	No	Yes	CABI, 2003
Geococcus coffeae Green	MX, US (FL, HI)	R	No	No	UH-CTAHR, 2004; USDA, 2004b
Maconellicoccus hirsutus (Green)	MX[21], US (CA, FL, HI)[20]	F, I, L, S	[Yes][45]	Yes	CABI, 2003; CERIS, 2004
Nipaecoccus filamentosus (= *Pseudococcus*) (Cockerell)	MX	L, S	Yes	No	Lal & Pillai, 1981; Nair, 1975; Tao & Wu, 1969; USDA, 2004b
Nipaecoccus nipae (Maskell)	MX, US (CA, FL, HI, LA)	F, L, S	No	Yes	CABI, 2003
Nipaecoccus viridis (Newstead) (= *N. vastator* [Maskell])	MX, US (HI)	F, I, L, R, S	Yes	Yes	USDA, 2004b
Paracoccus sp.	MX	F	Yes	Yes	PestID, 2008
Paracoccus marginatus Williams & Granara de Willink	MX, US (FL)	F, I, L, S	No	No[22]	CABI, 2003; Miller et al., 1999; PestID, 2008
Phenacoccus sp.	MX	L	Yes	No	PestID, 2008
Phenacoccus parvus Morrison	MX, US (FL)	L	No	No	Ben-Dov, 1994; Marohasy, 1997; Williams & Hamon, 1994

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Phenacoccus psidiarum (Cockerell)	MX	F, L, S	Yes	Yes	Gould & Raga, 2002; USDA, 2004b
Planococcus sp.	MX	F	Yes	Yes	PestID, 2008
Planococcus citri (Risso)	MX, US	F, I, L, R, S	No	Yes	CABI, 2003
Planococcus lilacinus (Cockerell)	MX	F, I, L, R, S	Yes	No[23]	CABI, 2003; Chacko & Sreedharan, 1981; PestID, 2008
Planococcus minor (Maskell)	MX	F, I, L, S	Yes	Yes	Gould & Raga, 2002; Ooi et al., 2002; Williams & Granara de Willink, 1992
Pseudococcus sp.	MX	F, L	Yes	Yes	PestID, 2008
Pseudococcus elisae Borchsenius	MX	F, L	Yes	No[24]	Charlín, 1973; Williams & Granara de Willink, 1992
Pseudococcus jackbeardsleyi Gimpel & Miller	MX, US (FL, HI, TX)	L	No	No	USDA, 2004b; Vasquez et al., 2002
Pseudococcus landoi (Balachowsky)	MX	L	Yes	No	USDA, 2004b; Vasquez et al., 2002
Pseudococcus longispinus (Targioni Tozzetti)	MX, US	F, I, L, S	No	Yes	CABI, 2003
Pseudococcus solenedyos Gimpel & Miller	MX	F	Yes	Yes	USDA, 2004b
Puto sp.	MX	F, L	Yes	Yes	PestID, 2008
Puto mexicanus (Cockerell)	MX, US (AZ, TX)	F	No	No[25]	Ben-Dov, 1994; PestID, 2008
Psyllidae					
Triozoida limbata (Enderlein)	MX	L	Yes	No	Brown & Hodkinson, 1988
HYMENOPTERA					
Apidae					
Apis mellifera L.	MX	F	No	No[26]	PestID, 2008
Formicidae					
Crematogaster sp.	MX	F, L, S	Yes	Yes	PestID, 2008
Pheidole sp.	MX	F	Yes	Yes	PestID, 2008
Pogonomyrmex sp.	MX	S	Yes	No	PestID, 2008

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
LEPIDOPTERA					
Argyresthiidae					
Argyresthia sp.	MX	F	Yes	Yes	PestID, 2008
Coleophoridae					
Coleophora sp.	MX	F	Yes	Yes	PestID, 2008
Gelechiidae					
Pectinophora gossypiella Saunders	MX, US	F, I	Yes	No[27]	CABI, 2003; PestID, 2008
Hesperiidae					
Phocides palemon (F.)	MX	L	Yes	No	Opler et al., 1995
Lasiocampidae					
Eutachyptera psidii (Salle)	MX	L	Yes	No	Gould & Raga, 2002
Megalopygidae					
Megalopyge defoliata Schaus	MX	L	Yes	No	Gould & Raga, 2002
Noctuidae					
Alabama argillacea Hübner	MX, US	F	No	No[28]	CABI, 2003; Marín, 1973
Mocis latipes (Guenée)	MX, US (FL, GA, TX)	F, L	No	No[28]	CABI, 2003; Marín, 1973
Oecophoridae					
Cerconota anonella (Sepp)	MX	F, I	Yes	No[29]	CABI, 2003; PestID, 2008
Pyralidae					
Maruca vitrata (F.)	MX, US (HI)	F, I, L	Yes	No[30]	CABI, 2003; PestID, 2008
Neoleucinodes elegantalis (Guenée)	MX	F	Yes	No[31]	PestID, 2008
Saturniidae					
Automeris banus (Boisduval)	MX	L[32]	Yes	No	MacGregor & Gutiérrez, 1983
Sphingidae					
Erinnyis ello (L.)	MX, US	L	No	No	Ferguson et al., 1999; Hill, 1983
Tortricidae					
Amorbia sp.	MX	F	Yes	Yes	PestID, 2008

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
Amorbia emigratella Busck	MX, US (CA, HI)	F, L	No	Yes	Ebeling, 1959; Zhang, 1994; Zimmerman, 1978
Argyrotaenia sp.	MX,	F	Yes	Yes	PestID, 2008
Gymnandrosoma aurantianum Lima (= *Ecdytolopha aurantiana* [Lima])	MX	F, L, S, Sd	Yes	Yes	Adamski & Brown, 2001
Platynota sp.	MX	F	Yes	Yes	PestID, 2008
Talponia sp.	MX	F	Yes	Yes	PestID, 2008
ORTHOPTERA					
Tettigoniidae					
Conocephalus sp.	MX	F	Yes	No[33]	PestID, 2008
THYSANOPTERA					
Thripidae					
Heliothrips haemorrhoidalis Bouché	MX, US	F, L	No	Yes	CABI, 2003
Odontothrips karnyi Priesner	MX	F, I, L	Yes	No[34]	Mound & Kibby, 1998; PestID, 2008; Strassen, 1982
Selenothrips rubrocinctus (Giard)	MX, US (FL, HI)	F, I, L	No	Yes	CABI, 2003
Thrips hawaiiensis (Morgan)	MX, US	I	No	No	CABI, 2003; UH-CTAHR, 2004
BACTERIUM					
Xanthomonas axonopodis pv. *citri* (Hasse) Vauterin *et al*. (Xanthomonadales)	MX, US (FL)	F, L, S	Yes	No[35]	CABI, 2003; PestID, 2008
FUNGI					
Alternaria sp. (Ascomycetes: Pleosporales)	MX	F, L[36]	Yes	Yes	SBML, 2003
Alternaria alternata (Fries) Keissler (Ascomycetes: Pleosporales)	MX, US	F, I, L	No	Yes	Jones & Aldwinckle, 1990; Pandey, 1990a; Sanchez et al., 1990; SBML, 2003
Alternaria citri Ellis & N. Pierce (Ascomycetes: Pleosporales)	MX, US (AZ, CA, FL, TX)	F, L	No	Yes	CABI, 2003; SBML, 2003

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Armillaria mellea (Vahl) P. Kumm. (Basidiomycetes: Agaricales)	MX, US	R, S	No	No	CABI, 2003; SBML, 2003
Ascochyta sp. (Ascomycetes)	MX	F	Yes	Yes	PestID, 2008
Aspergillus flavus Link (Ascomycetes: Eurotiales)	MX, US	F, L, R, S, Sd	No	Yes	CABI, 2003; Madhukar & Reddy, 1993
Aspergillus fumigatus Fresenius (Ascomycetes: Eurotiales)	MX, US	F	No	Yes	Adisa, 1985; Parra et al., 1971; SBML, 2003
Aspergillus niger Tiegh. (Ascomycetes: Eurotiales)	MX, US	F, I, L, R, S, Sd	No	Yes	CABI, 2003; Vazquez et al., 2000
Aureobasidium pullulans (de Bary) Arnaud (Ascomycetes: Dothideales)	MX, US	F, L	No	Yes	Alarcon et al., 1990; Pandey, 1990a, b; SBML, 2003
Auricularia auricula (L.:Fr.) Underw. (Basidiomycetes: Auriculariales)	MX, US	S	No	No	UH-CTAHR, 2004; SBML, 2003
Beltrania rhombica Penz. (Ascomycetes)	MX, US (FL, GA)	L	No	No	SBML, 2003
Botryosphaeria dothidea (Moug.) Ces. & de Not. (Ascomycetes: Dothideales)	MX, US	S	No	No	CABI, 2003; SBML, 2003; Valencia et al., 2003
Botryosphaeria ribis Grossenb. & Duggar (Ascomycetes: Dothideales)	MX, US	F, I, L, S	No	Yes	CABI, 2003; Majumdar, 1985
Botrytis cinerea Pers.: Fr. (Ascomycetes: Helotiales)	MX, US	L, S	No	No	CABI, 2003; SBML, 2003
Calonectria kyotensis Terash. (Ascomycetes: Hypocreales) (= *Cylindrocladium scoparium* Morgan)	MX, US	F, L, R, S	No	Yes	Lim & Manicom, 2003; SBML, 2003

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Capnodium sp. (Ascomycetes: Capnodiales)	MX	F, L, S[36]	Yes	Yes	SBML, 2003
Caudella psidii (Ascomycetes: Microthyriales)	MX	L, S	Yes	No	Kirk et al., 2001; SBML, 2003
Ceratocystis paradoxa (Dade) C. Moreau (Ascomycetes: Microascales)	MX, US (CA, FL, HI)	F, I, L, R, S, Sd	No	Yes	CABI, 2003; Lal et al., 1980
Cercospora sp. (Ascomycetes: Mycosphaerellales)	MX	L[36]	Yes	No	SBML, 2003
Ciliochorella mangiferae Syd. (Ascomycetes)	MX, US (HI)	L	No	No	SBML, 2003
Cladosporium sp. (Ascomycetes: Mycosphaerellales)	MX	F	Yes	Yes	PestID, 2008
Cladosporium cladosporioides (Fresen.) De Vries (Ascomycetes: Mycosphaerellales)	MX, US	F	No	Yes	Lim & Manicom, 2003; SBML, 2003
Cladosporium oxysporum Berk & Curtis (Ascomycetes: Mycosphaerellales)	MX, US	F, L	No	Yes	PestID, 2008; SBML, 2003
Clasterosporium sp. (Ascomycetes)	MX	L[37]	Yes	No	SBML, 2003
Cochliobolus hawaiiensis Alcorn (Ascomycetes: Pleosporales) (= *Bipolaris hawaiiensis* [M.B. Ellis] J. Uchida & Aragaki, *Drechslera hawaiiensis* M.B. Ellis)	MX, US (FL, HI, MS)	F, L	No	Yes	Lim & Manicom, 2003; SBML, 2003
Colletotrichum sp. (Ascomycetes: Phyllachorales)	MX	F, L, S[36]	Yes	Yes	SBML, 2003
Coniothyrium sp. (Ascomycetes: Pleosporales)	MX	F	Yes	Yes	PestID, 2008

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
Corticium salmonicolor Berk. & Broome (Basidiomycetes: Polyporales)	MX, US (FL, LA, MS)	F, L, S	No	Yes	CABI, 2003; Peregrine & bin Ahmad, 1982; SBML, 2003
Corynespora cassiicola (Berk. & M.A. Curtis) C.T. Wei (Ascomycetes: Pleosporales)	MX, US	L	No	No	SBML, 2003; Villalobos & Cárdenas, 2002
Cylindrosporium sp. (Ascomycetes: Helotiales)	MX	F	Yes	Yes	PestID, 2008
Diplodia sp. (Ascomycetes: Dothideales)	MX	F, L, R, S[36]	Yes	Yes	SBML, 2003
Dothiorella sp. (Ascomycetes: Dothideales)	MX	F	Yes	Yes	González et al., 2002
Earliella scabrosa (Pers.) R.L. Gilbertson & Ryvarden (= *Trametes corrugata* [Pers.] Bres.) (Basidiomycetes: Polyporales)	MX, US (FL, HI, LA)	S	No	No	SBML, 2003
Elsinoë sp. (Ascomycetes: Myriangiales)	MX	F	Yes	Yes	PestID, 2008
Fusarium sp. (Ascomycetes: Hypocreales)	MX	F, R, S[36]	Yes	Yes	SBML, 2003
Fusarium decemcellulare Brick (Ascomycetes: Hypocreales) (teleomorph: *Nectria rigidiuscula* Berk. & Broome)	MX, US (FL, OK)	F, S, Sd	No	Yes	CABI, 2003; Majumdar, 1985
Fusarium equiseti (Corda) Sacc. (Ascomycetes: Hypocreales) (teleomorph: *Gibberella intricans* Wollenw.)	MX, US	F, S	No	Yes	Adisa, 1985; CABI, 2003; Ceja et al., 2000

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Fusarium moniliforme Sheldon (Ascomycetes: Hypocreales) (teleomorph: *Gibberella fujikuroi* [Sawada] S. Ito)	MX, US	F	No	Yes	CABI, 2003; Madhukar & Reddy, 1993
Fusarium oxysporum Schlecht. (Ascomycetes: Hypocreales)	MX, US	F, L	No	Yes	CABI, 2003; Hahn, 2002
Fusarium semitectum Berk. & Ravenel (Ascomycetes: Hypocreales)	MX, US	F, L, S	No	Yes	Lim & Manicom, 2003; SBML, 2003
Fusarium solani (Martius) Sacc. (Ascomycetes: Hypocreales)	MX, US	F, R, S	No	Yes	CABI, 2003; Lim & Manicom, 2003
Fusicoccum sp. (Ascomycetes: Dothideales)	MX	F	Yes	Yes	PestID, 2008
Geotrichum candidum Link (Saccharomycetes: Saccharomycetales)	MX, US	F, S	No	Yes	Enrique & Fucikovsky, 1976; SBML, 2003
Gliocladium roseum Bainier (Ascomycetes: Hypocreales)	MX, US	F, R	No	Yes	Perez et al., 1992; SBML, 2003
Gloeosporium sp. (Ascomycetes: Helotiales)	MX	F, L, S[36]	Yes	Yes	SBML, 2003
Gloeosporium psidii Delacr. (Ascomycetes: Helotiales)	MX, US (DC, FL)	F, L	No	Yes	SBML, 2003; Villalobos & Cárdenas, 2002
Glomerella cingulata (Stonem.) Spauld. & Schrenk (Ascomycetes) (anamorph: *Colletotrichum gloeosporioides* [Penz.] Penz. & Sacc. in Penz.)	MX, US	F, I, L, S	No	Yes	CABI, 2003; SBML, 2003
Helminthosporium sp. (Ascomycetes: Pleosporales)	MX	L[36]	Yes	No	SBML, 2003

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Lasiodiplodia theobromae (Pat.) Griffin & Maubl. (Ascomycetes: Dothideales) (= *Botryodiplodia theobromae* Pat.)	MX, US	F, I, L, R, S, Sd	No	Yes	CABI, 2003; SBML, 2003
Lophodermium sp. (Ascomycetes: Rhytismatales)	MX	F	Yes	Yes	PestID, 2008
Macrophoma sp. (Ascomycetes: Dothideales)	MX	F	Yes	Yes	PestID, 2008
Macrophomina phaseolina (Tassi) Goidanich (Ascomycetes)	MX, US	F	No	Yes	CABI, 2003; Lim & Manicom, 2003
Meliola sp. (Ascomycetes: Meliolales)	MX	L	Yes	No	González et al., 2002
Meliola psidii Fr.:Fr. (Ascomycetes: Meliolales)	MX	L	Yes	No	SBML, 2003
Microsphaeropsis sp. (Ascomycetes: Dothideales)	MX	F	Yes	Yes	PestID, 2008
Monochaetia sp. (Ascomycetes)	MX	F	Yes	Yes	PestID, 2008
Monochaetinula sp. (Ascomycetes)	MX	F	Yes	Yes	PestID, 2008
Monochaetinula terminaliae (Batista & Bezerra) J. Muthumary et al. (Ascomycetes)	MX	F, L, S	Yes	No[38]	PestID, 2008; SBML, 2003
Mucor hiemalis Wehmer (Zygomycetes: Mucorales)	MX, US (CA, GA, HI)	F	No	Yes	Lim & Manicom, 2003; SBML, 2003
Mycena citricolor (Berk. & Curtis) Sacc. (Basidiomycetes: Agaricales)	MX, US (FL)	F, L, S	No	No[39]	CABI, 2003; SBML, 2003
Mycosphaerella sp. (Ascomycetes: Mycosphaerellales)	MX	F	Yes	Yes	PestID, 2008

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Mycovellosiella psidii Crous (Ascomycetes: Mycosphaerellales)	MX	F	Yes	Yes	Crous, 1999
Myrothecium roridum Tode (Ascomycetes: Hypocreales)	MX, US	L	No	No	CABI, 2003; Pandey et al., 1993
Nattrassia mangiferae (Syd. & P. Syd.) B. Sutton & Dyko (= *Hendersonula toruloidea* Nattrass) (Ascomycetes)	MX, US	S	No	No	CABI, 2003; Cook, 1975; SBML, 2003
Nectria rigidiuscula Berk. & Broome (Ascomycetes: Hypocreales) (= *Fusarium decemcellulare* Brick)	MX, US (FL, OK)	F, S	No	Yes	CABI, 2003; SBML, 2003
Nigrospora sp. (Ascomycetes: Trichosphaeriales)	MX	F[36]	Yes	Yes	SBML, 2003
Pellicularia koleroga Cooke (Basidiomycetes: Ceratobasidiales) (= *Corticium koleroga* [Cooke] Höhnel)	MX, US	L, S	No	No	SBML, 2003; Wellman, 1977
Penicillium sp. (Ascomycetes: Eurotiales)	MX	F, S[36]	Yes	Yes	SBML, 2003
Penicillium chrysogenum Thom (Ascomycetes: Eurotiales)	MX, US	F	No	Yes	CABI, 2003; Rosas et al., 1993; SBML, 2003
Periconia byssoides Pers. (Ascomycetes)	MX, US	F, L, S	No	Yes	SBML, 2003
Pestalotia sp. (Ascomycetes: Xylariales)	MX	L, S[36]	Yes	No	SBML, 2003
Pestalotiopsis sp. (Ascomycetes: Xylariales)	MX	F	Yes	Yes	PestID, 2008

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Pestalotiopsis palmarum (Cooke) Steyaert (Ascomycetes: Xylariales)	MX, US (CA, FL)	F, L	No	Yes	CABI, 2003; Lim & Manicom, 2003; Noriega et al., 1991; SBML, 2003
Pestalotiopsis podocarpi (Dennis) Sun & Ge (Ascomycetes: Xylariales)	MX	F, L	Yes	No[38]	PestID, 2008
Pestalotiopsis psidii (Pat.) Mordue (= *Pestalotia psidii* Pat.) (Ascomycetes: Xylariales)	MX	F, L, S	Yes	Yes	González et al., 2002; Kirk, 2004b; Lim & Manicom, 2003
Pestalotiopsis versicolor (Speg.) Steyaert (Ascomycetes: Xylariales)	MX, US	F, L, S	No	Yes	Lim & Manicom, 2003; SBML, 2003
Phellinus gilvus (Schwein.:Fr.) Pat. (Basidiomycetes: Hymenochaetales)	MX, US	S	No	No	SBML, 2003
Phoma sp. (Ascomycetes: Pleosporales)	MX	F, L, S[36]	Yes	Yes	SBML, 2003
Phoma psidii Henn. (Ascomycetes: Pleosporales)	MX	F, L	Yes	No[40]	Lim & Manicom, 2003; SBML, 2003; Wellman, 1977
Phomopsis sp. (Ascomycetes: Diaporthales)	MX	F, L, S	Yes	Yes	PestID, 2008
Phomopsis psidii Nag Raj & Ponnappa (Ascomycetes: Diaporthales)	MX, US (HI)	F, L	Yes	No[40]	Lim & Manicom, 2003; SBML, 2003
Phyllachora cayennensis (DC.) Theiss. & Syd. (Ascomycetes: Phyllachorales)	MX	L	Yes	No	SBML, 2003; Wellman, 1977
Phyllosticta sp. (Ascomycetes: Dothideales)	MX	F	Yes	Yes	PestID, 2008

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
Phyllosticta guajavae Viégas (Ascomycetes: Dothideales)	MX	F, L	Yes	No[40]	SBML, 2003; Wellman, 1977
Phyllosticta psidiicola Petr. (Ascomycetes: Dothideales)	MX, US (HI)	F	No	No[40]	SBML, 2003
Phymatotrichopsis omnivora (Duggar) Hennebert (Basidiomycetes) (= *Phymatotrichum omnivorum* Duggar)	MX, US	L, R, S	No	No	CABI, 2003; SBML, 2003
Phytophthora sp. (Oomycetes: Pythiales)	MX	F, L, S[36]	Yes	Yes	SBML, 2003
Phytophthora cactorum (Lebert & Cohn) Schröter (Oomycetes: Pythiales)	MX, US	F, L, R, S	No	Yes	SBML, 2003
Phytophthora cinnamomi Rands (Oomycetes: Pythiales)	MX, US	R, S	No	No	CABI, 2003; Raabe et al., 1981
Phytophthora citricola Sawada (Oomycetes: Pythiales)	MX, US	F	No	Yes	Lim & Manicom, 2003; SBML, 2003
Phytophthora heveae A.W. Thomps. (Oomycetes: Pythiales)	MX, US	F, L, S	No	Yes	CABI, 2003
Phytophthora nicotianae Breda de Haan (Oomycetes: Pythiales)	MX, US	F, L, R, S	No	Yes	CABI, 2003
Pleospora sp. (Ascomycetes: Pleosporales)	MX	F	Yes	Yes	PestID, 2008
Pleurotus smithii Guzman[41] (Basidiomycetes: Agaricales)	MX	S[42]	Yes	No	SBML, 2003
Pseudocercospora psidii (Rangel) R.F. Castaneda & U. Braun (Ascomycetes: Mycosphaerellales)	MX, US (FL)	F, L	No	Yes	SBML, 2003

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Puccinia sp. (Urediniomycetes: Uredinales)	MX	F, L	Yes	Yes	PestID, 2008
Puccinia psidii Winter (Urediniomycetes: Uredinales)	MX, US (FL)	F, I, L, S	No	Yes	CABI, 2003
Pyrenochaeta sp. (Ascomycetes: Pleosporales)	MX	L	Yes	No	PestID, 2008
Pythium aphanidermatum (Edson) Fitzp. (Oomycetes: Pythiales)	MX, US	F, R, S	No	Yes	Avelar et al., 2001; CABI, 2003; SBML, 2003
Rhizoctonia solani Küehn (Basidiomycetes: Polyporales)	MX, US	F, I, L, R, S, Sd	No	Yes	Adisa, 1985; CABI, 2003; Chew, 1999; SBML, 2003
Rhizopus arrhizus A. Fischer (Zygomycetes: Mucorales)	MX, US	F	No	Yes	CABI, 2003; Ferrera, 1976; SBML, 2003
Rhizopus microsporus Tiegh. (Zygomycetes: Mucorales)	MX, US (IL, ME, WI)	F	No	Yes	Cordova et al., 2003; Lim & Manicom, 2003; SBML, 2003
Rhizopus stolonifer (Ehrenb.) Lind (Zygomycetes: Mucorales)	MX, US	F, I	No	Yes	Adisa, 1985; Raabe et al., 1981; SBML, 2003; Zenteno & Ulloa, 1977
Rhytidhysterium rufulum (Spreng.:Fr.) Speg. (= *Tryblidiella rufula* [Spreng.:Fr.] Sacc.) (Ascomycetes: Patellariales)	MX, US	S	No	No	SBML, 2003
Rigidoporus microporus (Sw.:Fr.) Overeem (Basidiomycetes: Polyporales)	MX, US	R	No	No	CABI, 2003; SBML, 2003
Rosellinia bunodes (Berk. & Broome) Sacc. (Ascomycetes: Xylariales)	MX	R	Yes	No	SBML, 2003; Wellman, 1977

Pest	**Geographic distribution[1]**	**Plant part affected[2]**	**Quarantine pest[3]**	**Likely to Follow Pathway**	**References**
Rosellinia necatrix Prill. (Ascomycetes: Xylariales)	MX, US	R, S	No	No	SBML, 2003; Villalobos & Cárdenas, 2002
Rosellinia pepo Pat. (Ascomycetes: Xylariales)	MX	R, S	Yes	No	CABI, 2003; Wellman, 1977
Schizophyllum commune Fr. (Basidiomycetes: Agaricales)	MX, US	S	No	No	SBML, 2003
Sclerotium rolfsii Sacc. (Basidiomycetes: Agaricales)	MX, US	F, I, L, R, S	No	Yes	SBML, 2003; Ullasa & Rawal, 1985
Septoria sp. (Ascomycetes: Mycosphaerellales)	MX	F	Yes	Yes	PestID, 2008
Sphaceloma sp. (Ascomycetes: Myriangiales)	MX	L, S	Yes	No	SBML, 2003
Sphaceloma psidii Bitancourt & Jenkins (Ascomycetes: Myriangiales)	MX, US (FL)	F, L	Yes[43]	Yes	SBML, 2003; Villalobos & Cárdenas, 2002
Steccherinum ochraceum (Pers.:Fr.) S.F. Gray (Basidiomycetes: Polyporales)	MX, US	R, S	No	No	SBML, 2003
Subulicystidium longisporum (Pat.) Parmasto (Basidiomycetes: Polyporales)	MX, US	S	No	No	SBML, 2003
Trametes versicolor (L.: Fries) Pilát (Basidiomycetes: Polyporales)	MX, US	S	No	No	SBML, 2003
Trichoderma sp. (Ascomycetes: Hypocreales)	MX	R	Yes	No	González et al., 2002
Trichothecium (= *Cephalothecium*) sp. (Ascomycetes)	MX	F[36]	Yes	Yes	Kirk, 2004a; SBML, 2003

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Trichothecium roseum Link (Ascomycetes)	MX, US	F, I, L, R, S, Sd	No	Yes	SBML, 2003
Truncatella sp. (Ascomycetes: Xylariales)	MX	F	Yes	Yes	PestID, 2008
Ustulina deusta (Hoffm.:Fr.) Lind (= *Hypoxylon deustum* [Hoffm.:Fr.] Grev.) (Ascomycetes: Xylariales)	MX, US	S	No	No	SBML, 2003
Verticillium sp. (Ascomycetes: Hypocreales)	MX	L, S[36]	Yes	No	SBML, 2003
Verticillium albo-atrum Reinke & Berthold (Ascomycetes: Hypocreales)	MX, US	Whole plant	No	Yes	CABI, 2003; Gupta et al., 2003
Verticillium dahliae Kleb. (Ascomycetes: Hypocreales)	MX, US	F, I, L, R, S, Sd	No	Yes	Avelar et al., 2001; CABI, 2003
Zetiasplozna thuemenii (Spegazzini) Nag Raj (= *Pestalozzina thuemenii* [Spegazzini] Guba) (Ascomycetes)	MX, US	F, L	No	Yes	SBML, 2003
Zetiasplozna unicolor (Berk. & M.A. Curtis) Nag Raj (= *Pestalozzina unicolor* [Berk. & M.A. Curtis] Sacc.) (Ascomycetes)	MX, US	F, L	No	Yes	PestID, 2008; SBML, 2003
NEMATODES					
Aphelenchus avenae Bastian (Aphelenchidae)	MX, US	R	No	No	Latha et al., 1997; PSI, 2001
Ditylenchus dipsaci (Kühn) Filipjev (Anguinidae)	MX, US	I, L, S	No	No	CABI, 2003; Ruchi-Logani et al., 2002

Pest	Geographic distribution[1]	Plant part affected[2]	Quarantine pest[3]	Likely to Follow Pathway	References
Helicotylenchus dihystera (Cobb) Sher (Hoplolaimidae)	MX, US	R	No	No	CABI, 2003
Hemicriconemoides mangiferae Siddiqi (Criconematidae)	MX, US (CA, FL)	R	No	No	CABI, 2003
Meloidogyne arenaria (Neal) Chitwood (Meloidogynidae)	MX, US	R	No	No	CABI, 2003; Carrillo et al., 2000
Meloidogyne incognita (Kofoid & White) Chitwood (Meloidogynidae)	MX, US	R	No	No	CABI, 2003; Lee et al., 1998
Meloidogyne javanica (Treub) Chitwood (Meloidogynidae)	MX, US	R	No	No	CABI, 2003; Lee et al., 1998
Pratylenchus brachyurus (Godfrey) Filipjev & Schuurmans Stekhoven (Pratylenchidae)	MX, US	R	No	No	CABI, 2003; Crozzoli et al., 1991
Rotylenchulus reniformis Linford & Oliveira (Hoplolaimidae)	MX, US	R	No	No	CABI, 2003; Khan et al., 2001
Tylenchulus semipenetrans Cobb (Tylenchulidae)	MX, US	R	No	No	CABI, 2003; Ruchi-Logani et al., 2002
Xiphinema americanum Cobb (Longidoridae)	MX, US	R	No	No	CABI, 2003

[1] Distribution (specific states are listed only if distribution is limited): AZ = Arizona; CA = California; DC = District of Columbia; FL = Florida; GA = Georgia; HI = Hawaii; IL = Illinois; LA = Louisiana; ME = Maine; MO = Missouri; MS = Mississippi; MX = Mexico; NC = North Carolina; NM = New Mexico; NY = New York; OK = Oklahoma; SC = South Carolina; TX = Texas; US = United States (widespread); VA = Virginia; WI = Wisconsin

[2] Plant Parts: 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] Site of injury typical of *Trachyderes* spp. (Kliejunas et al., 2001).

[5] Host range of this species appears to be restricted to legumes (Fabaceae) (e.g.,Valverde et al., 1978; Tellez & Maes, 1991).

[6] Feeding site typical of species of *Promecosoma* (e.g., Fernández & Rosales, 2003).

[7] The only host of this species apparently is avocado (*Persea americana*) (CABI, 2003). The single record of this species on *Psidium guajava* (PestID, 2008) is an anomaly.

[8] Adults (length: 50 mm) may feed on overripe or damaged fruits (e.g., fig, peach, grape, cactus) (Evans, 2000; Faulkner, 2005), and are unlikely to remain with the commodity through harvest and processing.

[9] Adults are large (1.4 x 0.8 cm), external feeders on fruit (González et al., 2002), and are unlikely to remain with the commodity through harvest and processing.

[10] Species is primarily a dung or carrion feeder (Moron, 1987; Medina et al., 2001).

[11] Species apparently is restricted to *Chamaecyparis lawsoniana* (Cupressaceae) (Coutin, 1976). The single record of this species on *Psidium guajava* (PestID, 2008) is an anomaly.

[12] The only well confirmed host plants of this species are *Sterculia apetala* and *S. chicha* (Norrbom, 2003a).

[13] Records from *Psidium guajava* are considered questionable (Norrbom & Kim, 1988).

[14] Pest is under official control in Mexico (PPQ, 1999).

[15] Distribution is restricted to Asia (Mound & Halsey, 1978). The single port interception (in baggage; PestID, 2008) indicating presence of this species in Mexico is suspect.

[16] Mexico is included among distributional records in USDA (2004b), with reference to a single source (Komura et al., 1982), which gives no information on the species' presence in that country.

[17] No evidence from available sources of information, including Nakahara (1982), CABI (2003), and USDA (2004b), indicates that this species occurs in Mexico. The single port interception (in baggage; PestID, 2008) indicating its presence in that country is suspect.

[18] Occurrence in Mississippi based on host records of questionable origin (Nakahara, 1982).

[19] Host range of this species appears to be restricted to Rutaceae, particularly *Citrus* spp.; records from other hosts are questionable (Dekle, 1976; Blackburn & Miller, 1984). There is no evidence from available sources of information (CABI, 2003; USDA, 2004b) that the species occurs in Mexico. The single port interception (in baggage; PestID, 2008) indicating its presence in that country is suspect.

[20] Species is established in Imperial County, California, and occurs in Baja California, Mexico (D.E. Meyerdirk, USDA-APHIS, PPQ, *in litt*., March 24, 2004).

[21] Pest is under official control in Mexico (NAPPO, 2004a).

[22] There is no evidence from available sources of information (e.g., Williams & Granara de Willink, 1992; Ben-Dov, 1994; USDA, 2004b) that *Psidium guajava* is a host. The four port interceptions on guava (all from Puerto Rico; PestID, 2008) appear to be anomalies.

[23] There is no evidence from available sources of information (e.g., Williams & Granara de Willink, 1992; Ben-Dov, 1994; CABI, 2003; USDA, 2004b) that this species occurs in Mexico. The single port interception (in baggage; PIN 309) indicating its presence in that country is suspect.

[24] Distribution of this species apparently is restricted to northern South America and Central America; specimens originating from Oceania (e.g., Charlín, 1973) probably represent *P. jackbeardsleyi*, with which the species has been confused (Gimpel & Miller, 1996).

[25] There is no evidence from available sources of information (e.g., Williams & Granara de Willink, 1992; Ben-Dov, 1994; USDA, 2004b) that *Psidium guajava* is a host. The single port interception on guava (PestID, 2008) is an anomaly.

[26] Large, flight-active, externally feeding insect (Winston, 1987) that is not likely to remain with the commodity through harvest and post-harvest handling.

[27] Host range of this species is restricted to Malvaceae and Fabaceae (Pomonis et al., 1980; CABI, 2003). The single record of this species on *Psidium guajava* (PestID, 2008) is an anomaly.

[28] Adult moths, which are active fliers, feed on mature fruit (Marín, 1973), and are not likely to remain with the commodity through harvest and post-harvest handling.

[29] Host range of this species is restricted to Annonaceae (Zhang, 1994; Peña & Bennett, 1995; CABI, 2003).

[30] Host range of this species is restricted to legumes (Fabaceae; CABI, 2003). The single record of this species on *Psidium guajava* (PestID, 2008) is an anomaly.

[31] Host range of this species appears to be restricted largely or completely to Solanaceae (Viafara et al., 1999; CABI, 2003; Robinson et al., 2004). The single record of this species on *Psidium guajava* (PestID, 2008) is an anomaly.

[32] Feeding site typical of species of *Automeris* (Ferguson et al., 1999).

[33] Individuals are moderately large insects (e.g., ≈ 10-17 mm; Borror et al., 1989; Rentz, 1991), mostly associated with grasses, and are not likely to remain with the commodity through harvest and post-harvest handling.

[34] Species in this genus breed only in flowers of various legumes (Fabaceae; Mound & Kibby, 1998). The single record of this species on *Psidium guajava* (PestID, 2008) is an anomaly.

[35] Pathogen is absent from Mexico, and *Psidium guajava* is not reported to be a host (EPPO, 2003).

[36] Infection site or sites typical of species of the genus (Horst, 2001).

[37] Infection site typical of species of *Clasterosporium* (Hepting, 1971).

[38] Occurrence in Mexico and association with *Psidium guajava* based on records of U.S. port interceptions only

(e.g., PestID, 2008; SBML, 2003). Given a lack of corroborating evidence, these records are considered inadequate to
reflect the true distribution and host association of the species.

[39] Although the fruit of some hosts (e.g., coffee) is known to be attacked (CABI, 2003), there is no indication that this fungus produces other than a leaf spot disease in guava (e.g., Wellman, 1977).

[40] Occurrence in Mexico based on records of U.S. port interceptions only (e.g., PestID, 2008; SBML, 2003). Given a lack of corroborating evidence, these records are considered inadequate to reflect the true distribution of the species.

[41] Although Capelari & Fungaro (2003) regard *P. smithii* as a synonym of *Pleurotus cystidiosus* O.K. Miller, which occurs in the United States, based on morphological, biological, and molecular evidence, the two are considered distinct species by Zervakis et al. (2004).

[42] Infection site typical of species of *Pleurotus* (Agrios, 1997).

[43] This pest is only actionable on commodities imported for consumption to Hawaii, not for the continental United States or Alaska (PestID, 2008).

[44] This is primarily a pest on leaves, and has only once been intercepted in this pathway, and then not on fruit (PestID).

[45] Brackets (“[ ]”) indicate that this is a quarantine significant species with limited distribution in the United States and is being considered by APHIS for official control (NIS, 2006a, b; PestID, 2008).

[46] Armored scales may enter on commercial fruit for consumption, but are highly unlikely to become established via this pathway. Please see discussion below for a detailed explanation.

2.5. Pest Categorization: Quarantine Pests Likely to Follow the Pathway

Not all of the quarantine pests identified are likely to follow the pathway of guava fruit. Quarantine pests not expected to follow the pathway were not considered for further analysis, for a variety of reasons (e.g., a lack of specific identification). Should any of these pests be intercepted in shipments of the commodity, however, quarantine action may be taken and additional risk analyses may be done. The quarantine pests that were considered likely to follow the pathway are listed below (Table 4).

The armored scales *Hemiberlesia diffinis* and *Pseudaonidia trilobitiformis* (Hemiptera: Diaspididae) were not analyzed because although armored scales may enter on commercial fruit for consumption, they are not expected to establish via this pathway (Miller, 1985; PERAL, 2007). Even if high quantities of imported fruit are infested with armored scale species, a very low risk exists that an armored scale would establish along a commercial fruit pathway (This applies to commercial fruit shipped without leaves, stems, or contaminants). This low risk is explained by the poor ability of armored scales to disperse to new host plants from fruits for consumption. The following characteristics of armored scales contribute to their poor dispersal capabilities:

- Legs and wings are absent in females and in feeding immature forms; only short-lived males possess wings, and they do not feed and tend to mate with nearby females.
- Self-dispersal of armored scales occurs by immature forms, or “crawlers”. They are the most vulnerable life stage, survival of which decreases with long distance wind dispersal. Crawlers passively disperse by wind from one plant to another for only about 24 hours. After crawlers start feeding, they do not disperse further because they soon lose their legs and are anchored firmly to the host by their mouthparts.
- Dispersal from fruit discarded in the environment is considered very unlikely because of low wind speeds at ground level, and low survival rate of crawlers, either on the ground,

on decaying fruit, or on fruit peels. Crawlers are highly unlikely to walk away from their natal host because they cannot move rapidly over bare soil or rough surfaces.

Table 4. Quarantine pests selected for further analysis.

Scientific name	Taxonomy
Arthropods	
Aleurodicus dispersus	Homoptera: Aleyrodidae
Aleurodicus maritimus	Homoptera: Aleyrodidae
Aleurodicus pulvinatus	Homoptera: Aleyrodidae
Anastrepha bahiensis	Diptera: Tephritidae
Anastrepha fraterculus	Diptera: Tephritidae
Anastrepha ludens	Diptera: Tephritidae
Anastrepha obliqua	Diptera: Tephritidae
Anastrepha serpentina	Diptera: Tephritidae
Anastrepha striata	Diptera: Tephritidae
Ceratitis capitata	Diptera: Tephritidae
Coccus viridis	Homoptera: Coccidae
Conotrachelus dimidiatus	Coleoptera: Curculionidae
Conotrachelus psidii	Coleoptera: Curculionidae
Dysmicoccus neobrevipes	Homoptera: Pseudococcidae
Gymnandrosoma aurantianum	Lepidoptera: Tortricidae
Maconellicoccus hirsutus	Homoptera: Pseudococcidae
Nipaecoccus viridis	Homoptera: Pseudococcidae
Oligonychus biharensis	Acari: Tetranychidae
Oligonychus psidium	Acari: Tetranychidae
Phenacoccus psidiarum	Homoptera: Pseudococcidae
Planococcus minor	Homoptera: Pseudococcidae
Pseudococcus solenedyos	Homoptera: Pseudococcidae
Tetraleurodes truncatus	Homoptera: Aleyrodidae
Fungi	
Mycovellosiella psidii	Ascomycetes: Mycosphaerellales
Pestalotiopsis psidii	Ascomycetes: Xylariales
Sphaceloma psidii	Ascomycetes: Myriangiales

2.6. 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, climatic tolerances, and 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 noted above, risk is considered to be proportional to the degree of uncertainty surrounding a risk element. Because of a lack of information, and thus a high degree of uncertainty, concerning several of the risk elements, some pests have been given risk ratings higher than the available evidence, *prima facie*, might otherwise indicate.

***Aleurodicus dispersus* Russell (Hemiptera: Aleyrodidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Aleurodicus dispersus* is native to tropical Americas. It occurs in tropical and subtropical Central and South America, the Caribbean, Africa, Asia, and Oceania (Akinlosotu et al., 1993). Its distribution corresponds to U.S. Hardiness Zones 9-11 (PERAL, 2008). One or more of its potential hosts occur in these Zones (USDA-NRCS, 2008).	Medium (2)
Risk Element #2: Host Range *Aleurodicus dispersus* is highly polyphagous. Primary hosts include Myrtaceae (*Psidium guajava*), Arecaceae (*Cocos nucifera*), Rutaceae (*Citrus* spp.), Papilionoideae (*Glycine max*), Euphorbiaceae (*Manihot esculenta*), Musaceae (*Musa x paradisiacal*), Lauraceae (*Persea Americana*), and Rosaceae (*Prunus* spp.) (CABI, 2003). Other host species include Agavaceae (*Agave americana*), Amaranthaceae (*Amaranthus* spp.), Anacardiaceae (*Mangifera indica, Schinus terebinthifolius*), Annonaceae (*Annona squamosa*), Apocynaceae (*Plumeria* spp.), Araliaceae (*Hedera* spp.), Araceae (*Colocasia esculenta, Monstera deliciosa*), Arecaceae (*Areca catechu*, *Chrysalidocarpus lutescens*), Asteraceae (*Chrysanthemum* spp., *Dahlia pinnata*, *Lactuca sativa*), Begoniaceae (*Begonia* spp.), Brassicaceae (*Rorippa indica*), Cannaceae (*Cannas* pp.), Caricaceae (*Carica papaya*), Combretaceae (*Terminalia catappa*), Convolvulaceae (*Ipomoea* spp., *I. batatas*), Cucurbitaceae (*Cucumis* spp., *C. melo*, *Luffa aegyptiaca*), Ericaceae (*Rhododendron* spp.), Euphorbiaceae (*Acalypha* spp., *Euphorbia* spp., *E. pulcherrima*, *Ricinus communis*), Lamiaceae (*Coleus* spp., *Salvia* spp.), Fabaceae (*Acacia* spp., *Arachis hypogaea*, *Bauhinia* spp., *Cassia* spp., *Phaseolus* spp., *Pongamia pinnata*, *Vigna* spp.), Lauraceae (*Cinnamomum camphora*), Malvaceae (*Hibiscus* spp.), Moraceae (*Artocarpus* spp., *Ficus* spp., *Morus* spp.), Musaceae (*Musa* spp.), Myrtaceae (*Eugenia* spp.), Nyctaginaceae (*Bougainvillea* spp.), Oleaceae (*Jasminum* spp., *Osmanthus fragrans*), Poaceae (*Sorghum bicolor*), Proteaceae (*Macadamia* spp.), Rosaceae (*Rosa* spp., *Rubus* spp.), Rubiaceae (*Coffea* spp.), Sapotaceae (*Manilkara zapota*), Solanaceae (*Capsicum* spp., *Cestrum* spp., *Lycopersicon esculentum*, *Physalis* spp., *Solanum* spp., *S. melongena*), Strelitziaceae (*Strelitzia* spp.), Ulmaceae (*Celtis* spp.), and Zingiberaceae (*Zingiber zerumbet*) (CABI, 2003; Martin-Kessing & Mau, 1993; EPPO, 2004).	High (3)
Risk Element #3: Dispersal Potential The female lays her eggs the day of emergence, and continues to lay eggs throughout her lifetime (Martin-Kessing & Mau, 1993). Each female lays 14-	Medium (2)

Aleurodicus dispersus **Russell (Hemiptera: Aleyrodidae)**	**Risk ratings**
26 eggs in a loose spiral on the underside of leaves (CABI, 2004). The eggs hatch in 7-11 days (Martin-Kessing & Mau, 1993; CABI, 2004). There are four larval stages (Martin-Kessing & Mau, 1993). The first instar lasts for 6-7 days; the second instar, 4 days; the third instar, 5-13 days; and the fourth (pupae), 5-16 days (CABI, 2004; Martin-Kessing & Mau, 1993). Adults live for about two weeks (CABI, 2004); thus, several generations occur per year. During the immature stages, the first instar is the only stage capable of active movement (Martin-Kessing & Mau, 1993). The adult disperses beyond the leaf by flying, and is most active in the morning hours (Martin-Kessing & Mau, 1993). Long distance dissemination is via infested plants and fruits (EPPO, 2004).	
Risk Element #4: Economic Impact *Aleurodicus dispersus* is a serious pest of tropical and subtropical crops (EPPO, 2004), largely because it is polyphagous. *Aleurodicus dispersus* causes several types of economic damage: direct feeding damage to leaves; excreted honeydew encourages the development of sooty molds; and it vectors plant disease (CABI, 2004; Martin-Kessing & Mau, 1993). Whiteflies cause over 40 worldwide plant diseases of vegetables and crops (Martin-Kessing & Mau, 1993). *Aleurodicus dispersus* is a vector of the lethal yellowing virus of coconut palms in Florida (Akinolosotu et al., 1993). Depending on the crop, season, and prevalence, *A. dispersus* is capable of damaging from 20 to 100 percent of crops (Martin-Kessing & Mau, 1993). In Florida, it feeds on avocados, citrus, guavas, and palms (CABI, 2004). *Aleurodicus dispersus* is a quarantine pest for French Polynesia, Korea, New Zealand, and eastern and southern Africa (EPPO, 2004; PRF, 2004).	High (3)
Risk Element #5: Environmental Impact *Aleurodicus dispersus* may already be affecting Threatened and Endangered species in south Florida and Puerto Rico. If it established outside of Florida, it could affect others, including *Agave arizonica* (Endangered; AZ), *Amaranthus pumilus* (Threatened; DE, MA, MD, NC, NJ, NY, RI, SC, VA), *Manihot walkerae* (Endangered; TX), *Rorippa gambellii* (Endangered; CA), and *Solanum drymophilum* (Endangered; PR). Further spread in the continental United States could stimulate chemical or biological control programs. Successful biological control have been established in Hawaii (CABI, 2004; Martin-Kessing & Mau, 1993).	High (3)

Aleurodicus maritimus **Hempel (Homoptera: Aleyrodidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Aleurodicus maritimus* has been reported from Mexico (Quintana Roo; Sampson & Drews, 1941); Trinidad, and Brazil (Mound & Halsey, 1978). This tropical distribution suggests that the species would be able to survive only in the warmer, southern parts of the United States, or Plant Hardiness Zones 9-11.	Medium (2)
Risk Element #2: Host Range Apart from *Psidium guajava* (Myrtaceae), this pest has been recorded on *Licania tomentosa* (Chrysobalanaceae), *Vismia brasiliensis* (Clusiaceae), and *Cajanus*	High (3)

***Aleurodicus maritimus* Hempel (Homoptera: Aleyrodidae)**	**Risk ratings**
cajan (Fabaceae) (Mound & Halsey, 1978).	
Risk Element #3: Dispersal Potential No information is available on the biology of this species. Other species of *Aleurodicus* may exhibit several generations per year (e.g., *A. destructor* Mackie) and a fecundity exceeding 60 eggs per female (*A. dispersus*) (CABI, 2003). If the biology of *A. maritimus* is similar, a high reproductive capacity might be indicated. Whitefly crawlers can walk actively, but do not travel far before settling to feed, probably not leaving the leaf on which they have hatched (Mound & Halsey, 1978). Natural dispersal in whiteflies is achieved mainly by the winged adults; however, movement of more than a few hundred meters is likely assisted by humans (Byrne & Bellows, 1991). Long-distance dispersal might be achieved via the movement of infested plant materials. However, the species' restricted, Neotropical distribution and scant record of port interceptions (four; PestID, 2008) suggest that it is not spread widely in commerce. The dispersal potential of *A. maritimus* is estimated to be medium.	Medium (2)
Risk Element #4: Economic Impact *Aleurodicus maritimus* is regarded as a minor pest of guava (Gould & Raga, 2002). Heavy infestations of whiteflies can reduce crop yields; staining by sooty molds growing in the honeydew excreted by the insects can cause produce to be downgraded in value (Mound & Halsey, 1978). However, as it is known to attack few host plants, and none of great economic value to the U.S. economy (for example, estimated value of Florida guava production is approximately $3 million [NCSU, 2002a], less than 0.0015 percent of total U.S. agricultural output [U.S. Census Bureau, 2003b]), risk associated with this species' potential economic impact is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact Because of its narrow climatic tolerances and host range, *A. maritimus* likely would have limited potential to attack plants in the United States listed as Endangered or Threatened in 50 CFR §17.12. As it represents a potential threat to guava in the United States, its establishment in those areas in which the crop is produced, such as Hawaii or Florida, could lead to the initiation of biological control programs, as has occurred in response to introductions of other whitefly species (e.g., Clausen, 1978a).	Medium (2)

***Aleurodicus pulvinatus* (Maskell) (Homoptera: Aleyrodidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This whitefly is known only from the New World tropics (Martin & Watson, 1998). Distributional records include Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guyana, Honduras, Mexico (Tabasco), Nicaragua, Panama, Peru, Nevis, St. Kitts, Surinam, Trinidad, and Venezuela. It is estimated that the species would be able to establish permanent populations in the United States in areas corresponding to Plant Hardiness Zones 9-11 (PERAL, 2008).	Medium (2)
Risk Element #2: Host Range Although *A. pulvinatus* is oligophagous (Martin & Watson, 1998), its host range	High (3)

Aleurodicus pulvinatus **(Maskell) (Homoptera: Aleyrodidae)**	**Risk ratings**
is quite broad. Hosts include *Psidium guajava* (Myrtaceae), *Chrysobalanus icaco* (Chrysobalanaceae), *Cocos nucifera* (Arecaceae), *Coffea canephora* (Rubiaceae), *Coccoloba* spp. (Polygonaceae), *Echinodorus* sp. (Alismataceae), *Ficus* sp. (Moraceae), *Hura crepitans* (Euphorbiaceae), *Lacistema* sp. (Lacistemataceae), *Montrichardia arborescens* (Araceae), *Persea americana* (Lauraceae), *Piper nigrum* (Piperaceae), *Terminalia catappa* (Combretaceae), *Vismia* sp. (Clusiaceae) (Martin & Watson, 1998); *Musa* sp. (Musaceae), *Theobroma* sp. (Sterculiaceae), and *Petrea* sp. (Verbenaceae) (Kairo et al., 2001).	
Risk Element #3: Dispersal Potential Under laboratory conditions, fecundity averaged 42 eggs per female; there may be 12 or more generations per year (Lopez, 2004). As an indication of the species' invasiveness, recent surveys suggest that it is expanding its geographical range in the Caribbean, the most likely mode of spread being the movement of nursery plants (Kairo et al., 2001). The whitefly (as *A. iridescens*) has been intercepted at U.S. ports on 17 occasions since 1985 on various commodities, including ornamentals, from several countries (PestID, 2008). This species has a high dispersal potential, and attendant risk is estimated to be high.	High (3)
Risk Element #4: Economic Impact This whitefly is a major pest of coconut palm in the West Indies (Martin & Watson, 1998). Damage caused by *A. pulvinatus* is typical of that caused by whiteflies in general (Mound & Halsey, 1978). Feeding by nymphs reduces plant vigor, and the sooty molds that grow in excreted honeydew coating leaf surfaces interfere with photosynthesis, further reducing plant fitness; esthetic concerns also are raised by the unsightly appearance of infestations on valuable ornamental plants (Kairo et al., 2001). Although no studies have been carried out to quantify losses, the economic impact of this pest is thought potentially to be high; apart from the loss of plants and costs of their replacement, there have been the high costs of control measures, and potentially adverse effects on the environment and on tourism (Kairo et al., 2001). However, the whitefly is regarded as only a minor pest of guava (Gould & Raga, 2002), and its other hosts are of limited distribution (USDA, 2004a) or economic value in the United States. Given its history as a pest of coconut in the West Indies, and the importance of this palm, as an ornamental plant, to economies dependent on tourism, such as Hawaii and Florida (Neal, 1965; Broschat & Crane, 2000), risk associated with the potential economic impact of *A. pulvinatus* in the United States is estimated to be medium.	Medium (2)
Risk Element #5: Environmental Impact This pest is not expected to pose a threat to native plants in the United States. None of its known hosts, or their close relatives, are listed in 50 CFR §17.12. However, its introduction could result in the initiation of biological control programs, as has occurred in response to introductions of other whitefly species (e.g., Clausen, 1978a).	Medium (2)

Anastrepha bahiensis **Lima (Diptera: Tephritidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Anastrepha bahiensis* has been reported from Brazil, Colombia, Panama, Trinidad (White & Elson-Harris, 1992); Peru (Korytkowski & Ojeda, 1968); and Mexico (Veracruz and Chiapas; Hernández-Ortiz & Pérez-Alonso, 1993; Norrbom, 2004). This tropical distribution suggests that the species would be able to establish permanent populations only in the southern parts of the United States (Plant Hardiness Zones 9-11).	Medium (2)
Risk Element #2: Host Range This pest has been recorded on *Juglans neotropica* and *J. regia* (Juglandaceae), *Coffea arabica* (Rubiaceae) (White & Elson-Harris, 1992); *Brosimum alicastrum*, *Pseudolmedia oxyphyllaria*, *Pouroma cecropiaefolia* (Moraceae) (Hernández-Ortiz & Pérez-Alonso, 1993; Zucchi et al., 1996); *Spondias mombin* (Anacardiaceae), *Psidium guajava* (Myrtaceae) (Sommeijer, 1975); and *Eugenia variabilis* (Myrtaceae) (Norrbom & Kim, 1988). Guava is considered almost a universal host for fruit-infesting Tephritidae (Gould & Raga, 2002).	High (3)
Risk Element #3: Dispersal Potential Information on the reproductive biology of *A. bahiensis* is unavailable. Fecundity of other species of *Anastrepha* ranges from 200 to about 1500 eggs per female, and several generations per year are typical (White & Elson-Harris, 1992). Adults of *Anastrepha* species may fly as far as 135 km; flight thus can be an important means of spread (CABI, 2003). The major means of dispersal to previously uninfested areas is the transport, in international trade, of fruit containing larvae. Puparia also may be disseminated, concealed in packing materials accompanying produce. Assuming that the reproductive and dispersal potentials of *A. bahiensis* are similar to those of other *Anastrepha* species, risk associated with this element is estimated to be high.	High (3)
Risk Element #4: Economic Impact Little information is available on the economic impact of *A. bahiensis*. According to Norrbom (2003b), it is not considered a pest. Gould & Raga (2002) list the fly as only a minor pest of guava. Guava appears not to be a usual host; Sommeijer (1975) found only two specimens of *A. bahiensis* among large numbers of *A. striata* Schiner reared from guava fruits in Trinidad. Available evidence thus suggests that risk associated with the economic impact of this species is low.	Low (1)
Risk Element #5: Environmental Impact This species has the potential to attack plants listed as Threatened or Endangered in 50 CFR §17.12 (e.g., *Eugenia koolauensis*) should it be introduced into the United States. Introduction of the pest could result in the initiation of chemical or biological control programs. Insecticides for the control of fruit flies like *Anastrepha* spp. are used almost everywhere that guavas are grown commercially (Gould & Raga, 2002). *Anastrepha* spp. also have been the targets for biological control programs, with some measure of success (Clausen, 1978b).	High (3)

Anastrepha fraterculus **Wiedemann (Diptera: Tephritidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction The name *A. fraterculus* apparently represents a species complex that is as yet little studied (CABI, 2003). This group ranges from the south of Texas to Argentina (Foote et al., 1993). In Mexico, *A. fraterculus* is reported from Aguascalientes, Campeche, Chiapas, Nuevo León, Oaxaca, Quintana Roo, Tamaulipas, Veracruz, Yucatan, and Zacatecas (Hernández-Ortiz et al., 2002). This pest should be able to survive in areas of the United States corresponding to Plant Hardiness Zones 9-11.	Medium (2)
Risk Element #2: Host Range *Anastrepha fraterculus* is extremely polyphagous. Preferred hosts are Myrtaceae, including *Eugenia* and *Syzygium* spp. (CABI, 2003). A few of the species' many other hosts are *Terminalia catappa* (Combretaceae), *Malus pumila* and *Prunus* spp. (Rosaceae), *Annona* spp. (Annonaceae), *Citrus* spp. (Rutaceae), *Coffea* spp. (Rubiaceae), *Ficus carica* (Moraceae), *Juglans* spp. (Juglandaceae), *Diospyros kaki* (Ebenaceae), *Manilkara zapota* (Sapotaceae), *Persea americana* (Lauraceae), *Solanum quitoense* (Solanaceae), *Theobroma cacao* (Sterculiaceae), *Olea europaea* (Oleaceae), and *Vitis vinifera* (Vitaceae). Guava is listed by Aluja et al. (1987) among natural hosts of the fly.	High (3)
Risk Element #3: Dispersal Potential Females deposit from 200 to 400 eggs in host fruits (White & Elson-Harris, 1992). The species is multivoltine, there being several generations per year (Fletcher, 1989a). Long-distance dispersal has not been reported for adults of *A. fraterculus* (Fletcher, 1989a). The major means for introducing the species to previously uninfested areas is the transport, in international trade, of fruit containing larvae; for most regions, the most important fruits liable to carry this species are mango and guava (CABI, 2003). By all indications, *A. fraterculus* exhibits high reproductive and dispersal potentials.	High (3)
Risk Element #4: Economic Impact *Anastrepha fraterculus* is the most economically important species of *Anastrepha* in Brazil and other South American countries because of its broad host range (Foote et al., 1993). In Brazil, where it causes severe yield losses in apple, the pest is of major concern to growers, and represents a significant constraint to fresh fruit export into countries with quarantine barriers (Sugayama et al., 1996). The insect also is an important pest of guava and mango, and to some extent of *Citrus* and *Prunus* spp. (CABI, 2003). Even if eggs are not deposited in guava fruit, or do not hatch, the oviposition punctures ("stings") may render fruit unmarketable (Gould & Raga, 2002). *Anastrepha fraterculus* is a quarantine pest for Chile, Argentina, New Zealand, Turkey, China, and eastern and southern Africa (EPPO, 2003); thus, its introduction could result in a loss of foreign markets for American-grown commodities, such as citrus. In Peru, hot water is used as a quarantine treatment for mango exported to the United States (Sharp & Picho, 1990), which increases production costs.	High (3)
Risk Element #5: Environmental Impact This polyphagous species is a potential threat to native plants in the United States listed as Threatened or Endangered, such as *Prunus geniculata* in Florida and	High (3)

Anastrepha fraterculus **Wiedemann (Diptera: Tephritidae)**	**Risk ratings**
Eugenia koolauensis and *Solanum* spp. in Hawaii. Its permanent establishment in the United States likely would lead to the employment of chemical or biological controls (Clausen, 1978b; Gould & Raga, 2002).	

Anastrepha ludens **(Loew) (Diptera: Tephritidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction Originally native to Mexico, *A. ludens* occurs from southern Texas to Costa Rica (Foote et al., 1993). The species has been reported from 25 states in Mexico (Hernández-Ortiz et al., 2002). This is the only important *Anastrepha* species that ranges more into subtropical regions, occupying the more northern portion of the range of the genus and extending southward only at higher elevations (Weems, 1963). The fly is said to be able to withstand freezing weather well (Weems, 1963). We estimate this species could become established in areas of the United States corresponding to Plant Hardiness Zones 8-11.	High (3)
Risk Element #2: Host Range Primary hosts are *Citrus* spp. (Rutaceae), *Mangifera indica* (Anacardiaceae), and *Prunus persica* (Rosaceae) (CABI, 2003). Other hosts include *Annona* spp. (Annonaceae), *Coffea arabica* (Rubiaceae), *Passiflora edulis* (Passifloraceae), *Carica papaya* (Caricaceae), *Mammea americana* (Clusiaceae), *Musa* sp. (Musaceae), *Opuntia* sp. (Cactaceae), *Persea americana* (Lauraceae), *Pouteria sapota* (Sapotaceae), *Psidium guajava* (Myrtaceae), *Cucurbita* sp. (Cucurbitaceae), and *Inga* spp. (Fabaceae) (Norrbom & Kim, 1988).	High (3)
Risk Element #3: Dispersal Potential Fecundity is reported to range between 40 and 1600 eggs per female (Liedo & Carey, 1996). There are four to eight generations per year (Aluja, 1993). A flight range of at least 36 km has been reported, and the regular appearance of adults in Texas at least 135 km from known breeding sites in Mexico suggests that the species is capable of considerably greater migration (Fletcher, 1989b). As in other *Anastrepha* species, the major means of dispersal to previously uninfested areas is the transport of fruit, such as citrus and mango, and to a lesser extent peaches and guava, containing larvae (CABI, 2003).	High (3)
Risk Element #4: Economic Impact Because of its broad host range, including fruits of considerable economic importance, such as grapefruit and orange, *A. ludens* is considered to be the most economically important *Anastrepha* species in the United States (Foote et al., 1993). In an early study, potential production losses caused by this and three other fruit fly species were conservatively estimated to be 26.7 million boxes of citrus at a value of $70.1 million (1975 farm-level prices) (Andrew et al., 1977); losses at current price levels would be significantly higher. The fly is considered to be a key pest of guava (Gould & Raga, 2002). Quarantine treatments, such as hot water (Sharp et al., 1989a) and irradiation (Hallman & Rene-Martinez, 2001), have been developed to disinfest fruit, potentially increasing production costs. *Anastrepha ludens* is a quarantine pest for Argentina, Brazil, Chile, Paraguay, Uruguay, Turkey, China, and eastern and southern Africa (EPPO, 2003). Its	High (3)

Anastrepha ludens **(Loew) (Diptera: Tephritidae)**	**Risk ratings**
permanent establishment in the United States could result in a loss of foreign markets for various commodities, such as citrus.	
Risk Element #5: Environmental Impact This species poses a threat to native plants in the United States (e.g., *Prunus geniculata*, *Cucurbita okeechobeensis* ssp. *okeechobeensis*, *Opuntia treleasei*). Its wider establishment likely would lead to the initiation of chemical or biological control programs, as has occurred in response to the introduction of other *Anastrepha* species (Clausen, 1978b).	High (3)

Anastrepha obliqua **(Macquart) (Diptera: Tephritidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction One of the most widespread of *Anastrepha* species (Foote et al., 1993), *A. obliqua* ranges from Mexico to Argentina and through the Caribbean (CABI, 2003). In Mexico, it occurs in 18 states (Hernández-Ortiz et al., 2002). It is estimated that the species would be able to establish populations in southern regions of the United States (Plant Hardiness Zones 9-11).	Medium (2)
Risk Element #2: Host Range This fruit fly has been recorded on more than 60 plant species in 24 families (Foote et al., 1993). The main wild hosts are *Spondias* spp. (Anacardiaceae); *Mangifera indica* (Anacardiaceae) is the major commercial host (CABI, 2003). Other hosts include citrus (Rutaceae), *Annona* spp. (Annonaceae), *Carica papaya* (Caricaceae), *Coffea arabica* (Rubiaceae), *Phaseolus* sp. (Fabaceae), *Prunus* spp. (Rosaceae), *Brosimum alicastrum* (Moraceae), *Eugenia* spp. (Myrtaceae), *Diospyros* spp. (Ebenaceae), *Vitis vinifera* (Vitaceae), and *Pouteria* spp. (Sapotaceae) (Norrbom & Kim, 1988). Guava is a natural host of the fly (Aluja et al., 1987), which suggests that the plant also is a primary host.	High (3)
Risk Element #3: Dispersal Potential Fecundity may exceed 1300 eggs per female in the laboratory (Liedo & Carey, 1996), but 500-700 is the normal range under field conditions (Toledo & Lara, 1996). There are four to eight generations per year (Aluja, 1993). As in other *Anastrepha* species, the major means of dispersal to previously uninfested areas is the transport of fruit, such as mango and, to a lesser extent, citrus and guava, containing larvae. The species has been intercepted in France on mangoes from Mexico (CABI, 2003).	High (3)
Risk Element #4: Economic Impact *Anastrepha obliqua* is one of the most important fruit fly pests of mango (Foote et al., 1993). In Brazil, infestations ranging from 7-88 percent in commercial crops of *Malpighia punicifolia* (Malpighiaceae) were observed, leading to a downgrading of fruit quality (Ohashi et al., 1997). The fly is a major pest of *Eugenia stipitata* in Peru, causing reductions in yield and fruit quality (Couturier et al., 1996), and a major pest of guava (Gould & Raga, 2002). However, it apparently is not a significant pest of citrus (CABI, 2003). Establishment of this pest in the United States could cause a loss of domestic or foreign markets. The species is a quarantine pest for Argentina, Uruguay, China, Taiwan, Indonesia,	High (3)

Anastrepha obliqua **(Macquart) (Diptera: Tephritidae)**	**Risk ratings**
Korea, New Zealand, Namibia, South Africa, Turkey, eastern and southern Africa, and the European Union (EPPO, 2003; PRF, 2004).	
Risk Element #5: Environmental Impact This species is a potential threat to native plants in the United States (e.g., *Eugenia koolauensis*, *Prunus geniculata*). Its introduction could stimulate chemical or biological control programs. Biological control is used in Brazil to suppress *A. obliqua* populations in mango orchards (e.g., Montoya et al., 2000).	High (3)

Anastrepha serpentina **(Wiedemann) (Diptera: Tephritidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Anastrepha serpentina* occurs in most countries of Central America and in South America south to Brazil and Argentina (Foote et al., 1993; CABI, 2003). In Mexico, the species occurs in 16 states (Hernández-Ortiz et al., 2002). It also is reported from California and Texas (CABI, 2003), although Foote et al. (1993) raise doubts as to the species' permanent establishment in the United States. Given its subtropical to tropical distribution, it is estimated that *A. serpentina* could become established in areas of the United States corresponding to Plant Hardiness Zones 9-11.	Medium (2)
Risk Element #2: Host Range Species of Sapotaceae appear to be the favored hosts (Foote et al., 1993). Other hosts include *Citrus* spp. (Rutaceae), *Mammea americana* (Clusiaceae), *Spondias* spp. (Anacardiaceae), *Malus domestica* and *Prunus persica* (Rosaceae), *Lycopersicon esculentum* (Solanaceae), *Persea americana* (Lauraceae), *Annona glabra* (Annonaceae), *Ficus* sp. (Moraceae), *Byrsonima crassifolia* (Malpighiaceae), and *Eugenia uniflora* (Myrtaceae) (Norrbom & Kim, 1988). In their study of fruit fly hosts in Guatemala, Eskafi & Cunningham (1987) recovered *A. serpentina* from guava at lower elevations (0-499 m).	High (3)
Risk Element #3: Dispersal Potential Average fecundity ranges from about 80-100 eggs per female (CABI, 2003), although a maximum of almost 900 eggs per female has been recorded (Liedo & Carey, 1996). There are four to eight generations per year (Aluja, 1993). Long-distance dispersal is accomplished by the transport of immature stages in fruit or packaging (CABI, 2003).	High (3)
Risk Element #4: Economic Impact *Anastrepha serpentina* is an important pest of sapote (*Calocarpum* spp.), sapodilla (*Manilkara zapota*), *Lucuma salicifolia* and other fruits in Mexico; infestations in tree-ripened fruit are said frequently to be so high that growers are forced to harvest early and ripen fruit artificially, which lowers its quality (Weems, 1969). It also is considered a key pest of guava (Gould & Raga, 2002). Hot-water quarantine treatments have been developed for mango infested with this pest (Sharp et al., 1989b). Establishment of the fly in the United States could lead to the loss of domestic or foreign markets for commodities, such as citrus. The fly is a quarantine pest for Argentina, Uruguay, New Zealand, Indonesia, and Taiwan (EPPO, 2003; PRF, 2004).	High (3)

Anastrepha serpentina **(Wiedemann) (Diptera: Tephritidae)**	**Risk ratings**
Risk Element #5: Environmental Impact Forty plant species in 13 families have been recorded as hosts of *A. serpentina* (Foote et al., 1993). Host genera include *Prunus* and *Eugenia* (Norrbom & Kim, 1988), which contain species (i.e., *P. geniculata*, *E. koolauensis*) listed as Endangered in 50 CFR §17.12, and which potentially are vulnerable to attack by this pest. Introduction of this species into the United States also could stimulate the initiation of chemical or biological control programs, as has occurred in response to the introduction of other fruit fly pests (e.g., Clausen, 1978b).	High (3)

Anastrepha striata **Schiner (Diptera: Tephritidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Anastrepha striata* is found throughout Central America, in South America south to Bolivia and Brazil, and in the Netherlands Antilles (CABI, 2003). In Mexico, the species is reported from Aguascalientes, Colima, Chiapas, Guerrero, Jalisco, México D.F., Morelos, Nayarit, Oaxaca, Sinaloa, Tabasco, Veracruz, and Yucatan (Sanchez, 2000; Hernández-Ortiz et al., 2002). It is doubtfully established in the United States (Foote et al., 1993; CABI, 2003). It is estimated that the species could survive in the warmer regions of the United States (Plant Hardiness Zones 9-11).	Medium (2)
Risk Element #2: Host Range *Psidium guajava* is the primary host (Aluja et al., 1987; CABI, 2003). Secondary hosts include *Citrus sinensis* (Rutaceae), *Annona muricata* (Annonaceae), *Chrysophyllum cainito* (Sapotaceae), *Prunus persica* (Rosaceae), *Mangifera indica* (Anacardiaceae), *Persea americana* (Lauraceae), *Terminalia catappa* (Combretaceae) (CABI, 2003); *Manihot esculenta* (Euphorbiaceae) (White & Elson-Harris, 1992); *Solanum macranthum* (Solanaceae), *Eugenia uniflora* (Myrtaceae), and *Passiflora edulis* (Passifloraceae) (Norrbom & Kim, 1988).	High (3)
Risk Element #3: Dispersal Potential Fecundity ranges from 100-800 eggs per female; there are four to eight generations per year (Aluja, 1993). As in other *Anastrepha* species, long-distance dispersal is accomplished by the movement of immature stages present in consignments of infested fruit (CABI, 2003).	High (3)
Risk Element #4: Economic Impact Little detailed information is available concerning the economic impact of *A. striata*. Although Weems (1982) stated that the species is not considered to be of primary economic importance, it is reported to be an important pest of guava in Venezuela (Marín, 1973). It is listed by Gould & Raga (2002) as a key pest of guava. Norrbom (2003c) also considers the species to be an important pest of guava and other myrtaceous fruits. As it is a quarantine pest for New Zealand (EPPO, 2003), establishment of *A. striata* could result in a loss of that market for U.S.-grown commodities, such as citrus. Evidence indicates that this species has standing as a pest of considerable economic importance. Risk associated with its economic impact is estimated to be high.	High (3)

***Anastrepha striata* Schiner (Diptera: Tephritidae)**	**Risk ratings**
Risk Element #5: Environmental Impact *Anastrepha striata* can attack vulnerable native plants in the United States (e.g., *Prunus geniculata*, *Eugenia koolauensis*, Hawaiian *Solanum* spp.). As it represents a potential threat to the citrus and stone fruit industries, chemical or biological control programs could be initiated against the species, as has occurred in response to the introduction of other fruit fly pests (e.g., Clausen, 1978b).	High (3)

***Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Ceratitis capitata* is reported in Europe [Albania, Bulgaria, Croatia, Cyprus, France, Greece, Italy, Malta, Portugal, Russian Federation (Southern Russia), Serbia and Montenegro, Slovenia, Spain, Switzerland], Asia (Iran, Israel, Jordan, Lebanon, Saudi Arabia, Syria, Turkey, Yemen), Africa (Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Comoros, Congo Democratic Republic, Congo, Côte d'Ivoire, Egypt, Ethiopia, Gabon , Ghana, Guinea, Kenya, Liberia, Libya, Madagascar, Malawi, Mali, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Réunion, Saint Helena, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe), Central America (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama), North America (Mexico, Hawaii), South America (Argentina, Bolivia, Brazil, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela), and Oceania (Australia) (CABI, 2005). This species has the capacity to tolerate colder climates better than most other fruit fly species (Weems, 1981). The area in which it survives is of Mediterranean climate, virtually coinciding with where citrus is grown (CABI, 2005). Based on the geographic distribution of *C. capitata*, we estimate the species could establish in areas of the continental United States corresponding to four Plant Hardiness Zones (8-11) and is rated High (3) for this risk element. One or more hosts of *C. capitata* are present in these Plant Hardiness Zones in the United States (USDA-NRCS, 2008).	High (3)
Risk Element #2: Host Range *Ceratitis capitata* has been recorded from a wide variety of host plants in numerous families (CABI, 2005). Its major hosts include *Coffea* sp. (Rubiaceae), *Capsicum annuum* (Solanaceae), *Citrus* (Rutaceae), *Malus domestica*, *Prunus* (Rosaceae), *Ficus carica* (Moraceae), *Psidium guajava* (Myrtaceae), and *Theobroma cacao* (Sterculiaceae) (CABI, 2005). Because this species attacks multiple species among multiple plant families, it is rated High (3) for the Host Range risk element.	High (3)
Risk Element #3: Dispersal Potential Females may deposit up to 22 eggs per day and as many as 800 eggs in a lifetime, although 300 is the more typical number (Weems, 1981). Eggs are inserted into the host fruit in small batches of one to 10 (Weems, 1981). In Australia, breeding is year-round, with several overlapping generations (Hassan, 1977). Adult flight, with a range of 20 km or more (Fletcher, 1989b), and the transport of infested fruits are the major means by which this fruit fly is able to move and disperse to previously	High (3)

Ceratitis capitata **(Wiedemann) (Diptera: Tephritidae)**	**Risk ratings**
uninfested areas (CABI, 2002). Since 1985, *Ceratitis capitata* has been intercepted almost 3,000 times by agricultural specialists at U.S. ports-of-entry, with the vast majority intercepted on fruit (PestID, 2008), which is evidence of this species' ability to be transported long distances in fruit. *Ceratitis capitata* may also be dispersed via puparia in soil, or growing medium accompanying plants (CABI, 2002). As this species has both high biotic potential (several generations per year and many offspring per reproduction) and capability for rapid dispersal (over 10 km/year via natural and/or human-mediated means), it is rated High (3) for the Dispersal Potential risk element.	
Risk Element #4: Economic Impact *Ceratitis capitata* is one of the world's most destructive fruit pests (Weems, 1981). Because of its wide distribution (almost every other continent), ability to tolerate colder climates compared to most other fruit flies, and its wide host range, it is ranked as the most important among economically important fruit flies (CABI, 2002; Weems, 1981). It is a major pest of citrus, but is often an even more serious pest of some deciduous fruits, such as peach, pear, and apple (Weems, 1981). In Mediterranean countries, it is damaging to citrus and peach crops (CABI, 2002). It may also transmit fruit-rotting fungi (CABI, 2002). The species is of quarantine significance worldwide, particularly in Japan and the United States. Its presence, even as temporary adventive populations, can lead to severe constraints for the export of fruits to uninfested areas in other parts of the world. For instance, eradication of recurring populations of *C. capitata* in an area (to maintain pest-free status) can be very costly and resource intensive. Consequently, *C. capitata* is one of the most significant quarantine pests for any tropical or warm temperate areas in which it is not yet established (CABI, 2002). Based on this evidence, *C. capitata* is rated High (3) for the Economic Impact risk element.	High (3)
Risk Element #5: Environmental Impact Its broad host range predisposes this species to attack plants in the United States listed as Threatened or Endangered in 50 CFR §17.12. Examples of potential host plants listed as Threatened or Endangered include *Opuntia treleasei* (in California) and *Prunus geniculata* (in Florida) (USFWS, 2006). As it represents a significant economic threat, the wider establishment of *C. capitata* in the United States undoubtedly would trigger the initiation of chemical or biological control programs, as has occurred in California and Hawaii. Consequently, it is rated High (3) for the Environmental Impact risk element.	High (3)

Coccus viridis **(Green) (Hemiptera: Coccidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This species is pantropical in distribution. It has been reported in India, Indo-China, Malaysia, the Philippines and Indonesia, throughout much of Oceania and sub-Saharan Africa (CABI, 2003). In the New World, it is present in Florida, and ranges from Central America to the northern part of South America and across the Caribbean (CABI, 2003). It could become established in the United States in Plant Hardiness Zones 9-11 (PERAL, 2008). Survival outside of these areas	Medium (2)

***Coccus viridis* (Green) (Hemiptera: Coccidae)**	**Risk ratings**
would be limited to greenhouse or other artificial situations.	
Risk Element #2: Host Range This species is polyphagous and has a broad host range. Primary hosts include *Citrus* spp.(Rutaceae), *Coffea arabica* (Rubiaceae), *Artocarpus* sp. (Moraceae), *Camellia sinensis* (Theaceae), *Manihot esculenta* (Euphorbiaceae), *Mangifera indica* (Anacardiaceae), *Psidium guajava* (Myrtaceae), and *Theobroma cacao* (Sterculiaceae) (CABI, 2003). Other hosts include *Alpinia purpurata* (Zingiberaceae), *Chrysanthemum* sp. (Asteraceae), *Manilkara zapota* (Sapotaceae), and *Nerium oleander* (Apocynaceae) (CABI, 2003).	High (3)
Risk Element #3: Dispersal Potential Females may deposit up to 500 eggs, with number of generations depending on temperature and food availability (CABI, 2003). Kosztarab (1996) reports several generations per year, repeating every 50 to 70 days (Caldwell, 2001). The scale is capable of spreading quickly and widely via the transport of infested plant materials and it has been intercepted numerous times by PPQ on a variety of plants from many countries (PestID, 2008).	High (3)
Risk Element #4: Economic Impact *Coccus viridis* is a major pest of coffee in Haiti (Aitken-Soux, 1985), New Guinea (Williams,1986), and India (Narasimham, 1987). Under laboratory conditions, infestations of 50 scales per plant caused significant damage to coffee seedlings, reducing leaf area and plant growth rate by the nintieth day (Silva and Parra, 1982). In India, quality of citrus fruit was significantly lower on trees following an infestation of *C. viridis* and the sooty mold (*Capnodium citri*) contamination that accompanied it (Haleem, 1984).	High (3)
Risk Element #5: Environmental Impact As a polyphagous organism, *C. viridis* is likely to attack native plants in the United States, some of which could be Threatened or Endangered (*Ochrosia kilaueaensis* – HI; *Illex* – two species, PR; *Senecio layneae* – CA; *Cucurbita okeechobeensis* – FL; *Cordia bellonis* – PR; *Manihot walkerae*– TX; *Scaevola coriacea* – HI; *Hibiscus* – four species, HI; *Eugenia koolauensis* – HI; *E. woodburyana* – PR; *Gardenia* – two species, HI; *Callicara ampla* – PR; *Verbena californica* -CA) (USFWS, 2003). Additional introductions of this species could have a negative impact in citrus production areas, stimulating the initiation of additional chemical or biological control programs, such as the release of predators (ladybird *Chilocorus*, caterpillars *Eublemma*, parasites *Coccophagus*, or parasitic fungus *Cephalosporium lecanii*).	High (3)

***Conotrachelus dimidiatus* Champion (Coleoptera: Curculionidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Conotrachelus dimidiatus* has been reported from El Salvador, Honduras, and Mexico (Aguascalientes, Morelos, Oaxaca, San Luis Potosí, Veracruz, and Zacatecas; González et al., 2002). It should be able to establish only in guava-producing areas of the United States (e.g., Florida, Hawaii), which lie within Plant	Medium (2)

Conotrachelus dimidiatus **Champion (Coleoptera: Curculionidae)**	**Risk ratings**
Hardiness Zones 9-11.	
Risk Element #2: Host Range *Psidium guajava* appears to be the only host of this species (González et al., 2002).	Low (1)
Risk Element #3: Dispersal Potential No information is available on the biology or behavior of this species. Fecundity in other species of *Conotrachelus* (e.g., *C. humeropictus*, *C. psidii*) ranges from 55-793 eggs per female (Mendes et al., 1997; Bailez et al., 2003), and the lengthy life cycles (up to about 300 days) suggest no more than one generation per year, as is known for *C. juglandis* (Corneil & Wilson, 1979). If the reproductive potential of *C. dimidiatus* is similar, a high biotic potential is not indicated. Numerous records of port interceptions of *Conotrachelus* spp. (including *C. dimidiatus*) in various fruits, including guava, in cargo (PestID, 2008) suggest that *C. dimidiatus* has the capacity to disperse rapidly over long distances in trade. Risk associated with the dispersal potential of this pest is estimated to be within the medium range.	Medium (2)
Risk Element #4: Economic Impact Apart from fruit flies (Tephritidae), *C. dimidiatus* is said to be one of the most serious pests of guava (Gould & Raga, 2002). However, because of its narrow host range, it has not become as widespread or as damaging. Damage is caused by larvae boring through fruits (González et al., 2002). Establishment of this weevil in guava-producing areas of the United States (e.g., Hawaii, Florida) could have a negative impact on production. However, guava is a minor crop in terms of its contribution to the U.S. agricultural economy (NCSU, 2002a), and any threats to the guava industry probably would be viewed with less concern than those to other, more economically important crops, such as citrus. Also, insects that have extremely restricted host ranges may be considered to have minor pest potential, particularly where the distribution of their hosts is limited (e.g., Miller et al., 2002). Overall, we rated the risk for economic impact of *C. dimidiatus* as low.	Low (1)
Risk Element #5: Environmental Impact Because of its restricted host range, we do not expect this species to pose a significant threat to native plants in the United States. No *Psidium* species and few Myrtaceae (all in Puerto Rico or the Virgin Islands) are listed in 50 CFR §17.12. As it is a serious pest of guava, its introduction into guava-producing areas (e.g., Hawaii, Florida) could stimulate the initiation of chemical or biological control programs, as has occurred in response to the introduction of other pestiferous weevils into the United States and other countries (e.g., Clausen, 1978c).	Medium (2)

Conotrachelus psidii **Marshall (Coleoptera: Curculionidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Conotrachelus psidii* has been reported from Brazil, Venezuela (González et al., 2002); Bolivia (Squire, 1972); and Mexico (Tabasco; Sanchez, 2000). Given this tropical distribution, it is estimated that it would be able to survive in areas of the United States corresponding to Plant Hardiness Zones 9-11.	Medium (2)

Conotrachelus psidii **Marshall (Coleoptera: Curculionidae)**	**Risk ratings**
Risk Element #2: Host Range *Psidium guajava* appears to be the only host of this weevil (e.g., Bailez et al., 2003).	Low (1)
Risk Element #3: Dispersal Potential Fecundity ranged from 539 to 793 eggs per female in the laboratory (Bailez et al., 2003). One generation per year is indicated (Boscán de Martínez & Cásares, 1981). The pest thus does not appear to have a high reproductive rate. Numerous records of port interceptions of *Conotrachelus* spp. in various fruits, including guava, in cargo (PestID, 2008) suggest that *C. psidii* has the capacity to disperse rapidly over long distances in trade. Risk associated with the dispersal potential of this pest is estimated to be within the medium range.	Medium (2)
Risk Element #4: Economic Impact Apart from fruit flies (Tephritidae), *C. psidii* is said, along with *C. dimidiatus*, to be one of the most serious pests of guava (Gould & Raga, 2002). However, because of its narrow host range, it has not become as widespread or as damaging. Eggs are deposited in small, immature fruit, producing hard, dark lesions in the pulp; subsequent larval feeding within fruit causes extensive damage (Bailez et al., 2003), which may involve destruction of seeds (Boscán de Martínez & Cásares, 1980). In orchards untreated with insecticides, yield losses ranging from 80 to 100 percent have been reported (Boscán de Martínez & Cásares, 1980; Bailez et al., 2003). The best control has been obtained by timing insecticidal applications to coincide with emergence of adults from pupation sites in soil (Gould & Raga, 2002). However, even in treated orchards, yield losses as high as 64 percent may be seen (Boscán de Martínez & Cásares, 1980). Establishment of this weevil in guava-producing areas of the United States (e.g., Hawaii, Florida) could have a negative impact on production. However, guava is a minor crop in terms of its contribution to the U.S. agricultural economy (NCSU, 2002a), and any threats to the guava industry probably would be viewed with less concern than those to other, more economically important crops, such as citrus. Also, insects that have extremely restricted host ranges may be considered to have minor pest potential, particularly where the distribution of their hosts is limited (e.g., Miller et al., 2002). Available evidence suggests that risk associated with the economic impact of *C. psidii* is low.	Low (1)
Risk Element #5: Environmental Impact Because of its restricted host range, this species would not be expected to pose a significant threat to native plants in the United States. No *Psidium* species and few Myrtaceae (all in Puerto Rico or the Virgin Islands) are listed in 50 CFR §17.12. As it is a serious pest of guava, its introduction into guava-producing areas (e.g., Hawaii, Florida) could stimulate the initiation of chemical or biological control programs, as has occurred in response to the introduction of other pestiferous weevils into the United States and other countries (e.g., Clausen, 1978c).	Medium (2)

Dysmicoccus neobrevipes **Beardsley (Hemiptera: Pseudococcidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction The mealybug *D. neobrevipes* occurs throughout Central America, in northern	Medium (2)

***Dysmicoccus neobrevipes* Beardsley (Hemiptera: Pseudococcidae)**	**Risk ratings**
South America, the Caribbean, Indo-China, the Philippines, and parts of Oceania (Ben-Dov, 1994; CABI, 2003). Outside of greenhouse, this species can survive in United States Plant Hardiness Zones 9-11.	
Risk Element #2: Host Range This species is extremely polyphagous, attacking plants from at least 31 families. Hosts include *P. guajava* (USDA, 2004b), *Ananas comosus* (Bromeliaceae), *Malus domestica* (Rosaceae) (CABI, 2003); *Musa paradisiaca* (Musaceae), *Agave sisalana* (Agavaceae), *Cucurbita maxima* (Cucurbitaceae), *Zea mays* (Poaceae), *Gossypium* sop. (Malvaceae), *Heliconia latispatha* (Heliconiaceae), *Citrus* spp. (Rutaceae), *Artocarpus altilis* (Moraceae), *Opuntia megacantha* (Cactaceae), *Lycopersicon esculentum* (Solanaceae), *Acacia koa* and *Samanea saman* (Fabaceae) (USDA, 2003a); *Pritchardia* sp. (Arecaceae), *Helianthus annuus* (Asteraceae) (Nakahara, 1981); and *Furcraea* sp. (CPPR, 1979).	High (3)
Risk Element #3: Dispersal Potential Ito (1938) reported females of the “gray form” of *D. brevipes* (considered by Beardsley [1959] to be *D. neobrevipes*) to produce an average of 347 progeny. Life span averaged about 95 days, and several generations per year were indicated. The main dispersal stage of mealybugs is the first-instar crawler, which may be locally transported by wind or other animals. All life stages may be dispersed over longer distances through the movement of infested plant materials in commerce.	High (3)
Risk Element #4: Economic Impact *Dysmicoccus neobrevipes* attacks a number of valuable commercial crops, and is a particularly serious pest of pineapple, *Ananas comosus*. Like *D. brevipes*, it is a vector of the virus causing pineapple wilt disease (Rohrbach et al., 1988). Infestations of large mealybug populations may cause a loss of host plant vigor. Also, honeydew deposited on leaves and fruit by mealybugs serves as a medium for the growth of black sooty molds, which interfere with photosynthesis and reduce the market value of the crop. Biological and chemical controls often are implemented to control mealybugs, or the attending ants, that aid in their spread and interfere with their biological control. Because many of the host plants attacked by *D. neobrevipes* are commercially or environmentally important to the states of Texas, Arizona, and California, introduction might cause the loss of international and domestic markets.	High (3)
Risk Element #5: Environmental Impact Introduction of *D. neobrevipes* would likely initiate chemical or biological control programs. The species is polyphagous, and can infest plants listed as Threatened or Endangered (e.g., *Agave arizonica* – AZ; *Opuntia treleasei* – CA; *Cucurbita okeechobeensis*- FL; *Helianthus eggertii* – AL, KY, TN, *H. paradoxus* – NM, TX, *H. schweinitzii* – NC, SC; *Pritchardia* – eight species from HI) (USFWS, 2003).	High (3)

***Gymnandrosoma aurantianum* Lima (Lepidoptera: Tortricidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Gymnandrosoma aurantianum* has been reported from Argentina, Brazil, Peru, Ecuador, Venezuela, Colombia, French Guiana, and Surinam in South America, throughout Central America, Mexico (Colima and Veracruz), and from Cuba, Dominica, Puerto Rico, and Trinidad and Tobago in the Caribbean (White, 1999; Adamski & Brown, 2001). Given this tropical distribution, it is estimated that this species could establish only in the warmer, southern regions of the United States (Plant Hardiness Zones 9-11).	Medium (2)
Risk Element #2: Host Range Hosts include *Cupania vernalis* and *Litchi chinensis* (Sapindaceae), *Cojoba arborea* (Fabaceae), *Theobroma cacao* (Sterculiaceae), *Citrus* spp. (Rutaceae), *Macadamia integrifolia* (Proteaceae), *Prunus persica* (Rosaceae), *Punica* sp. (Punicaceae), *Psidium guajava* (Myrtaceae) (Adamski & Brown, 2001); *Simarouba amara* (Simaroubaceae) (White & Tuck, 1993); *Cocos nucifera* (Arecaceae), *Musa acuminata* (Musaceae), and *Annona* spp. (Annonaceae) (Bento et al., 2001).	High (3)
Risk Element #3: Dispersal Potential Fecundity ranges from about 150-200 eggs per female (Bento et al., 2001); eggs apparently are deposited on mature fruit (White & Tuck, 1993). The life cycle may be completed within 36 days (Blanco et al., 1993). Field data indicate at least three generations per year (White, 1999). Although some tortricid species are strong fliers, capable of dispersing over considerable distances under their own power (e.g., *Choristoneura fumiferana* [Clemens]; Solomon, 1991), evidence suggests that the mobility of adult *G. aurantianum* is limited, restricted only to local, within-habitat movements (Bento et al., 2001). However, rapid, long distance dispersal could be accomplished by larvae within fruit transported in commerce, as is suggested by the record of *Gymnandrosoma* or *Ecdytolopha* spp. intercepted at U.S. and foreign ports in cargo (Adamski & Brown, 2001; PestID, 2008).	High (3)
Risk Element #4: Economic Impact *Gymnandrosoma aurantianum* is an important pest of citrus in Brazil (Bento et al., 2001). Yield losses have been estimated to be as high as 50 percent in infested areas, and total losses to the industry may reach $50 million per year. The moth also is considered to be a major pest of macadamia in Costa Rica, causing reductions in yield and nut quality (Coto, 1999). Damage is caused by caterpillars boring through fruits and consuming seeds (Adamski & Brown, 2001). Control measures typically consist of insecticidal treatments (e.g., Scarpellini and dos Santos, 1997), which increase costs of production. As this pest reportedly is difficult to control (Faria et al., 1998; Bento et al., 2001), its introduction could cause a loss of domestic or foreign markets for U.S.-produced citrus, macadamia, or guava. *Gymnandrosoma* spp. are quarantine pests for New Zealand and Venezuela (PRF, 2004).	High (3)
Risk Element #5: Environmental Impact *Gymnandrosoma aurantianum* has the potential to attack threatened or endangered plants in the United States (e.g., *Prunus geniculata*). As it represents a significant threat to citrus production, its introduction could stimulate the initiation of control programs. It is a candidate for biological control in Brazil (Molina et al., 2005).	High (3)

Maconellicoccus hirsutus **(Green) (Hemiptera: Pseudococcidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Maconellicoccus hirsutus* is reported in northern and sub-Saharan Africa, the Middle East, south and-southeast Asia, Mexico, the Caribbean, Central America, northern South America, and Oceania (CABI, 2005). It has a limited distribution in the United States, occurring only in Hawaii, California (CABI, 2005), and Florida (CABI, 2005; Hoy et al., 2003). We estimate *M. hirsutus* could establish in Plant Hardiness Zones 9-11 in the continental United States. One or more of its potential hosts occurs in these Zones (USDA-NRCS, 2008).	Medium (2)
Risk Element #2: Host Range *Maconellicoccus hirsutus* is very polyphagous. It feeds on plants from 73 plant families and over 200 plant genera; it shows some preference for hosts in the families Malvaceae, Leguminosae and Moraceae (CABI, 2002).	High (3)
Risk Element #3: Dispersal Potential Local movement of *M. hirsutus* is accomplished by the first instar (crawler) (CABI, 2002). Crawlers are very small and light, and are able to survive a day or so without feeding (CABI, 2002). They are unable to walk far; on the other hand, they are ideally suited for transport by water, wind and animal agents (CABI, 2002). Accidental introductions into new countries can occur via infested plant material (CABI, 2002). Each adult female lays 150-600 eggs over a one week period (CABI, 2002). A generation is completed in 5 weeks under warm conditions; the species can survive under cold conditions as eggs or other stages on the host plant or in the soil (CABI, 2002). There can be up to 15 generations per year (CABI, 2002). As this species has both high biotic potential (several generations per year and many offspring per reproduction) and capability for rapid dispersal, it is rated High (3) for the Dispersal Potential risk element.	High (3)
Risk Element #4: Economic Impact Estimated annual losses in Grenada due to *M. hirsutus* are $3.5 million (CABI, 2002). Feeding by this scale can cause severe stunting, crinkling of leaves, thickening of stems and a bunchy-top appearance of shoots (CABI, 2002). Honeydew excreted by *M. hirsutus* often leads to sooty mold contamination of fruit, which reduces the value of the fruit (CABI, 2002). Crops seriously damaged by this scale include cotton in Egypt (growth can be arrested); tree cotton in India (yield is reduced); the fiber crops *Hibiscus sabdariffa var. altissima* (roselle), *H. cannabinus* (mesta), and *Boehemeria nivea*, in India and Bangladesh (roselle fiber yield reduced by 21.4% - 40%); and grapes in India (up to 90% of bunches destroyed or so heavily infested that they are unfit for consumption) (CABI, 2002). The establishment of this pest in the United States beyond areas where it already occurs could cause a loss of foreign or domestic markets and would likely stimulate chemical and/or biological control programs, which would lower the value of the commodity by increasing production costs.	High (3)
Risk Element #5: Environmental Impact Because *M. hirsutus* is extremely polyphagous, it is likely to affect Threatened and Endangered plants. Potential hosts listed as Treatened or Endangered (50 CFR § 17.12) that are present in areas of the continental United States outside California and Florida (where it already occurs), and that are present in areas	High (3)

***Maconellicoccus hirsutus* (Green) (Hemiptera: Pseudococcidae)**	**Risk ratings**
climatically suitable for *M. hirsutus* include *Helianthus paradoxus, Helianthus schweinitzii,* and *Manihot walkerae* (USFWS, 2006). Because several economically important plants are potential hosts (*e.g.* cotton, grapes), wider establishment of *M. hirsutus* in the United States would likely stimulate chemical and/or biological control programs.	

***Mycovellosiella psidii* Crous (Ascomycetes: Mycosphaerellales)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This newly described species has been reported only from Mexico (Crous, 1999). It is estimated that it could become established in the United States in areas, in which its host, guava, could survive (Plant Hardiness Zones 9-11).	Medium (2)
Risk Element #2: Host Range *Psidium guajava* is the only known host of the fungus (Crous, 1999).	Low (1)
Risk Element #3: Dispersal Potential Nothing is known of the biology of *M. psidii*. The related species *M. fulva* (Cooke) Arx causes epiphytotics in tomato and disperses by conidia and possibly seed (CABI, 2006). Specimens of *Mycovellosiella psidii* were identified on the fruit of guava (Crous, 1999), and presumably infected guava fruit, transported in commerce, would be able to move the pathogen over long distances. However, since this fungus is currently only reported from one country in the world (Mexico, Crous, 1999) the actual dispersal capability may be limited. The dispersal potential of this species is considered medium.	Medium (2)
Risk Element #4: Economic Impact Lesions on fruit are circular, two to three mm in diameter; mycelium is mostly internal (Crous, 1999). No information is available on the economic impact of *M. psidii*. The related species *M. robbsii* Barreto & Marini causes significant damage to the foliage of *Mimosa caesalpiniaefolia*, a valued ornamental tree in Brazil (Barreto & Marini, 2002). Production losses in bean (*Phaseolus vulgaris*) caused by *M. phaseoli* (O.A. Drumm.) Deighton were estimated to exceed 30,000 tonnes per year in East Africa (Trutmann & Graf, 1993). *Mycovellosiella fulva* was a contributor to storage rots in breadfruit (Amusa et al., 2002). If the damage potential of *M. psidii* is similar, its economic impact might be significant. However, as the fungus apparently is monophagous on guava, a crop of limited production and of no great value to the U.S. agricultural economy, risk associated with its potential economic impact is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact This pathogen is not expected to pose a threat to Threatened or Endangered plants. There are no species of *Psidium* listed in 50 CFR §17.12. Measures (e.g., fungicidal application) already employed to control fungal pathogens of guava in the United States probably would be equally effective against *M. psidii* were it to become established, obviating the need for any new chemical control programs.	Low (1)

Nipaecoccus viridis **(Newstead) (Homoptera: Pseudococcidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This species is widespread in tropical and subtropical Asia, occurs throughout Africa and in parts of Oceania, but has limited distribution in North America (CABI, 2003). In Mexico, the mealybug has been reported from Baja California and Jalisco (CIE, 1983). It should be able to survive only in the warmer, southern regions of the United States (Plant Hardiness Zones 9-11).	Medium (2)
Risk Element #2: Host Range *Nipaecoccus viridis* has been recorded on hosts in at least 40 families (USDA, 2004b). Species include *Citrus* spp. (Rutaceae), *Coffea arabica* (Rubiaceae), *Gossypium hirsutum* and *Hibiscus* spp. (Malvaceae), *Leucaena leucocephala* (Fabaceae), *Nerium* spp. (Apocynaceae), *Punica granatum* (Punicaceae), *Artocarpus* spp. (Moraceae), *Corchorus capsularis* (Tiliaceae), *Asparagus* spp. (Liliaceae), *Euphorbia hirta* and *Manihot esculenta* (Euphorbiaceae), *Mangifera indica* (Anacardiaceae), *Jacaranda mimosifolia* (Bignoniaceae), *Vitis vinifera* (Vitaceae), *Clerodendrum infortunatum* (Verbenaceae), *Solanum tuberosum* (Solanaceae), *Psidium guajava* (Myrtaceae), *Persea americana* (Lauraceae), *Phoenix dactylifera* (Arecaceae), and *Ziziphus* spp. (Rhamnaceae).	High (3)
Risk Element #3: Dispersal Potential Fecundity may exceed 1100 eggs per female; there are multiple generations per year (Bartlett, 1978). Local dispersal is accomplished by crawlers, which often settle in protected areas (e.g., under the sepals of fruitlets); the species is easily disseminated long distances on exported plants or plant products (CABI, 2003).	High (3)
Risk Element #4: Economic Impact Feeding on young twigs causes bulbous outgrowths, and heavy infestations may severely stunt the growth of young trees (CABI, 2003). Citrus fruits infested with *N. viridis* may develop lumpy outgrowths or raised shoulders near the stem end. Frequently, fruits turn yellow and then partly black around the stem end, finally dropping off the tree. Late infestations on large green fruits result in congregations of young mealybugs in clumps over the face of the fruit. Copious quantities of honeydew may contaminate fruit and other plant parts, and serve as a medium for the growth of sooty molds; fruits so contaminated may be unmarketable (Sharaf & Meyerdirk, 1987). This mealybug was responsible for losses up to 5 percent in vineyards in India (CABI, 2003). Losses in citrus orchards are due firstly to fruit drop caused by large infestations of mealybugs; in South Africa, 50 percent or more of the navel orange crop has been lost in this way. Secondly, fruits with deformities caused by mealybug feeding are culled in the packinghouse, resulting in further lost production (CABI, 2003). The mealybug is regarded as a minor pest of guava (Gould & Raga, 2002). *Nipaecoccus viridis* reportedly is difficult to control with chemicals, resulting in repeated application of insecticides at increasing rates (Sharaf & Meyerdirk, 1987). Miller et al. (2002) consider *N. viridis* to be a major threat to U.S. agriculture. The species is a quarantine pest for Korea and New Zealand (PRF, 2004), suggesting that its introduction into the continental United States could result in a loss of foreign markets for various agricultural commodities. The weight of evidence indicates that risk attending the potential economic impact of this pest should be considered high.	High (3)

***Nipaecoccus viridis* (Newstead) (Homoptera: Pseudococcidae)**	**Risk ratings**
Risk Element #5: Environmental Impact This pest represents a potential threat to native plants (e.g., *Euphorbia telephioides*, *Manihot walkerae*, *Ziziphus celata*) in the continental United States. If introduced into the continental United States, its status as a citrus pest could lead to initiation of chemical or biological control programs. The pest (as *N. vastator*) has been the target for successful biological control in Hawaii and Egypt (Bartlett, 1978).	High (3)

***Oligonychus biharensis* (Hirst) (Acari: Tetranychidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction The geographic distribution of *O. biharensis* extends from South and East Asia, through Southeast Asia into various islands of the Pacific (e.g., Hawaii, Samoa, Fiji, New Caledonia, Tonga, Wallis and Futuna), and south to Papua New Guinea and Australia (Bolland et al., 1998). The species also occurs in South Africa and Mauritius. In the New World, it has been reported from Brazil, the Caribbean, and Mexico (Veracruz; Estébanes & Baker, 1966). Given this subtropical to tropical distribution, it is estimated that the mite could become established in the United States within Plant Hardiness Zones 9-11.	Medium (2)
Risk Element #2: Host Range This polyphagous species feeds on host plants in several families, including *Psidium guajava* and *Eugenia javanica* (Myrtaceae), *Euphorbia longana* and *Manihot esculenta* (Euphorbiaceae), *Malus pumila* and *Pyrus communis* (Rosaceae), *Mangifera indica* (Anacardiaceae), *Musa* sp. (Musaceae), *Persea americana* (Lauraceae), *Vitis vinifera* (Vitaceae), *Ziziphus cambodiana* (Rhamnaceae), *Artocarpus* spp. (Moraceae), *Citrus* sp. (Rutaceae), *Acacia* spp. (Fabaceae), *Diospyros* spp. (Ebenaceae), *Durio zibethinus* (Bombacaceae), *Litchi chinensis* (Sapindaceae), *Manilkara sapota* (Sapotaceae), *Grewia paniculata* (Tiliaceae), *Hibiscus tiliaceus* (Malvaceae) (Bolland et al., 1998); *Eichhornia crassipes* (Pontederiaceae) (Haq & Sumangala, 2003); and *Areca catechu* (Arecaceae) (ChannaBasavanna & Banu, 1972).	High (3)
Risk Element #3: Dispersal Potential Depending on temperature and host, average fecundity ranged from 9-72 eggs per female; several generations per year were indicated (Chen et al., 2005; Ji et al., 2005). Under optimal conditions, the calculated intrinsic rate of natural increase (0.3069; Ji et al., 2005) indicated the potential of a population of *O. biharensis* to grow at a rate of over 30 percent per day. The species thus exhibits a high biotic potential. As in all spider mites (Tetranychidae), long-distance spread would be facilitated by passive dispersal on wind currents (“ballooning”) and by the movement of infested plant materials (Jeppson et al., 1975). However, a complete lack of interception records (PestID, 2008) at U.S. ports suggests that it is not spread widely by human agency. Risk is estimated to be medium.	Medium (2)
Risk Element #4: Economic Impact *Oligonychus biharensis* is one of two phytophagous mites considered to have the greatest economic impact on grape production in Taiwan (Tseng, 1974). It also is a	High (3)

Oligonychus biharensis **(Hirst) (Acari: Tetranychidae)**	**Risk ratings**
major pest of cassava (*Manihot esculenta*) (Pillai et al., 1993), contributing, with other phytophagous mites, to yield losses in that crop of 17-33 percent (Pillai & Palaniswami, 1983), and of okra (*Abelmoschus esculentus*), contributing to yield losses of more than 17 percent (Jaydeb Ghosh et al., 1996). Miticides are applied routinely to control the mite (e.g., Pillai & Palaniswami, 1983, 1991), a practice that increases production costs. As the mite is a quarantine pest for Korea and New Zealand (PRF, 2004), its introduction could result in a loss of those markets for various U.S. agricultural commodities. Risk of significant economic consequences occurring with entry of this pest therefore is judged to be high.	
Risk Element #5: Environmental Impact Because its host range includes closely related species, *O. biharensis* is a potential threat to listed (50 CFR §17.12) plants in the continental United States or Puerto Rico, such as *Eugenia haematocarpa* and *E. woodburyana*, *Euphorbia telephioides*, *Manihot walkerae*, and *Ziziphus celata*. As it attacks economically important crops, such as avocado, citrus, grape, and pome fruit, its introduction could lead to the initiation of biological control programs similar to those targeting other tetranychid mites (e.g., McMurtry, 1978). Risk is estimated to be high.	High (3)

Oligonychus psidium **Estébanes & Baker (Acari: Tetranychidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This species occurs in Brazil, Colombia (Bolland et al., 1998); Mexico (Veracruz; Estébanes & Baker, 1966); and Venezuela (Camacho et al., 2002). Based on this distribution, it is estimated that it would be able to establish only in the southern United States (Plant Hardiness Zones 9-11).	Medium (2)
Risk Element #2: Host Range *Oligonychus psidium* has been recorded on *P. guajava* (Myrtaceae) (Camacho et al., 2002) and *Qualea grandiflora* (Vochysiaceae) (Bolland et al., 1998).	High (3)
Risk Element #3: Dispersal Potential We found no information on the reproductive or dispersal potentials of this species. Reproductive capacity is highly variable among species of *Oligonychus*, some have as many as 30 generations per year (e.g., *O. grypus* Baker & Pritchard; Jeppson et al., 1975). If the biology of *O. psidium* is similar, its capacity for increase could be significant. As in all spider mites, long-distance dispersal would be facilitated by wind and the movement of infested plant materials (Jeppson et al., 1975). However, a complete lack of interception records (PestID, 2008) at U.S. ports suggests that it is not spread widely by human agency. Risk is estimated to be medium.	Medium (2)
Risk Element #4: Economic Impact Little information is available on the pest status of this mite. Gould & Raga (2002) list it as a minor pest of guava in Mexico. As it is known to attack few host plants, and none of great economic value to the U.S. economy, risk associated with the species' potential economic impact is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact *O. psidium* is unlikely to be a major threat to plants in the United States listed as	Medium (2)

***Oligonychus psidium* Estébanes & Baker (Acari: Tetranychidae)**	**Risk ratings**
Threatened or Endangered. No species of *Psidium* or *Qualea* is listed in 50 CFR §17.12. However, introduction of the mite into guava production areas could lead to the initiation of biological control programs similar to those targeting other tetranychid mites (e.g., McMurtry, 1978).	

***Pestalotiopsis psidii* (Pat.) Mordue (Ascomycetes: Xylariales)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction The geographic distribution of *P. psidii* includes Australia, Burma, India, Bangladesh, Nepal, Malaysia, Taiwan, Mozambique, Nigeria, Zambia, Zimbabwe, Italy, Puerto Rico, Mexico (Aguascalientes, Zacatecas), Ecuador, Venezuela, and Brazil (Tsay, 1991; Hossain & Meah, 1992; Cardoso et al., 2002; González et al., 2002; Lim & Manicom, 2003; SBML, 2003). Based on this subtropical to tropical distribution, we estimate this pathogen could become established in areas of the United States within Plant Hardiness Zones 9-11.	Medium (2)
Risk Element #2: Host Range Recorded hosts include *Feijoa sellowiana*, *Psidium* spp. (Myrtaceae), and *Musa paradisiaca* (Musaceae) (SBML, 2003).	High (3)
Risk Element #3: Dispersal Potential Little information is available on the reproductive potential of *P. psidii*. It is regarded as a weak parasite, normally occurring as an endophyte in the woody tissues of twigs, that invades fruits opportunistically through insect injuries (Lim & Manicom, 2003), indicating a low degree of virulence. Conditions for local spread of the pathogen are optimal during periods of high precipitation (>130 mm), relative humidity of at least 77 percent, and an average temperature of 23ºC (González et al., 2002). The pathogen has been intercepted on guava fruit in cargo from Mexico (PestID, 2008), suggesting that it has the capacity to disperse widely in commerce.	Medium (2)
Risk Element #4: Economic Impact *Pestalotiopsis psidii* is reported to cause severe losses in guava in Taiwan (Tsay, 1991). In co-infections with other fungi, *P. psidii* contributed to yield losses in guava of 83-100 percent (Hossain & Meah, 1992; Rawal, 1993). Use of fungicides provides effective control of the pathogen (e.g., Tsay, 1991; Hossain & Meah, 1992; González et al., 2002), but increases production costs (Ribeiro & Pommer, 2004). The fruit lesions caused by *P. psidii* (Lim & Manicom, 2003) also could result in a downgrading of fruit quality and divert the commodity from the more lucrative fresh-fruit market into lower value end uses, such as juice. However, the two economic hosts of the fungus, guava and banana, are rather low-value crops (2003 U.S. banana production, restricted to Hawaii, was valued at approximately $9.2 million; NASS, 2004). Risk associated with this pest's potential economic impact is estimated to be medium.	Medium (2)
Risk Element #5: Environmental Impact This pathogen is not expected to pose a threat to native plants in the United States. There are no close relatives of its known hosts listed in 50 CFR §17.12. Measures	Low (1)

Pestalotiopsis psidii **(Pat.) Mordue (Ascomycetes: Xylariales)**	**Risk ratings**
(e.g., application of broad-spectrum fungicides) already employed to control fungal pathogens of guava or other hosts probably would be equally effective against *P. psidii* were it to become established.	

Phenacoccus psidiarum **(Cockerell) (Homoptera: Pseudococcidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This species is known only from Mexico (Jalisco; USDA, 2004b). It is estimated that it would be able to establish permanent populations in the United States in areas corresponding to Plant Hardiness Zones 9-11.	Medium (2)
Risk Element #2: Host Range Guava is the only known host of this species (USDA, 2004b).	Low (1)
Risk Element #3: Dispersal Potential No information on the biology or behavior of this mealybug is available. Other species of *Phenacoccus* may exhibit fecundities in excess of 500 eggs per female (e.g., *P. acericola* King; Kosztarab, 1996) and nine generations per year (*P. manihoti* Matile-Ferrero; CABI, 2003). If the biology of *P. psidiarum* is similar, a high reproductive rate may be indicated. As in all Coccoidea (Gullan & Kosztarab, 1997), the main dispersal stage of mealybugs is the first-instar crawler, which may be transported locally by wind or other animals. As observed in other mealybug species, long-distance dispersal might be achieved via the movement of infested plant materials. However, the species' restricted, Neotropical distribution and a lack of U.S. port interception records (PestID, 2008) suggest that it is not spread widely in commerce. The dispersal potential of *P. psidiarum* is estimated to be medium.	Medium (2)
Risk Element #4: Economic Impact Little is known of the pest potential of *P. psidiarum*. Gould & Raga (2002) consider it to be only a minor pest of guava in Mexico. The only known host of the mealybug is guava, a crop of no great economic value to the U.S. economy. Insects that have extremely restricted host ranges may be considered to have minor pest potential, particularly where the distribution of their hosts is limited (e.g., Miller et al., 2002). Available evidence thus would seem to justify a low estimate of risk attending the species' potential economic impact.	Low (1)
Risk Element #5: Environmental Impact As *P. psidiarum* apparently is monophagous, it is not considered likely to pose a threat to native plants in the United States listed as Endangered or Threatened. No species of *Psidium* is listed in 50 CFR §17.12. However, introduction of the mealybug into guava production areas could lead to the initiation of chemical or biological control programs similar to those targeting other species of *Phenacoccus* (e.g., Bartlett, 1978).	Medium (2)

Planococcus minor **(Maskell) (Homoptera: Pseudococcidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction The distribution of this species extends from South Asia, through parts of Southeast	Medium (2)

Planococcus minor **(Maskell) (Homoptera: Pseudococcidae)**	**Risk ratings**
and East Asia and the Pacific, to Australia. It also is widespread in South and Central America and in the Caribbean (USDA, 2004b), and has been reported from Mexico (Williams & Granara de Willink, 1992). It should be able to establish in areas of the southern United States (Plant Hardiness Zones 9-11).	
Risk Element #2: Host Range This species is extremely polyphagous, having been recorded on hosts in at least 65 families (USDA, 2004b). These include *Colocasia esculenta* (Araceae), *Abutilon* sp. and *Hibiscus* spp. (Malvaceae), *Solanum* spp. (Solanaceae), *Theobroma cacao* (Sterculiaceae), *Citrus* spp. (Rutaceae), *Coffea* spp. (Rubiaceae), *Mangifera indica* (Anacardiaceae), *Musa* spp. (Musaceae), *Eugenia* spp. and *Psidium guajava* (Myrtaceae), *Vitis vinifera* (Vitaceae), *Ziziphus* sp. (Rhamnaceae), *Amaranthus* sp. (Amaranthaceae), *Annona* spp. (Annonaceae), *Helianthus* sp. and *Bidens pilosa* (Asteraceae), *Euphorbia* spp. and *Manihot esculenta* (Euphorbiaceae), *Persea americana* (Lauraceae), *Ipomoea* spp. (Convolvulaceae), *Brassica* spp. (Brassicaceae), *Cucurbita* spp. (Cucurbitaceae), *Zea mays* (Poaceae), *Arachis hypogaea* (Fabaceae), *Artocarpus* spp. (Moraceae), *Cocos nucifera* (Arecaceae), *Pandanus* spp. (Pandanaceae), *Pyrus pyrifolia* (Rosaceae), and *Asparagus plumosus* (Liliaceae) (CABI, 2003; USDA, 2004b).	High (3)
Risk Element #3: Dispersal Potential Reported fecundity ranges from about 200 to over 500 eggs per female, depending on host plant (Maity et al., 1998; Martinez & Suris, 1998; Sahoo et al., 1999); there may be as many as 10 generations per year. The insect is known to be transported long distances in shipments of fruit (Sugimoto, 1994). It has been intercepted at U.S. ports over 440 times on fruits in cargo from various countries (PestID, 2008). *Planococcus minor* thus exhibits high reproductive and dispersal potentials.	High (3)
Risk Element #4: Economic Impact *Planococcus minor* is an important pest of coffee in India (Reddy et al., 1997). Severe outbreaks (originally attributed to *P. citri* [Risso]) also have been reported on coffee and sugarcane in New Guinea (CABI, 2003). It is a pest of durian (*Durio zibethinus*) in Thailand, causing loss of yield and reduction in market value (Anon., 2003). On guava, it is considered only a minor pest (Gould & Raga, 2002). Miller et al. (2002) consider the species to be a major threat to U.S. agriculture. Introduction of this mealybug into the United States could cause the loss of foreign markets for a number of commodities. The species is a quarantine pest for Korea (PRF, 2004). The weight of evidence suggests that risk associated with the economic impact of this pest is high.	High (3)
Risk Element #5: Environmental Impact This species has the potential to attack Threatened or Endangered native plants in the United States (e.g., *Amaranthus brownii*, *Cucurbita okeechobeensis* ssp. *okeechobeensis*, *Helianthus paradoxus*, Hawaiian *Hibiscus*, *Solanum*, *Bidens*, and *Abutilon* spp., *Eugenia koolauensis*, *Euphorbia telephioides*, *Ziziphus celata*, and *Manihot walkerae*). As it represents a potentially serious threat to economically valuable crops (e.g., avocado, citrus, cucurbits), its introduction likely would stimulate initiation of chemical or biological control programs. It has been the target of a biological control program in India (Reddy et al., 1997); other species of	High (3)

***Planococcus minor* (Maskell) (Homoptera: Pseudococcidae)**	**Risk ratings**
Planococcus have been targeted for biological control in the United States and elsewhere (Bartlett, 1978).	

***Pseudococcus solenedyos* Gimpel & Miller (Homoptera: Pseudococcidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This species is known only from Mexico (Chihuahua; USDA, 2004b). Given this subtropical distribution, it is estimated that it could become established in areas of the United States corresponding to Plant Hardiness Zones 9-11.	Medium (2)
Risk Element #2: Host Range *Pseudococcus solenedyos* has been recorded on *Mangifera indica* and *Spondias mombin* (Anacardiaceae), *Psidium guajava* (Myrtaceae), and *Punica granatum* (Punicaceae) (USDA, 2004b).	High (3)
Risk Element #3: Dispersal Potential No information is available on the reproductive or dispersal potentials of this species. Other species of *Pseudococcus* may exhibit fecundities of 200-300 eggs per female and two to three generations per year (e.g., *P. comstocki* [Kuwana]; Kosztarab, 1996). If the biology of *P. solenedyos* is similar, a high reproductive rate may be indicated. As in all Coccoidea (Gullan & Kosztarab, 1997), the main dispersal stage of mealybugs is the first-instar crawler, which may be transported locally by wind or other animals. As observed in other mealybug species, long-distance dispersal might be achieved via the movement of infested plant materials. However, the species' restricted distribution and a lack of U.S. port interception records (PestID, 2008) suggest that it is not spread widely in commerce. The dispersal potential of *P. solenedyos* is estimated to be medium.	Medium (2)
Risk Element #4: Economic Impact No information is available concerning the damage potential of *P. solenedyos*. Miller et al. (2002) consider the species to be a threat to U.S. agriculture, suggesting that it is a potentially serious pest. However, it is known to attack few host plants, and none of great economic value to the U.S. economy. For example, the estimated value of mango and guava production combined is approximately $4.64 million (NCSU, 2002a, b; USDA, 2002), less than 0.0023 percent of total U.S. agricultural output (U.S. Census Bureau, 2003b). Also, insects that have restricted host ranges may be considered to have minor pest potential, particularly where the distribution of their hosts is limited (e.g., Miller et al., 2002). Risk associated with this species' potential economic impact is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact Given its restricted host range, *P. solenedyos* is not considered likely to attack plants listed as Endangered or Threatened in 50 CFR §17.12. As it represents a potential threat to guava and mango in the United States, its establishment in those areas in which the crops are produced, such as Hawaii or Florida, could lead to the initiation of biological control programs, as has occurred in response to introductions of other species of *Pseudococcus* (e.g., Bartlett, 1978).	Medium (2)

Sphaceloma psidii **Bitancourt & Jenkins (Ascomycetes: Myriangiales)[a]**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This species is known from Mexico, New Zealand, Brazil, and one state in the United States (Florida) (Alfieri et al., 1994; Farr et al., 2008). We estimate that it could become established all areas of Hawaii where guava, the primary host, grows in Plant Hardiness Zones 9-13 (USDA-NRCS, 2008).	High (3)
Risk Element #2: Host Range Reported hosts of *S. psidii* are guava, *P. guajava*, and pineapple guava, *Feijoa sellowiana* (Farr et al., 2008; Jenkins & Bitancourt, 1955; USDA-NRCS, 2008). Both of these species are within the Myrtaceae plant family (USDA-NRCS, 2008).	Medium (2)
Risk Element #3: Dispersal Potential We found little information about the dispersal potential of *S. psidii.* The pathogen attacks new leaves and branches but can damage fruits in any stage of development (TCA, 1999). Disease development is favored by a combination of warm temperatures and high relative humidity (TCA, 1999). A related species, *S. perseae* (Jenkins) can be dispersed via conidia moved by wind, rain, and insects (Menge & Ploetz, 2003; Palmeteer et al., 2006). Palmeteer et al. (2006) report that *S. perseae* can quickly move through an avocado grove, most likely being spread by insects. Scab of citrus, *Elsinoë fawcetti* (Anamorph: *Sphaceloma fawcettii*), is spread primarily by rain (or irrigation water in orchard situations), and perhaps also by insects or wind-carried water droplets (CABI, 2007). Another *Sphaceloma* species, *S. mangifereae,* in a study on the dispersal potential of conidia in a sheltered situation, was rain splashed 4.25m (CABI, 2007). In an unsheltered situation the distance was postulated to be longer but the dispersal distances for these rain splashed (wind assisted) pathogens are probably not as great as the dry windborne pathogens like powdery mildews or rusts that can disperse many kilometers (CABI, 2007). *Sphaceloma psidii* has been intercepted 86 times on fruit in passenger baggage since 1988, but has only been intercepted in cargo twice (PestID, 2008). This pathogen is reported in Florida (Alfieri et al., 1994; Farr et al., 2008) and no official control is in place to stop its movement out of Florida. Despite that, it has yet to be reported from any other region of the United States, which may indicate that it is not readily dispersed. The combined evidence from related species and historical movement amounts to a medium rating.	Medium (2)
Risk Element #4: Economic Impact Infection by *Sphaceloma* species causes a hyperplasia, or overgrowth of the infected plant cells, that manifests as a raised “scab-like” lesion or a slightly raised necrotic spot (Horst, 2001). The scab-like lesions on guava fruit, caused by *S. psidii* could result in a downgrading of fruit quality and reduced marketability. Little information is available on the economic impacts on *S. psidii* in the countries where it occurs. This may be due to taxonomic confusion with the other agents causing similar symptoms, or may indicate that the pathogen is not causing significant economic impacts. In avocado, the related species *S. perseae*, can cause severe yield losses from premature fruit drop or culling of infected	Low (1)

Sphaceloma psidii **Bitancourt & Jenkins (Ascomycetes: Myriangiales)**[a]	**Risk ratings**
mature fruit (Pohronezny & Simone, 1994). The pathogen is already reported in Florida where guavas are grown (Alfieri et al., 1994; USDA-NRCS, 2008), and other than a listing of its presence, we found no reports of it having significant impacts. Establishment of this pathogen in guava-producing areas of Hawaii is not likely to greatly increase production costs as many of the recommended cultural and chemical controls typically used for other pathogens (such as sanitation, copper/fungicide sprays) would likely manage the disease (Menge & Ploetz, 2003; Mitchell, 1973).	
Risk Element #5: Environmental Impact Because of its restricted host range, we do not expect *S. psidii* to pose a significant threat to plants listed as Endangered or Threatened. No species of *Psidium* or *Feijoa* are currently is listed in 50 CFR §17.12. Measures (e.g., fungicide application) already employed to control fungal pathogens of guava in Hawaii probably would be equally effective against *S. psidii* were it to become established, obviating the need for any new chemical control programs.	Low (1)

[a] This pest is only actionable on commodities imported for consumption to Hawaii, not for the continental United States or Alaska (PestID, 2008). Therefore, the analysis is for Hawaii only.

Tetraleurodes truncatus **Sampson & Drews (Homoptera: Aleyrodidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This species is known only from Mexico (Mound & Halsey, 1978), wherein it has been reported from the states of Jalisco and Nayarit (Sampson & Drews, 1941). It is estimated that it could become established in tropical and subtropical areas of the United States (Plant Hardiness Zones 9-11), in which guava grows (i.e., Florida, Hawaii).	Medium (2)
Risk Element #2: Host Range Available information indicates that guava is the only host of *T. truncatus* (Mound & Halsey, 1978).	Low (1)
Risk Element #3: Dispersal Potential We found no information on the biology or spread potential of *T. truncatus*. Reproductive rates of whitefly species vary widely, but some have fecundities in excess of 300 eggs per female and several generations per year (Byrne & Bellows, 1991). Natural dispersal in whiteflies is achieved mainly by the winged adults; however, movement of more than a few hundred meters is likely assisted by humans (Byrne & Bellows, 1991). Long-distance dispersal might be achieved via the movement of infested plant materials. However, the species' restricted, Neotropical distribution and a lack of U.S. port interception records (PestID, 2008) suggest that it is not spread widely in commerce. Because of the uncertainty surrounding the reproductive biology of this species, arising from a lack of information, risk associated with its dispersal potential is estimated to be medium.	Medium (2)

Tetraleurodes truncatus Sampson & Drews (Homoptera: Aleyrodidae)	Risk ratings
Risk Element #4: Economic Impact Little information is available on the damage potential of *T. truncatus*. It is regarded by Gould & Raga (2002) as only a minor pest of guava. Establishment of this whitefly in guava-producing areas of the United States (e.g., Hawaii, Florida) could increase costs of production. However, because guava is a minor crop in terms of its contribution to the U.S. agricultural economy, any threats to the guava industry probably would be viewed with less concern than those to other, more economically important crops, such as citrus. Also, insects that have extremely restricted host ranges may be considered to have minor pest potential, particularly where the distribution of their hosts is limited (e.g., Miller et al., 2002). Risk associated with the economic impact of *T. truncatus* is estimated to be low.	Low (1)
Risk Element #5: Environmental Impact Because of its restricted host range, *T. truncatus* is not expected to pose a significant threat to plants listed as Endangered or Threatened. No species of *Psidium* currently is listed in 50 CFR §17.12. As guava is of some economic importance in the United States, introduction of this species into guava-producing areas could lead to the initiation of biological control programs, as has occurred in response to introductions of other whitefly species (e.g., Clausen, 1978a).	Medium (2)

Table 5. Risk rating for consequences of introduction (guava, *Psidium guajava*, from Mexico).

Pest	**Risk elements**					**Cumulative Risk Rating**
	1	**2**	**3**	**4**	**5**	
	Climate / Host Interaction	**Host range**	**Dispersal potential**	**Economic impact**	**Environ. impact**	
Aleurodicus dispersus	Med (2)	High (3)	Med (2)	High (3)	High (3)	High (13)
Aleurodicus maritimus	Med (2)	High (3)	Med (2)	Low (1)	Med (2)	Medium (10)
Aleurodicus pulvinatus	Med (2)	High (3)	High (3)	Med (2)	Med (2)	Medium (12)
Anastrepha bahiensis	Med (2)	High (3)	High (3)	Low (1)	High (3)	Medium (12)
Anastrepha fraterculus	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Anastrepha ludens	High (3)	High (3)	High (3)	High (3)	High (3)	High (15)
Anastrepha obliqua	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Anastrepha serpentina	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Anastrepha striata	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Ceratitis capitata	High (3)	High (3)	High (3)	High (3)	High (3)	High (15)
Coccus viridis	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Conotrachelus dimidiatus	Med (2)	Low (1)	Med (2)	Low (1)	Med (2)	Low (8)
Conotrachelus psidii	Med (2)	Low (1)	Med (2)	Low (1)	Med (2)	Low (8)
Dysmicoccus neobrevipes	Med (2)	High (3)	High (3)	Med (2)	High (3)	High (13)

Pest	Risk elements					Cumulative Risk Rating
	1	2	3	4	5	
	Climate / Host Interaction	**Host range**	**Dispersal potential**	**Economic impact**	**Environ. impact**	
Gymnandrosoma aurantianum	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Maconellicoccus hirsutus	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Mycovellosiella psidii	Med (2)	Low (1)	Med (2)	Low (1)	Low (1)	Low (7)
Nipaecoccus viridis	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Oligonychus biharensis	Med (2)	High (3)	Med (2)	High (3)	High (3)	High (13)
Oligonychus psidium	Med (2)	High (3)	Med (2)	Low (1)	Med (2)	Medium (10)
Pestalotiopsis psidii	Med (2)	High (3)	Med (2)	Med (2)	Low (1)	Medium (10)
Phenacoccus psidiarum	Med (2)	Low (1)	Med (2)	Low (1)	Med (2)	Low (8)
Planococcus minor	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Pseudococcus solenedyos	Med (2)	High (3)	Med (2)	Low (1)	Med (2)	Medium (10)
Sphaceloma psidii [a]	High (3)	Med (2)	Med (2)	Low (1)	Low (1)	Medium (9)
Tetraleurodes truncatus	Med (2)	Low (1)	Med (2)	Low (1)	Med (2)	Low (8)

[a] For Hawaii only

2.7. 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 in Table 7.

2.7.1. Quantity of commodity imported annually

The rating for the quantity imported annually usually is based on the amount reported by the exporting country, converted into standard units of 40-foot-long shipping containers. Guava imports from Mexico are expected to total about 20,000 tonnes per week during the peak harvest season between September and February (approximately 480,000 tonnes per year; T.W.C., unpublished data), a quantity that would fill well in excess of 19,000 shipping containers.

For *Sphaceloma psidii*, we are only concerned about shipments to Hawaii, since this pathogen is non-actionable for the continental United States (PESTID, 2008). the population of Hawaii is about 1.3 million, which is only 0.4 percent of the total U.S. population (U.S. Census Bureau, 2003a). Moreover, since guavas are produced locally in Hawaii (NASS, 2007), the quantity imported is anticipated to be substantially reduced. Anecdotal reports indicate imported guavas are rarely if ever available in Hawaii (Liquido, 2008). Thus, the potential quantity imported to Hawaii will be significantly less than for the continental United States.

2.7.2. Survive post-harvest treatment

ost-harvest treatment of guava fruit in packinghouses in Mexico consists of a clear water bath, brushing with mechanical brushes, sorting, and culling defective or damaged fruits (T.W.C., unpublished data). Among the arthropod pests of concern, all of the fruit flies, the moth *Gymnandrosoma aurantianum*, and the weevils *Conotrachelus dimidiatus* and *C. psidii*, as internal feeders, would be expected to have a high probability (>10 percent; USDA, 2000) of surviving post-harvest treatment, 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 whiteflies *Aleurodicus dispersus, A. maritimus*, *A. pulvinatus*, and *Tetraleurodes truncatus*, scale insects *Coccus viridis, Dysmicoccus neobrevipes*, *Maconellicoccus hirsutus, Nipaecoccus viridis*, *Phenacoccus psidiarum*, *Planococcus minor*, and *Pseudococcus solenedyos*, and the two mites *O. biharensis* and *O. psidium* are external feeders, and are less likely to survive post-harvest treatments. However, depending on their stage (egg, larva, adult) or instar, these arthropods might find shelter on fruit, particularly within the calyx, or in packing materials. For example, many scales prefer to settle within tight, protected areas on hosts (Kosztarab, 1996). Surveys of guava fruit in orchards in Mexico revealed several arthropods, including lepidopterous larvae, mealybugs, beetles (Elateridae, Tenebrionidae), thrips, mites, and bark lice (Psocidae), sheltering within the calyx (T.W.C., unpublished data). Also, whiteflies have sessile stages that live firmly appressed to plant surfaces. This posture and their water-repellent, waxy cuticles could make them difficult to see or dislodge, especially if sheltered within the calyx. 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).

The fungi are likely to survive post-harvest treatment. *Pestalotiopsis psidii* and *Sphaceloma psidii* invade the fruit epidermis, eventually producing a scabby lesion on the fruit surface (Horst, 2001; Lim & Manicom, 2003). The mycelium of *Mycovellosiella psidii* also occurs in the interior of the fruit (Crous, 1999). As internal parasites, the fungi would be protected from any post-harvest operations that treat the fruit surface only.

2.7.3. Survive shipment

The conditions for shipping guavas to the United States are unknown at present. Interception records may provide some indication of the ability of pest organisms to survive shipping conditions. Low rates of interception may suggest that certain pests do not survive well conditions under which produce from Mexico is shipped. Those exhibiting low rates of interception (< 50 individuals; Table 6) at U.S. ports on Mexican fruits are estimated to present a low risk of surviving shipment (< 0.1 percent). Species intercepted in higher numbers (50-100 individuals) are estimated to present a medium risk. Finally, for those pests intercepted in the highest numbers (> 100 individuals), risk of their surviving shipment is considered to be high.

Table 6. Interceptions at U.S. ports of pests on or in various fruits in cargo from Mexico (PestID, 2008).

Pest	**Individuals Intercepted (no.)**
Aleurodicus dispersus	1
Aleurodicus maritimus	0
Aleurodicus pulvinatus	0
Anastrepha spp.	680[a]
Ceratitis spp.	30
Coccus spp.	36
Conotrachelus spp.	76[a]
Gymnandrosoma or *Ecdytolopha*[b] sp.	3
Dysmicoccus spp.	145
Maconellicoccus spp.	4
Nipaecoccus viridis	0
Oligonychus biharensis	0
Oligonychus psidium	0
Phenacoccus sp.	2
Planococcus spp.	5
Pseudococcus solenedyos	0
Tetraleurodes sp.	1
Mycovellosiella psidii	0
Pestalotiopsis psidii	4[a]
Sphaceloma psidii	1

[a] Records include guava among fruits inspected.
[b] *Ecdytolopha* and *Gymnandrosoma* are closely related genera with similar characters (Adamski & Brown, 2001).

2.7.4. Not detected at a port-of-entry

As with assessing the risk of guava 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 tephritids (*Anastrepha* spp. and *Ceratitis capitata*) could have a high probability of escaping detection at a port-of-entry; fruit fly-infested fruit can go unrecognized (White & Elson-Harris, 1992). *Gymnandrosoma aurantianum* and the *Conotrachelus* spp., also internal pests, similarly could go undetected. 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, in surveys in Mexican guava orchards, mealybugs and mites, among other arthropods, were found sheltering within the calyx on guava fruits (T.W.C., unpublished data). 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). The small size of tetranychid mites and their habit of living or depositing eggs in secluded places on hosts has tended to protect them against detection during transportation (Jeppson et al., 1975). The ease with which whiteflies elude detection and cross phytosanitary barriers is indicated by recent, significant range expansions of several species, such as *Aleurodicus dispersus* and *Aleurocanthus* spp., despite the best efforts of port quarantine officials (Martin et al., 2000). Risk of the external pests' not being detected is estimated to be medium.

Latent fungal infections of guava 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.

2.7.5. Moved to a habitat suitable for survival

Guavas from Mexico are likely to be sold in every state except perhaps Hawaii. 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. Guavas are popular in Hispanic cooking (Heaton, 1997). The fruit also figures prominently in holiday celebrations of Hispanic and Asian groups (Degner et al., 1997). These groups likely would constitute the major markets for guava in the United States. Seven states, having 60 percent of the total U.S. Hispanic or Latino and Asian population (U.S. Census Bureau, 2003a), contain areas within Plant Hardiness Zones 9, 10, or 11; and 17 states (68 percent of the total Hispanic or Latino and Asian population) contain areas within Plant Hardiness Zones 8, 9, 10, or 11. Assuming that infestations or infections will be randomly distributed among shipments, because it is considered capable of surviving in a range of states (those containing areas within Zones 8 and above) that may comprise a high percentage (> 67 percent) of likely markets for Mexican guavas, *A. ludens* and *C. capitata* are estimated to present a high risk of moving to habitat suitable for survival. We estimated the remaining pests, except for *Sphaceloma psidii*, present medium risk.

For *Sphaceloma psidii*, the analysis is only for Hawaii. That is a much smaller geographic area and guavas grow naturally throughout Hawaii (CABI, 2007; USDA-NRCS, 2008), making them a part of the local diet. Thus, the approach used above for the rest of the pests is not applicable. Disease development of *S. psidii* is favored by a combination of warm temperatures and high relative humidity (TCA, 1999) and while Hawaii boasts a range of climatic conditions, these two variables are likely to be available in most parts of Hawaii throughout the year (NOAA, 2008). *Sphaceloma psidii* is reported in Mexico, New Zealand, Brazil, and Florida in the United States (Alfieri et al., 1994; Farr et al., 2008). Based on these distributions and the biology of the pathogen, we estimated that if transported to Hawaii, *S. psidii* has a high likehood of being moved to a suitable habitat for survival in Hawaii.

2.7.6. 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 successfully.

For several reasons, most pests could have a low probability of finding suitable host material. Although some guava may be exported to the United States at all times of year, the bulk of shipments is more likely to occur during the peak harvest season from about September to February (fall to late winter; T.W.C., unpublished data). Hosts, if present, may not be in suitable condition (i.e., with new vegetative growth) during much of that period. Also, because guavas will be imported for consumption only, the fruits would be expected to have a limited chance of introduction directly into the natural or agricultural environments, in which hosts might be found. The pest identificaton database (PestID), maintained by APHIS, provides a record of interceptions at U.S. ports of quarantine pests on various commodities (fruits and vegetables). As only a small percentage of goods passing through the ports is inspected, 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, and are thus presented with opportunities to become established. Yet no records of establishment exist for many of these pests. For example, *Planococcus minor* has been intercepted at U.S. ports more than 3600 times on various commodities for consumption over the past 19 years (PestID, 2008), but has apparently failed to become established.

Superimposed on the question of host access is that concerning the influence many of the mortality factors (e.g., predators; inclement weather) present in any environment (and the stochasticity often operating in these; Mack et al., 2000) would have on the probability that a small animal, like an arthropod, would survive long enough to encounter hosts. 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. For the above reasons, risk that they will come into contact with host material is estimated to be low for most of the pests, with some exceptions.

Several of the arthropods potentially accompanying guava consignments from Mexico (i.e., females of the scale insects *C. viridis*, *D. neobrevipes*, *N. viridis*, *P. psidiarum*, *P. minor*, and *P. solenedyos*), because they lack wings or other means to achieve flight, have limited powers of dispersal (Gullan & Kosztarab, 1997), and thus lack the ability to locate hosts quickly. For these insects, successful establishment in a new environment is contingent on the likelihood of at least two necessary conditions occurring: close proximity of susceptible hosts and presence on the imported fruit of crawlers or other mobile forms to transfer to new hosts (e.g., Miller, 1985; Blank et al., 1993), circumstances that are highly unlikely to co-occur. A few of the pests (i.e., *A. maritimus*, *A. bahiensis*, *C. dimidiatus*, *C. psidii*, *O. psidium*, *P. psidiarum*, *T. truncatus*, *Pestalotiopsis psidii*, and *Mycovellosiella psidii*) are restricted to guava or to that host and one or a few tropical species that have limited distributions within the United States (USDA, 2004a). The polyphagous *O. biharensis* is capable only of passive dispersal on air currents. Its probability of encountering acceptable hosts in a new region is considered low.

Several of the pests have become sporadically established in the continental United States. These are *Anastrepha fraterculus* (Texas), *A. ludens* (Texas), *A. serpentina* (California and Texas) (Foote et al., 1993), and *Ceratitis capitata* (California and Florida) (Bergsten et al., 1999; Lance and Gates, 1994). (These pests have not become permanently established and are subject to official control when detected.) That these species have a high probability of coming into contact with host material suitable for reproduction is demonstrated clearly by the fact that they already have done so. Risk, therefore, is estimated to be high.

Hosts of the polyphagous and highly mobile *Anastrepha* spp., *Ceratitis capitata*, and *Gymnandrosoma aurantianum* include temperate-zone or widely cultivated plants, such as *Prunus* and *Citrus* spp. (USDA, 2004a), which should be available throughout the potential area of establishment. Risk that these pests will encounter suitable host material is considered high. This is also true for the whitefly *A. dispersus.*

For *Sphaceloma psidii*, host material is available in a much larger portion of the risk area (Hawaii) than in the rest of the United States. Guavas were introduced into Hawaii in the early 1800's and in some areas their growth is aggressive to the point of being considered "weedy" (Morton, 1987; pp. 356-363). The other reported host for *S. psidii*, pineapple guava, *Feijoa sellowiana* (Farr et al., 2008; Jenkins & Bitancourt, 1955), is an introduced and cultivated species in Hawaii (Starr and Starr, 2008). Because host material is available throughout much of the risk area and the pathogen can move via infected plant material or other natural means (see above), we rated this element as high.

Table 7. Risk ratings for likelihood of introduction (guava, *Psidium guajava*, from Mexico).

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**
Aleurodicus dispersus	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	High (3)	Medium (13)
Aleurodicus maritimus	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Aleurodicus pulvinatus	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Anastrepha bahiensis	High (3)	High (3)	High (3)	High (3)	Med (2)	Low (1)	High (15)
Anastrepha fraterculus	High (3)	High (3)	High (3)	High (3)	Med (2)	High (3)	High (17)
Anastrepha ludens	High (3)	High (3)	High (3)	High (3)	High (3)	High (3)	High (18)
Anastrepha obliqua	High (3)	High (3)	High (3)	High (3)	Med (2)	High (3)	High (17)
Anastrepha serpentina	High (3)	High (3)	High (3)	High (3)	Med (2)	High (3)	High (17)
Anastrepha striata	High (3)	High (3)	High (3)	High (3)	Med (2)	High (3)	High (17)
Ceratitis capitata	High (3)	High (3)	Low (1)	High (3)	High (3)	High (3)	High (16)
Coccus viridis	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Conotrachelus dimidiatus	High (3)	High (3)	Med (2)	High (3)	Med (2)	Low (1)	Medium (14)
Conotrachelus psidii	High (3)	High (3)	Med (2)	High (3)	Med (2)	Low (1)	Medium (14)
Dysmicoccus neobrevipes	High (3)	Med (2)	High (3)	Med (2)	Med (2)	Low (1)	Medium (13)

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
Gymnandrosoma aurantianum	High (3)	High (3)	Low (1)	High (3)	Med (2)	High (3)	High (15)
Maconellicoccus hirsutus	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Mycovellosiella psidii	High (3)	High (3)	Low (1)	High (3)	Med (2)	Low (1)	Medium (13)
Nipaecoccus viridis	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Oligonychus biharensis	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Oligonychus psidium	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Pestalotiopsis psidii	High (3)	High (3)	Low (1)	High (3)	Med (2)	Low (1)	Medium (13)
Phenacoccus psidiarum	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Planococcus minor	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Pseudococcus solenedyos	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)
Sphaceloma psidii [a]	Low (1)	High (3)	Low (1)	High (3)	High (3)	High (3)	Medium (14)
Tetraleurodes truncatus	High (3)	Med (2)	Low (1)	Med (2)	Med (2)	Low (1)	Medium (11)

[a] For Hawaii only

2.8. 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 8). 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 port-of-entry inspection is not considered sufficient to provide phytosanitary security. An outline of appropriate phytosanitary options to mitigate pest risks is presented in the next section of this document.

Pestalotiopsis psidii (Pat.) Mordue and *Mycovellosiella psidii* Crous received **medium** pest risk potential ratings; however, for the following reasons the actual risk is considered to be lower and mitigation measures beyond inspection and monitoring are not warranted.

2.8.1. *Pestalotiopsis psidii* (Pat.) Mordue

Pestalotiopsis psidii, although regarded as a common pathogen in guava production (Kwee & Chong, 1990 *In* Keith et al., 2006) is considered a weak parasite and acts opportunistically on insect-damaged host tissue (Lim & Manicom, 2003). The host range for *P. psidii* is primarily limited to *P. guajava* (Farr et al., 2008). Three other *Psidium* species were reported in association with *Pestalotiopsis psidii*: *Psidium pomiferum*, *P. guineense*, and *P. cattleianum* (Farr et al., 2008). *Psidium pomiferum* is considered a synonym of *Psidium guajava* (USDA-ARS, 2008) and U.S. field cultivation of *P. cattleianum* and *P. guineense* is mainly limited tropical to sub-tropical areas only found in parts of Florida and California (USDA-NRCS, 2008; Mortan, 1987). There are reports on *Feijoa* and *Musa* but these records seem incidental in comparison to the reports on guava; one reference on *Feijoa sellowiana* in Italy (1991) and one reference on *Musa* x *paradisiaca* in India (1979) (Farr et al., 2008).

Since *Pestalotiopsis psidii* has been intercepted with guava fruit from Mexico (PestID, 2008), a pathway of introduction exists. But for rain splash dispersal and successful infection to occur, an infected fruit intended for consumption must then be discarded in close proximity to a susceptible host with the proper climatic conditions (proper temperature, relative humidity, and perhaps presence of wounded tissue as stated above).

In the continental United States, guava cultivation is limited to southern Florida (USF, 2000). There is also some production in California (Degner et al., 1997; USDA-NASS, 2002). Currently, about 360 acres are planted to guava in south Florida with production mostly based in just one county (Dade) (USDA-NASS, 2002).

The fungus is also only known to occur in regions with climates comparable to Plant Hardiness Zones 9 and above and therefore survival may be limited to just those areas in the United States where guavas are being grown.

Pestalotiopsis psidii is able to attack all growth stages of the guava and causes scabby fruit cankers that result in pre- and postharvest losses (Kwee & Chong, 1990 *In* Keith et al*.,* 2006; Lim & Manicom, 2003). Scab laden fruit would likely be culled in postharvest processing and early infection may even cause fruit to drop before maturation (Verma & Sharma, 1999).

The history of interceptions of this pathogen on fruit from Mexico demonstrates that visual detection of infected fruit is possible. However as with most pathogens there still is the possibility of latent infections but due to the limited host range, lack of inherent dispersal potential, low availability of host material in the United States, and the weak parasitic nature of the fungus the actual pest risk is reduced and measures such as inspection/monitoring (including ensuring fruits are free of insect damage) is sufficient.

2.8.2. *Mycovellosiella psidii*

Mycovellosiella psidii has a host range limited to *Psidium guajava* (Farr et al., 2008) so a similiar arguement about low availability of host material in the United States also applies. Very little biological or geographical information has been published on *M. psidii*.

The fact that this fungus has only been reported in one country in the world (Crous, 1999) may be an indication that it is being reported under a different name in other countries, it is not causing enough damage in other countries to be researched and reported, or that its dispersal potential is quite low.

If a latently infected fruit intended for consumption, were to enter the United States from Mexico the likelihood of it being discarded in close enough proximity to host material and obtaining necessary climatic conditions to sporulate and be dispersed into a guava canopy is low. Using Version 5.02 of the USDA Guidelines for Pathway-Initiated Pest Risk Assessments (USDA, 2000) this fungus was found to have a medium pest risk potential however because of the limited host availability and limited inherent dispersal capabilities, mitigation measures beyond inspection/monitoring are not warranted.

Table 8. Pest Risk Potentials.

Pest	Consequences of Introduction	Likelihood of Introduction	Pest Risk Potential
Aleurodicus dispersus	High (13)	Medium (13)	Medium (26)
Aleurodicus maritimus	Medium (10)	Medium (11)	Medium (21)
Aleurodicus pulvinatus	Medium (12)	Medium (11)	Medium (23)
Anastrepha bahiensis	Medium (12)	High (15)	High (27)
Anastrepha fraterculus	High (14)	High (17)	High (31)
Anastrepha ludens	High (15)	High (18)	High (33)
Anastrepha obliqua	High (14)	High (17)	High (31)
Anastrepha serpentina	High (14)	High (17)	High (31)
Anastrepha striata	High (14)	High (17)	High (31)
Ceratitis capitata	High (15)	High (16)	High (31)
Coccus viridis	High (14)	Medium (11)	Medium (25)
Conotrachelus dimidiatus	Low (8)	Medium (14)	Medium (22)
Conotrachelus psidii	Low (8)	Medium (14)	Medium (22)
Dysmicoccus neobrevipes	High (13)	Medium (13)	Medium (26)
Gymnandrosoma aurantianum	High (14)	High (15)	High (29)
Maconellicoccus hirsutus	High (14)	Medium (11)	Medium (25)
Mycovellosiella psidii	Low (7)	Medium (13)	Medium (20)
Nipaecoccus viridis	High (14)	Medium (11)	Medium (25)
Oligonychus biharensis	High (13)	Medium (11)	Medium (24)
Oligonychus psidium	Medium (10)	Medium (11)	Medium (21)
Pestalotiopsis psidii	Medium (10)	Medium (13)	Medium (23)
Phenacoccus psidiarum	Low (8)	Medium (11)	Medium (19)
Planococcus minor	High (14)	Medium (11)	Medium (25)
Pseudococcus solenedyos	Medium (10)	Medium (11)	Medium (21)
Sphaceloma psidii	Medium (9)	Medium (14)	Medium (23)
Tetraleurodes truncatus	Low (8)	Medium (11)	Medium (19)

3. Risk Management

3.1. Measures for Pest Risk Reduction

The appropriate level of protection for an importing country can be achieved by the application of a single phytosanitary measure, such as inspection or a quarantine treatment, or a combination of measures. The combination of specific phytosanitary measures that provides overlapping or redundant safeguards is distinctly different from the use of a single risk mitigative technique. Such combinations vary in complexity; however, all require the integration of two or more measures that act independently of each other, the cumulative effect achieving the desired level of phytosanitary protection (i.e., a systems approach; IPPC, 2002b). Specific mitigations may be selected from a range of pre-harvest and post-harvest options, and may include other safeguarding measures. Measures may be added or the strength of measures increased to compensate for uncertainty. At a minimum, for a measure to be considered for use in a systems approach, it must be: 1) clearly defined; 2) efficacious; 3) officially required (mandated); and 4) subject to monitoring and control by the responsible national plant protection organization (IPPC, 2002b). Systems approaches to risk mitigation have been specified in recent work plans for the importation of commodities, such as citrus from Chile (Fernandez, 2004) and avocado from Mexico (USDA, 2005).

A systems approach to mitigating risks involved with guava imports from Mexico might combine a variety of measures, including: 1) certification of pest free areas, pest free places of production, or areas of low pest prevalence for certain quarantine pests, such as fruit flies; 2) programs (e.g., mechanical, chemical, cultural) to control pests within orchards; 3) preclearance oversight by USDA-APHIS officials; 4) packinghouse procedures (e.g., washing, brushing, inspection of fruit) to eliminate external pests; 5) quarantine treatments to disinfest fruit of internal and external pests; 6) consignments inspected and certified by Mexico SAGARPA and APHIS, PPQ to be free of quarantine pests; 7) fruit traceable to state of origin, packing facility, grower, and orchard; 8) consignments subject to sampling and inspection after arrival in the United States; and 9) limits on distribution and transit within the United States.

3.2. Phytosanitary Options

This section describes risk mitigative options with discussion of efficacy, if known, and application.

3.2.1. Pest-free areas

As a sole mitigative measure, the establishment of pest-free areas or pest-free places of production may be completely effective in satisfying an importing country’s appropriate level of phytosanitary protection (IPPC, 1996b, 1999). This option has proven to be successful in practice, obviating the need for post-harvest commodity treatments to achieve probit-9-level security (e.g., TDOA, 2003). Establishment and maintenance of pest-free areas or production sites should be in compliance with international standards (e.g., IPPC, 1996b, 1999; NAPPO, 2004b). For example, in surveys for fruit flies, such as *Anastrepha* spp., for which parapheromones are not available, minimal trap density in zones of high risk (areas having high probability of fly establishment or introduction) should be five traps per km^2 (NAPPO, 1998), traps (e.g., McPhail) to be baited with protein hydrolysate (IAEA, 2003; NAPPO, 2004b). To confirm area freedom from *Ceratitis capitata*, which is under official control in Mexico (PPQ, 1999), surveys should continue, following the protocol specified in the draft "Work Plan for Export of Guava Under Systems Approach from Mexico to the United States of America" (Hernández, 2005). All specimens should be identified to species and sexed within four days of capture.

The sex pheromone of *Gymnandrosoma aurantianum* has been discovered, and the active ingredients isolated, synthesized, and field-tested (Leal et al., 2001). The resulting parapheromone has been developed into a commercial product in Brazil under the trade name Ferocitrus Furão® (http://www.ferocitrusfurao.com.br/controlar.htm), which includes the compound in tablet form and a trap (Parra et al., 2004). For *G. aurantianum* survey in citrus orchards, traps are placed at a density of one per 10 ha.

Orchard survey to detect other internal and external guava pests may follow procedures (e.g., foliage inspection, branch beating) outlined in the work plan for Mexican Hass avocado (USDA, 2005). Survey for the *Conotrachelus* weevils, in particular, may be aided by the use of unbaited, active or passive traps that capture by exploiting beetle behavior. For example, Bloem et al. (2002) collected specimens of 89 species of Curculionidae, including 13 *Conotrachelus* spp., using traps of three designs placed in various wild and cultivated habitats. The active, free-standing "Tedders" and "Stinkbug" traps create an upright silhouette (presumably mimicking objects, such as tree trunks), which attract crawling or flying beetles, whereas the "Circle" trap, which normally is attached to a tree trunk, serves as a passive funnel to capture beetles as they crawl upwards.

3.2.2. Areas of low pest prevalence

According to the IPPC, an area of low pest prevalence may comprise all of a country, part of a country, or all or parts of several countries, in which a particular pest species occurs at low population densities and which is or are subject to effective surveillance and control or eradication measures (FAO, 1999). Procedures for the establishment and maintenance of areas of low pest prevalence should comply with international standards (e.g., NAPPO, 2003; IPPC, 2005). For example, elements of an operational plan for establishment and maintenance of such areas might include a geographic description to delimit the area; specification of an upper limit to pest densities; means to document and verify all necessary procedures and maintain records; specification of phytosanitary procedures (e.g., survey, pest control); and movement controls to prevent pest entry or re-entry into the area. The international standards recommend that the exporting country consult with the importing country in the early stages of implementation to ensure that importing country requirements are met. In particular, target or threshold population densities defining an area of low pest prevalence should be established in consultation with the importing country.

Any protocol for establishing and maintaining a pest-free area or area of low pest prevalence also should include a pest-reporting procedure and emergency action plan to address target pest detections in the pest-free or low-prevalence zones (IPPC, 1999, 2005; NAPPO, 2003, 2004b). Orchards producing fruit for export to the United States will be restricted to the states of Aguascalientes and Zacatecas (Hernández, 2004).

3.2.3. Control program

Cultural, chemical, or mechanical means (e.g., orchard sanitation, pruning of dead and diseased branches, pre-harvest application of pesticides, fruit bagging) may be used to eliminate pests from orchards or prevent fruit infestation. Sanitation and pesticidal applications, as essential components of best management practices, are mainstays of commercial fruit production (e.g., Kirk et al., 2001). For fruit flies, in particular, sterile insect release and other controls may be employed as prophylactic measures or in response to pest detection, following guidelines in USDA (2003a).

Simple physical barriers, such as paper or plastic bags, may be highly effective in protecting fruit from pests. For example, fruit bagging combined with protein bait sprays reduced fruit fly (*Bactrocera* and *Dacus* spp.) infestations in unspecified fruit by up to 98 percent (Sar et al., 2001). Depending on the timing of the operation (early or late in fruit development), bagging reduced infestations of the fruit-boring caterpillar, *Deudorix livia* (Klug) (Lycaenidae), by 84-98 percent in pomegranate, *Punica granatum* (Hussein et al., 1994). In pineapple guava, *Feijoa sellowiana*, effective control of *Anastrepha fraterculus* was achieved if bagging was commenced when fruit reached an average diameter of 22 mm (Hickel & Ducroquet, 1994). Bagging has the potential to prevent the insect damage to guava fruit that provides entry for *Pestalotiopsis psidii* infection (Lim & Manicom, 2003). Experimentation is needed to determine the timing of guava (*P. guajava*) fruit bagging that will provide optimal control of pests in Mexico. However, despite its high degree of efficacy in preventing attack by some insect pests, bagging may increase fruit infestation by others, such as mealybugs (Shevale & Khaire, 1998).

3.2.4. Phytosanitary certification inspections and monitoring

Fruit should be sampled and inspected periodically during the growing season and after harvest. Orchards should be surveyed twice per year, during which time 10 percent of the area of each orchard is inspected. At these times, a random sample of fruit per tree (some from the ground), in a specified number of trees (at orchard edges) per ha, should be taken, inspected, and cut to detect a 0.00003 infestation rate (three infested fruit per 100,000; Hennessey & Jones, 2005). Results of surveys must be negative for larvae of fruit flies, *G. aurantianum*, and *Conotrachelus* weevils, and external pests. Production areas also may be subject to periodic, unannounced inspections by certified inspectors from PPQ and SAGARPA to ensure that they meet stipulated requirements for the issuance of a phytosanitary certificate that would be required for each consignment. This measure is useful for detecting pests present in the field that may be more difficult to detect post-harvest, but it must be combined with other measures to ensure the absence of pests of concern. Statistical procedures are available to verify, to a specified confidence level, the pest-free status of an area, given negative survey or trapping results (e.g., Venette et al., 2002; Barclay & Hargrove, 2005).

3.2.5. Post-harvest safeguards and packinghouse procedures

Containers of harvested fruit should be covered with tarpaulins or other covers and moved to the packinghouse in a fruit fly-proof conveyance in a timely manner (e.g., within three hours of harvest), consistent with requirements in the work plan for the importation of Mexican Hass avocado (USDA, 2005). Upon arrival at the packinghouse, a random sample of fruit per lot should be taken to be inspected for external pests and cut to reveal internal pests, each sample to be of sufficient size to detect a 0.00003 infestation rate (Hennessey & Jones, 2005). In the packinghouse, fruit should undergo mechanical brushing or other treatment to remove external pests. Fruit then should be immersed in a water bath containing surfactant and, perhaps, a surface sterilant, such as chlorine bleach (e.g., NaOCl). Surfactants, such as common dishwashing detergent, may show a high degree of insecticidal activity with minimal risk of phytotoxicity. For example, Liu & Stansly (2000) achieved mortalities of 95-99 percent in leaf-infesting populations of silverleaf whitefly, *Bemisia argentifolii* Bellows & Perring, treated with detergent-water solutions ranging in concentration from 2-30 ml L^{-1}. Detergent-water solutions of about 1 ml L^{-1} are effective in killing mealybugs and other Coccoidea on plants (Townsend, 1993). Research is needed to ensure that the liquid in the bath will penetrate the residual floral material within the calyx of guava fruit, to contact and kill any arthropods that may be concealed therein. All fruit should be inspected prior to packing. Consignments should be transported in sealed, refrigerated vehicles.

3.2.6. Quarantine treatments

There are no quarantine treatment schedules for guava fruit specified in the APHIS, PPQ Treatment Manual (USDA, 2007). However, several treatment protocols, employing heat, cold, and irradiation, have been tested and found to be effective in disinfesting various commodities of pests (e.g., Hallman, 1998a; Mangan & Hallman, 1998), and some of these may prove to be effective for disinfesting guava fruit from Mexico. Hot-water treatment usually entails dipping fruit in water baths heated to temperatures between 43° and 49°C, and may provide effective control of arthropod pests and plant pathogens (Fallik, 2004). For example, immersion of guava for 33 minutes in water heated to 46°C achieved probit-9 (≈ 100 percent) mortality of *Anastrepha suspensa* (Loew) larvae with no significant negative effects on fruit quality (Gould & Sharp, 1992; McGuire, 1997). Immersion of Persian lime, *Citrus latifolia*, for 20 minutes in water at 49°C eliminated infestations of mealybugs, Coleoptera, Hymenoptera, Lepidoptera, Thysanoptera, and mites on the fruit surface and within the calyx with no loss of fruit quality (Gould & McGuire, 2000). Hallman (1998b) obtained 100 percent mortality in larvae and adults of *Conotrachelus nenuphar* (Herbst) immersed for 40 minutes in water baths heated to 46°C (a similar protocol might prove successful in disinfesting guava fruit of *C. dimidiatus* and *C. psidii* if their susceptibilities to high temperatures are similar). Results of studies of apricot, *Prunus armeniaca*, indicated that immersion of fruit in water at 46°C for about 10 minutes produced 99 percent mortality in external infestations of the tydeid mite, *Orthotydeus californicus* (Koch) (Jones & Waddell, 1996), and might prove similarly effective against *Oligonychus psidium*. Immersion of guava for 30 minutes in water heated to 50°C eliminated *Pestalotiopsis versicolor* (Speg.) Steyaert infection while preserving storage quality of the fruit (Madhukar & Reddy, 1990). Hot-water treatment thus is a risk mitigative option, provided that the appropriate research demonstrates its efficacy in eliminating infestations of the *Anastrepha* spp., *Ceratitis capitata* (for fruit originating from areas of Mexico not declared pest-free), and other internal and external pests of guava fruit in Mexico. Hot-water treatment, combined with area pest-freedom or low pest prevalence certification, may be major contributors to achieving quarantine security for guava imports, given the rather low efficiency of fruit cutting (≈ 50 percent) in detecting, for example, fruit fly infestations in guava (Gould, 1995).

Cold treatment of guava at a temperature and duration necessary for disinfestation of *A. suspensa* (1.1°C for 15 days) caused unacceptable blackening of the fruit surface (Gould, 1994). Prospects for its use to disinfest the fruit of *Anastrepha* spp. and other pests in Mexico therefore are not encouraging.

APHIS has approved irradiation with a minimum generic absorbed pest dose of 150 Gy as a treatment for all tephritid fruit flies in fruit, a minimum dose of 400 Gy for all other insects, except Lepidoptera pupae and adults (USDA, 2007). Therefore, irradiation would be an effective pest quarantine treatment for all the insect pests of concern, except for the pupae and adults of *G. aurantianum*.

Treatment of commodities with ionizing radiation, employing x-rays, gamma rays (from ^{60}Co or ^{137}Cs), or electron beams (beta rays), has been shown to be an effective means of controlling pests to achieve quarantine security (Hallman, 2000; Fields & White, 2002). For example, based on results of experiments on several species in various hosts, a generic dose of 150 Gy has been proposed for the control of pestiferous fruit flies, including *Anastrepha* spp. (Bustos et al., 2004; Follett & Armstrong, 2004). A dose of 400 Gy was sufficient to control *G. aurantianum* in citrus (Faria et al., 1998). External pests, such as scales, were controlled effectively at a dose of 250 Gy (Hara et al., 2002). Hallman (2003) found that a target dose as low as 80 Gy (maximal absorbed dose: 92 Gy) was sufficient to prevent development and reproduction of *C. nenuphar* in apple, *Malus pumila*; a comparable dose might provide effective control of *C. dimidiatus* and *C. psidii* if their biologies are similar. Minimal absorbed doses (preventing normal pest development or reproduction) ranging from 50-100 and 200-350 Gy provided effective control of Aleyrodidae and tetranychid mites, respectively (IPPC, 2003). Specifically, doses of 100-300 Gy, administered to eggs and adults, resulted in sterility in *Oligonychus biharensis* (Majumder et al., 1996). Doses within the ranges discussed above have minimal detrimental effects on the quality of guava fruit (Mitcham, 1999).

Methyl bromide (CH_3Br) fumigation is effective in killing eggs and larvae of internal Diptera and Lepidoptera, as well as some scale insects and mites, infesting fresh fruit (Bond, 1984), and thus is an option for disinfesting guava of these pests. In one study, for example, methyl bromide produced 100 percent mortality in *A. suspensa* at all dosages tested (16, 32, and 48 g/m^3 at 24° and 30°C); by the ninth day of storage under ideal conditions (10°C at 85-90 percent R.H.), fumigated guava fruit had suffered no loss of market quality (Witherell, 1983). Further research is needed to determine the efficacy of fumigation for the control of the *Anastrepha* spp. and other quarantine-significant guava fruit pests in Mexico.

The probit-9-level security afforded by a quarantine treatment may be overwhelmed by a large volume of infested fruit (Powell, 2003). For this reason, adoption of a particular quarantine treatment should be in conjunction with efforts to maintain pest populations in production zones below specified densities (e.g., 0.01 fruit fly trap^{-1} day^{-1}; DeHaven, 2005), as would satisfy requirements for the establishment of areas of low pest prevalence (IPPC, 2005).

3.2.7. Point-of-entry sampling and inspection

Upon arrival in the United States, consignments should be inspected, with particular attention given to paperwork and seals on vehicles, to ascertain that the chain of custody has remained intact. A random sample of fruit from each consignment should be inspected to detect a pest infestation rate of 10 percent or greater (USDA, 2004c).

3.2.8. Limits on distribution and transit within the United States

For the first two years, distribution of guavas may be limited to northern tier states, and transit restricted, to limit pest risk to states that are major commercial producers of common fruit fly hosts, such as citrus and pome and stone fruits, or commercial producers of guava. During this period, the following states may be exempted as destinations for guava fruit imports from Mexico: Alabama, Arizona, Arkansas, California, Florida, Georgia, Hawaii, Louisiana, Mississippi, Nevada, New Mexico, North Carolina, Oklahoma, Oregon, South Carolina, Tennessee, Texas, and Washington, as well as the U.S. territories. If a systems approach is adopted, this stipulation will allow sufficient time for the gathering and analysis of field and packinghouse detection, and port interception, data to determine if quarantine security has been achieved, and is consistent with distributional and transit restrictions specified in the original operational plan for the importation of Hass avocadoes from Mexico into the United States (USDA, 2003b).

3.3. Oversight

3.3.1. Pre-shipment programs

Inspection, treatment, or other mitigative measures performed in the orchard and packinghouse should be under the direct supervision of qualified APHIS and SAGARPA personnel, and in accordance with specified phytosanitary procedures. Such programs require monitoring all aspects of the application of any required phytosanitary measures and also aim to identify shortcomings or opportunities for program modifications (IPPC, 2002b). Provision should be made for the formal recognition of approved areas, sites, or producers, as well as the specification of conditions for revoking approvals or refusing certification for export to the United States.

3.3.2. Shipments traceable to place of origin in Mexico

A requirement that guava be packed in containers with identification labels indicating the specific place of origin is necessary to ensure traceability to each production site.

3.4. Conclusions

The number and diversity of pests potentially infesting guava imports make it unlikely that a single mitigative measure will be adequate to reduce risk of their introduction into the United States. For this reason, a combination of measures in a systems approach, including orchard monitoring and management programs to achieve and maintain area pest freedom or low pest prevalence, packinghouse inspection and treatments, quarantine treatments, and maintenance of consignment security and traceability in transit, is most feasible. Options for risk mitigation are summarized in Table 9.

This document does not purport to establish specific work plans or to evaluate the quality of a specific program or systems approach. It identifies risks and provides information regarding known mitigative measures. The specification and implementation of measures, as would be present in an operational work plan, is beyond the scope of this document.

Table 9. Summary of risk mitigative options (guava, *Psidium guajava*, from Mexico).

Measure(s)	Pests	Efficacy
Pest-free areas or places of production	All	Satisfies requirements for appropriate level of protection
Control program	All	Research required to demonstrate efficacy
Packinghouse procedures	Aleyrodidae, Coccoidea, *Oligonychus psidium*, external stowaways, fungi	Research required to demonstrate efficacy
Hot-water treatment combined with low pest prevalence	*Anastrepha* spp., *Conotrachelus* spp., *Gymnandrosoma aurantianum*, *Oligonychus psidium*, fungi, external pests	Potential probit-9; research required to demonstrate efficacy
Irradiation combined with low pest prevalence	All insect pests (except pupae and adults of *Gymnandrosoma aurantianum*)	APHIS-recognized quarantine treatment
	All other pests	Potential probit-9; research required to demonstrate efficacy
Methyl bromide fumigation combined with low pest prevalence	All	Potential probit-9; research required to demonstrate efficacy

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