United States Department of Agriculture
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Plant Protection and Quarantine

Evidence-based, Pathway-Initiated Risk Assessment of the Importation of Fresh Eggplant, *Solanum melongena*, from Israel into Continental United States

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Agency Contact:

United States Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Center for Plant Health Science and Technology
Plant Epidemiology and Risk Analysis Laboratory
1730 Varsity Dr., Suite 300
Raleigh, NC 27606

Executive Summary

In this risk analysis we examined the plant pest risks associated with the importation of eggplant (*Solanum melongena* L.) grown in pest exclusionary structures into the continental United States from Israel. Information regarding pests affecting eggplant in Israel indicates that seven quarantine pests have the potential to be introduced via the importation of fresh eggplant into the continental United States. These pests include the following arthropods:

Ceratitis capitata Wiedemann (Diptera: Tephritidae)
Eutetranychus orientalis Klein (Acari: Tetranychidae)
Frankliniella schultzei (Trybom) (Thysanoptera: Thripidae)
Helicoverpa armigera (Hübner) (Lepidoptera: Noctuidae)
Nipaecoccus viridis (Newstead) (Hemiptera: Pseudococcidae)
Scirtothrips dorsalis Hood (Thysanoptera: Thripidae)
Spodoptera littoralis (Boisduval) (Lepidoptera: Noctuidae)

The quarantine pests likely to follow the pathway were qualitatively analyzed using the methodology described in the USDA-APHIS-PPQ Guidelines 5.02. The guidelines examine pest biology to assess the Consequences of Introduction and the Likelihood of Introduction, which, in turn, is used to estimate the Baseline Pest Risk Potential. The Baseline Pest Risk Potential for all the pests was High. Port-of-entry inspections are considered insufficient to safeguard from the introduction of pests with High Baseline Pest Risk Potential, therefore a choice of available phytosanitary measures is suggested for risk mitigation.

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1. Introduction

This risk analysis was prepared by the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture (USDA) to examine the plant pest risks associated with the importation of fresh fruits of eggplant, *Solanum melongena* L. from Israel into the continental United States. Typically, an eggplant fruit is harvested with a short stem attached to the calyx. In this document, we considered only risks of pests associated with the fruit and the calyx and sepals. We assume that the length of the stem is not sufficient to sustain internal pests specifically associated with this plant part during their development, and that external pests of this stem part could be eliminated when subjected to the same mitigation measures as the pests on the fruit. Based on the proposal by Israel, we also assume that eggplants for export will be produced in insect-proof pest exclusionary structures, with oversight by their national plant protection organization.

This risk analysis is qualitative, with risk being expressed in terms of High, Medium or Low rather than probabilities or frequencies. The details of the methodology and rating criteria can be found in “Pathway-Initiated Pest Risk Assessments: Guidelines for Qualitative Assessments, Version 5.02” (PPQ, 2000).

The International Plant Protection Convention (IPPC) provides guidance for conducting pest risk assessments. The methods used to initiate, conduct, and report this analysis are consistent with the guidelines provided by IPPC (1996, 2004). The use of biological and phytosanitary terms conforms to the Definitions and Abbreviations in the International Standards for Phytosanitary Measures: Guidelines for Pest Risk Analysis (IPPC, 1996, 2004), and the Glossary of Phytosanitary Terms (IPPC, 2006a). These guidelines describe three stages of pest risk analysis: Stage 1, Initiation, Stage 2, Risk Assessment, and Stage 3, Risk Management. This document satisfies the requirements of all three stages, however, the detailed examination of appropriate phytosanitary measures to mitigate pest risk is undertaken as part of the pest risk management phase within APHIS and is not addressed within this document.

Eggplant (or aubergine) is in the Solanaceae plant family. There are about 41 genera in the family, and 102 species in the genus *Solanum* (NRCS, 2005). In 2004, Israel commercially harvested 47,000 metric tons of eggplants from 650 ha (FAO, 2005). Currently, eggplant for export into the United States is suggested from Arava valley, but other areas may be included later.

In the continental United States, major commercial eggplant production takes place in Florida and New Jersey followed by California and North Carolina (NIS RIPMC, 2005). The young and almost mature fruits can be roasted, fried, stuffed, cooked as curry or pickled (CABI, 2004). Eggplant contains over 90 percent water, very little fat or protein, approximately 2 percent total sugars, and a range of minerals with high potassium, carotenes and small quantities of vitamins E, C and B (CABI, 2004). In India and Southeast Asia, young fruits are eaten raw. The eggplant is widely used in traditional medicine (CABI, 2004).

2. Risk Assessment

A. Initiating Event: Proposed Action

This commodity-based, pathway-initiated pest risk analysis accompanies a request for USDA authorization to allow the importation of eggplant grown in Israel (a potential pathway for plant pest introduction) into the continental United States. The United States Code of Federal Regulations (7 CFR § 319.56-1) provides regulatory authority for the importation of fruits and vegetables from foreign countries into the United States. The entry of eggplant from Israel into United States is not currently authorized.

B. Assessment of the Weediness Potential of Eggplant

If the species considered for import poses a risk as a weed pest, then a "pest-initiated" risk assessment is conducted. The results of the weediness screening for eggplant do not prompt a pest-initiated risk assessment because plants are already present in the United States, not reported as weeds (Table 1), and it has no history of weediness or invasive traits.

Table 1. Assessment of the weediness potential of eggplant

Commodity: Eggplant (*Solanum melongena*) (Solanaceae).

Phase 1: Eggplant is found in California, Connecticut, Florida, Georgia, Hawaii, Louisiana, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania and other states (NASS, 2002; NRCS, 2005).

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	1982 Report of the Technical Committee to Evaluate Noxious Weeds: Exotic Weeds for Federal Noxious Weed Act (Gunn and Ritchie, 1982)
No	*Economically Important Foreign Weeds* (Reed, 1977)
No	Weed Science Society of America Composite List of Weeds (WSSA, 1989).
Yes	Is there any literature reference indicating weediness, e.g. AGRICOLA, CAB, Biological Abstracts, AGRIS; search on "species name" combined with "weed."

Phase 3: Randall (2003) listed *Solanum melongena* as a weed of minimal potential, characterized with the statuses of 'naturalized' and 'cultivation escape'. Eggplant is a weed of unknown importance in India (Holm et al., 1979). The species is commercially grown in at least nine states (NASS, 2002), and is widely distributed in backyard gardens. No evidence exists that eggplant is a weed of any economic or environmental significance. Importing eggplant from Israel should not increase the risk of spreading this plant beyond its present range in the United States. A pest-initiated risk assessment for the species is unnecessary.

C. Previous Risk Assessments, Decision History, Current Status and Pest Interceptions

Previous Risk Assessments for eggplant, S. melongena:

1996, Completed for importation from El Salvador and Nicaragua.
2005, Completed for importation from Fiji.

Decision History:

The decision history for eggplant from the Eastern Hemisphere is summarized in Table 2.

Pest interceptions:

Twelve different taxa of pests have been intercepted on eggplant imports from the Middle East (PestID, 2007) (Table 3). The Middle East includes the following countries: United Arab Emirates, Bahrain, Kuwait, Qatar, Gaza, Israel, Iraq, Iran, Jordan, Lebanon, Oman Saudi Arabia, Syria, Turkey, and Yemen (CABI, 2004).

Table 2. Decision history for Eastern Hemisphere countries

Year(s)	Country	Decision	Comments
1924	China	Disapproved	Due to fruit flies
1924	Japan	Disapproved	Due to fruit flies
1925	Syria	Disapproved	Due to *Ceratitis capitata*
1930	Cyprus	Approved	North Atlantic Ports
1930, 1936	Egypt	Disapproved	Due to fruit flies and other pests
1951	Liberia	Approved	North Atlantic Ports
1960	Israel	Disapproved	Due to pests with no available treatments
1965	Liberia	Imports stopped	Due to interceptions of *Leucinodes orbonalis*
1938, 1972	Philippines	Disapproved	Due to pests with no available treatments
1969	Japan	Approved	Hawaii, Guam, Commonwealth of the Northern Mariana Islands
1972	France	Approved	North Atlantic Ports
1980	Kenya	Disapproved	Due to pests with no available treatments
1983	The Netherlands	Approved	All Ports
1988	Jordan	Disapproved	Due to insect pests with no available treatments
1992	South Africa	Disapproved	Due to presence of fruit flies and other pests
1994	Korea	Approved	All Ports
N/A	Spain	Approved	All Ports (commercial shipments)

Table 3. Pest interceptions on Eggplant from Middle Eastern countries (PestID, 2007). Every interception was on the plant part 'fruit.'

Organism	Country	Location	Interceptions (no.)
Aphididae, species of	Israel	Baggage	1
Ceratitis capitata (Diptera: Tephritidae)	Israel	Baggage	1
	Jordan	Baggage	1
Ceratitis sp. (Diptera: Tephritidae)	Jordan	Baggage	1
Cladosporium sp.	Israel	Baggage	1
Gelechiidae, species of	Egypt	Permit Cargo	1
	Iran	Baggage	1
	Israel	Baggage	1
	Jordan	Baggage	1
	Syria	Baggage	1
Helicoverpa sp.	Turkey	Baggage	1
Leucinodes orbonalis (Lepidoptera: Pyralidae)	Egypt	Baggage	4
	Iran	Baggage	1
	Israel	Baggage	3
	Jordan	Baggage	1
	Kuwait?	Baggage	1
	Lebanon	Baggage	1
	Middle East	Baggage	1
	Turkey?	Stores	1
Olethreutinae, species of	Yemen	Baggage	1
Parlatoria ziziphi (Hemiptera: Diaspididae)	Egypt	Baggage	2
Pestalotiopsis sp.	Israel	Baggage	1
Pyraustinae, species of	Iran	Baggage	1
Thysanoptera, species of	Turkey	Baggage	1

D. Pest Categorization

Pests associated with eggplant from anywhere in the world

We listed the pests associated with eggplant that occur worldwide (Table 4), with information about the following: 1) the presence or absence of these pests in the continental United States, 2) the generally affected plant part(s), 3) the quarantine status of the pest with respect to the continental United States, 4) whether the pest is likely to follow the pathway to enter the continental United States on commercially exported eggplant fruit and 5) pertinent citations for either the distribution or biology of the pest. In light of pest biology and distribution, we eliminated many organisms from further consideration of phytosanitary risk on eggplant from Israel because they either did not satisfy the definition of a quarantine pest or were not associated with the commodity during harvest and processing.

Table 4: Pests reported on eggplant, *Solanum melongena*, anywhere in the world and present in Israel on any host.

Scientific Name, Classification	Distribution[1]	Plant Part(s) Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway[4]	References
ARTHROPODS					
ACARI					
Eriophyidae					
Aculops lycopersici (Tryon)	IL, US	L, S, F	No	Yes	CABI, 2004
Tarsonemidae					
Polyphagotarsonemus latus Banks	IL, US	L, S, F, I	No	Yes	CABI, 2004
Tenuipalpidae					
Brevipalpus obovatus Donnadieu	IL, US	F, L, S	No	Yes	CABI, 2004
Tetranychidae					
Eutetranychus orientalis Klein	IL	L, F	Yes	Yes	Avidov and Harpaz, 1969; Bolland et al., 1998; CABI, 2004; Van den Berg et al., 2001
Petrobia (*Tetranychus*) *harti* (Ewing)	IL, US	L	No	No	Bolland et al., 1998
Tetranychus turkestani (Ugarov & Nikilskii)	IL, US	L	No	No	Bolland et al., 1998
Tetranychus cinnabarinus (Boisduval) (syn. *Tetranychus telarius*)	IL, US	L	No	No	Bolland et al., 1998; CABI, 2004
Tetranychus urticae Koch	IL, US	L	No	No	Bolland et al., 1998; CABI, 2004
INSECTA					
COLEOPTERA					
Anobiidae					
Stegobium paniceum (L.)	IL, US	F, R, Sd	No	No[14]	CABI, 2004; Reddy & Reddy, 1994
Anthribidae					
Araecerus fasciculatus (De Geer)	IL, US	F, R, S, Sd	No	No[14]	CABI, 2004; Yunus & Ho, 1980
Coccinellidae					
Henosepilachna elaterii (Rossi) =*Epilachna chrysomelina*	IS	L, F	Yes	No[30]	CABI, 2006; Frempong, 1979

Scientific Name, Classification	**Distri-bution**[1]	**Plant Part(s) Affected**[2]	**Quaran-tine Pest**[3]	**Likely to Follow Pathway**[4]	**References**
Tenebronidae					
Tenebronidae, species of	IL	Sd, F	Yes[4]	No[3]	CABI, 2004; PPIS, 2005b
DIPTERA					
Agromyzidae					
Liriomyza bryoniae Kaltenbach	IL	L	Yes	No	CABI, 2004
Liriomyza huidobrensis (Blanchard)	IL	L	Yes	No	CABI, 2004
Liriomyza sativae Blanchard	IL, US	L	No	No	CABI, 2004
Liriomyza trifolii Burgess in Comstock	IL, US	L	No	No	CABI, 2004
Phytomyza sp.	IL	L	Yes[4]	No	CABI, 2004; PPIS, 2005b
Muscidae					
Atherigona orientalis Schiner	IL, US	L, S, R, F	No	Yes	CABI, 2004
Tephritidae					
Ceratitis capitata Wiedemann	IL, US (HI)	F	Yes	Yes	CABI, 2004; Liquido et al., 1998; PestID, 2007
HEMIPTERA					
Aleyrodidae					
Aleurothrixus floccosus (Maskell)	IL, US	L, S, F, I	No	Yes	CABI, 2004
Bemisia tabaci (Gennadius)	IL	L, S	Yes	No	CABI, 2004
Bemisia tabaci (B biotype) (Gennadius) (Syn. *Bemisia argentifolii*)	IL, US	L, S	No	No	CABI, 2004
Trialeurodes vaporariorum Westwood	IL, US	F, L, I, S	No	Yes	CABI, 2004; PPIS, 2005b
Aphididae					
Aphididae, species of	IL	I, L, S	Yes[4]	No	PestID, 2007
Aphis craccivora Koch	IL, US	I, L, S	No	No	CABI, 2004; Tripathi and Kumar, 1984
Aphis fabae Scopoli	IL, US	L, I	No	No	CABI, 2004; Millar, 1994
Aphis gossypii (Glover)	IL, US	L, S, I	No	No	CABI, 2004
Aphis spiraecola Patch	IL, US	F, L, S, I	No	Yes	CABI, 2004; Millar, 1994; Blackman and Eastop, 2000
Aulacorthum solani Kaltenbach	IL, US	L, S	No	No	CABI, 2004

Scientific Name, Classification	**Distri-bution**[1]	**Plant Part(s) Affected**[2]	**Quaran-tine Pest**[3]	**Likely to Follow Pathway**[4]	**References**
Lipaphis erysimi Kaltenbach	IL, US	I, L, S	No	No	CABI, 2004; Mondal et al., 1992
Macrosiphum euphorbiae (Thomas)	IL, US	L, S	No	No	CABI, 2004
Myzus persicae Sulzer	IL, US	L, S	No	No	CABI, 2004
Rhopalosiphum padi (L.)	IL, US	I, L	No	No	CABI, 2004; Millar, 1994
Rhopalosiphum rufiabdominalis (Sasaki)	IL, US	R, S	No	No	CABI, 2004
Cicadellidae					
Asymmetrasca decedens (Paoli)	IL	L	Yes	No	CABI, 2004; Yasaraknc and Hncal, 2000
Empoasca decipiens Paoli	IL	L	Yes	No	Avidov and Harpaz, 1969; PPIS, 2005b
Empoasca lybica (de Bergevin)	IL	L	Yes	No	Avidov and Harpaz, 1969; CABI, 2004: PPIS, 2005b
Empoasca vitis (Gothe)	IL	L	Yes	No	CABI, 2005; MAF, 1999
Macrosteles quadripunctulatus (Fobes)	IL	L	Yes	No	Avidov and Harpaz, 1969; PPIS, 2005b
Coccidae					
Parasaissetia nigra Nietner	IL, US	L, S	No	No	CABI, 2004; Ben-Dov et al., 2001
Pulvinaria urbicola Cockerell	IL, US	L, S	No	No	Ben-Dov et al., 2001
Saissetia coffeae Walker	IL,US	L, S	No	No	CABI, 2004; Ben-Dov et al., 2001
Saissetia oleae (Olivier)	IL, US	L, S	No	No	CABI, 2004; Gokmen and Seckin, 1980
Diaspididae					
Aonidiella orientalis (Newstead)	IL, US (FL)	F, L, S	No	Yes	CABI, 2004; Ben-Dov et al., 2001
Chrysomphalus dictyospermi (Morgan)	IL, US	F, L, S	No	Yes	CABI, 2004
Hemiberlesia lataniae (Signoret)	IL, US	F, L, S	No	Yes	CABI, 2004
Oceanaspidiotus spinosus (Comstock)	IL, US	L, S (bark)	No	No	Ben-Dov et al., 2001

Scientific Name, Classification	Distribution[1]	Plant Part(s) Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway[4]	References
Pinnaspis aspidistrae aspidistrae (Signoret)	IL, US	(F, L, S)[9]	No	Yes	Ben-Dov et al., 2001
Pseudaulacaspis pentagona (Targioni Tozzetti)	IL, US	L, R, S	No	No	Hill, 1983; Staneva, 1992; Ben-Dov et al., 2001
Lygaeidae					
Spilostethus pandurus (Scopoli)	IL	L, I, Sd	Yes	No	Mukhopadhyayand Saha, 1993; PestID, 2007
Margarodidae					
Icerya aegyptiaca Douglas	IL	L, S	Yes	No	CABI, 2005
Icerya purchasi Maskell	IL, US	L, S	No	No	CABI, 2004; CTAHR, 2002
Miridae					
Nesidiocoris tenuis (Reuter) (Syn. *Cyrtopeltis tenuis*)	IL, US	L, S, I, F	No	Yes	CABI, 2004
Pentatomidae					
Nezara viridula (L.)	IL, US	L, S, Sd, I, F	No	No[10]	CABI, 2004
Stenozygum coloratum Klug	IL	L, F	Yes	No[11]	Avidov and Harpaz, 1969; PPIS, 2005b
Pseudococcidae					
Nipaecoccus viridis (Newstead)	IL	I, F, L, S	Yes	Yes	Ben-Dov et al., 2001
Phenacoccus parvus Morrison	IL, US (FL)	L, S, R	[Yes][8a]	No	Ben-Dov et al., 2001
Phenacoccus solani Ferris	IL, US	L, R, S	No	No	Ben-Dov et al., 2001
Planococcus citri (Risso)	IL, US	I, F, L, S, R	No	Yes	Ben-Dov et al., 2001
Pseudococcus longispinus (Targioni Tozzetti)	IL, US	I, F, L, S	No	Yes	Ben-Dov et al., 2001
Pseudococcus viburni (Signoret)	IL, US	F, L, S	No	Yes	CTAHR, 2002; Ben-Dov et al., 2001
LEPIDOPTERA					
Gelechiidae					
Gelechiidae, species of	IL	F, L, Sd	Yes[4]	Yes	PestID, 2007
Phthorimaea operculella (Zeller)	IL, US	R, S, L	No	No	CABI, 2004; Robinson et al., 2005
Scrobipalpa heliopa (Lower)	IL	S, I	Yes	No	CABI, 2005; Robinson et al., 2005
Lyonetidae					

Scientific Name, Classification	**Distri-bution**[1]	**Plant Part(s) Affected**[2]	**Quaran-tine Pest**[3]	**Likely to Follow Pathway**[4]	**References**
Bedellia somnulentella (Zeller)	IL, US	L	No	No	CABI, 2004; Robinson et al., 2005;
Noctuidae					
Agrotis ipsilon (Hufnagel)	IL, US	F, L, S	No	Yes	CABI, 2004
Agrotis segetum Denis & Schiffermuller	IL	L, S, R	Yes	No	CABI, 2004; PPIS, 2005b
Chrysodeixis chalcites (Esper)	IL	F, S, L	Yes	No[15]	CABI, 2004; Ramakers, 1979; Robinson et al., 2005
Helicoverpa armigera (Hübner)	IL	I, L, F	Yes	Yes	CABI, 2004
Plusia spp[4].	IL	L, F	Yes[4]	Yes	PPIS, 2005b
Sesamia nonagrioides (Lefebvre)	IL	R, S, I, F, Sd	Yes	No[20]	Berjon and Maison, 1971; CABI, 2004; Zhang, 1994
Spodoptera exigua (Hübner)	IL, US	L, I, S, F	No	No[10]	CABI, 2004
Spodoptera littoralis (Boisduval)	IL	F, L	Yes	Yes	CABI, 2004, PestID, 2007
Thysanoplusia orichalcea (Fabricius) [= syn. *Plusia orichalcea* (Fabricius)]	IL	F, L	Yes	No[27]	CABI, 2005; Zhang, 1994
Trichoplusia ni (Hübner)	IL, US	L	No	No	CABI, 2004
Nymphalidae					
Cynthia cardui L.	IL, US	L	No	No	PPIS, 2005b
Pyralidae					
Cryptoblabes gnidiella Millière	IL	F, L, S	Yes	No[21]	CABI, 2004; PestID, 2007; Swailem and Ismail, 1973
Euzophera osseatella (Treitschke)	IL	S, F[17]	Yes	No[17]	Avidov and Harpaz, 1969; PPIS, 2005b; PestID, 2007
Leucinodes orbonalis Guenée	IL[12]	F, I, S	Yes	No[12]	CABI, 2004; PestID, 2007
Ostrinia nubilalis (Hübner)	IL, US	S, L, F, Sd	No	Yes	CABI, 2004; Robinson et al., 2005
Spoladea recurvalis (F)	IL, US	S, I, L, R	No	No	CABI, 2004
Udea ferrugalis (Hübner)	IL[24]	L, I	Yes	No	PestID, 2007; Robinson et al., 2005
Sphingidae					
Acherontia atropos L.	IL	L	Yes	No	CABI, 2004; PPIS, 2005b

Scientific Name, Classification	Distri-bution[1]	Plant Part(s) Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway[4]	References
Yponomeutidae					
Plutella xylostella L.	IL, US	F, I, L, S	No	Yes	CABI, 2004; Robinson et al., 2005
ORTHOPTERA					
Gryllotalpidae					
Gryllotalpa gryllotalpa L.	IL, US	R, S	No	No	Avidov and Harpaz, 1969; PPIS, 2005b
THYSANOPTERA					
Thripidae					
Frankliniella intonsa (Trybom)	IL, US (WA)	F, I	No	Yes	CABI, 2004; Courneya, 2004; PestID, 2007
Frankliniella occidentalis (Pergande)	IL, US	L, I, F	No	Yes	CABI, 2004
Frankliniella schultzei (Trybom)	IL, US (FL, HI)	F, L, S, I	[Yes][8a]	Yes	Annadurai and Morrison, 1987; CABI, 2004; Courneya, 2003; PestID, 2007
Hercinothrips femoralis (Reuter)	IL, US	L, I, S, F	No	Yes	Ben-Dov et al., 1986; CTAHR, 2002
Scirtothrips dorsalis Hood	IL, US (HI)	L, F, I	Yes	Yes	CABI, 2005; Ciomperlik and Seal, 2004; OPIS, 2006
Thrips flavus Schrank	IL[25]	I, Sd	Yes	No	CABI, 2004; PestID, 2007
Thrips palmi Karny	IL[8b], US (FL, HI)	F, L	[Yes] [8a]	No[8b]	PestID, 2007
Thrips tabaci Lindeman	IL, US	L, I, S	No	No	CABI, 2004; PPIS, 2005b
VIRUSES AND VIROIDS					
Alfalfa mosaic virus	IL, US	L, R, S, F	No	Yes	CABI, 2004
Citrus exocortis viroid *Pospviroid*	IL, US	F, I, L, R, S	No	Yes	CABI, 2004; Hadidi et al., 2003
Cowpea mild mottle virus	IL	F, I, L, R, S, Sd	Yes	No[23]	CABI, 2004; Mansour et al., 1998
Cucumber mosaic virus	IL, US	L, F, Sd	No	Yes	CABI, 2004
Eggplant mild mottle virus	IL	L, F, I, Sd, R, S	Yes	No[16]	Brunt et al., 1996; CABI, 2004; Dallwitz, 1980; Dallwitz et al., 1993; Fauquet et al.,2005

Scientific Name, Classification	Distri-bution[1]	Plant Part(s) Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway[4]	References
Eggplant mottled dwarf virus	IL	L, S, F	Yes	No[6]	Brunt et al., 1996; CABI, 2004; Dallwitz, 1980; Dallwitz et al., 1993; Fauquet et al., 2005
Tobacco streak *ilarvirus*	IL, US	L, F, I, Sd, R, S	No	Yes	Brunt et al., 1996; CABI, 2004; Dallwitz, 1980; Dallwitz et al., 1993
Tomato spotted wilt *tospovirus*	IL, US	L, F	No	No[7]	Brunt et al., 1996; CABI, 2004; Dallwitz, 1980; Dallwitz et al., 1993
Tobacco mosaic tobamovirus	IL, US	L, F, I, S	No	Yes	CABI, 2004; PPIS, 2005b
BACTERIA AND PHYTOPLASMAS					
Aster yellows phytoplasma group (Acholeplasmatales: Acholeplasmataceae)	IL, US	F, I, L, S, R	No	Yes	CABI, 2004;
Erwinia carotovora subsp. *altroseptica* (van Hall) Dye (Euterobacteriales: Euterobacteriaceae)	IL, US	L, S, R	No	No	CABI, 2004; PPIS, 2005b
Erwinia chrysanthemi (Burkh.) Young et al. (Euterobacteriales: Euterobacteriaceae)	IL[26], US	L, R, S	No	No	CABI, 2004
Grapevine Yellows Disease phytoplasmas Seemüller et al. (Acholeplasmatales: Acholeplasmataceae)	IL, US (NY, VA)	I, L, S, R	No	No	CABI, 2004
Pseudomonas fluorescens (Trevisan) Migula (Pseudomonadales: Pseudomonadaceae)	IL, US	L, R	No	No	CABI, 2004; Farr et al., 2006; Gamliel and Katan, 1991
Ralstonia solanacearum[22a] (Smith) Yabuuchi et al. (Pseudomonadales: Pseudomonadaceae)	IL, US	F, I, S, R, L, Sd	Yes[22b]	No[22a]	Allen *et a*l., 2005; CABI, 2004
Rhizobium radiobacter (Rhizobiales: Rhizobiaceae)	IL[29],US	R	No	No	CABI, 2005; Young et al., 2001

Scientific Name, Classification	**Distri-bution[1]**	**Plant Part(s) Affected[2]**	**Quaran-tine Pest[3]**	**Likely to Follow Pathway[4]**	**References**
Xanthomonas campestris pv. *vesicatoria* (Doidge) Dowson (Xanthomonadales: Xanthomonadaceae)	IL, US	L, F, I, S, Sd	No	Yes	CABI, 2004; PPIS, 2005b
FUNGI					
Alternaria alternata (Fr.:Fr.) Keissl (syn. *Alternaria fasciculata* (Cooke & Ellis) L. Jones & Grout) (Fungi Imperfecti: Hyphomycetes)	IL, US	F, L, S	No	Yes	CABI, 2004; Farr et al., 2006
Alternaria dauci (J.G. Kühn) J.W. Groves & Skolko (Fungi Imperfecti: Hyphomycetes)	IL, US	F, L, R, S	No	Yes	CABI, 2004
Alternaria longipes (Ellis & Everh.) E.W. Mason (Fungi Imperfecti: Hyphomycetes)	IL, US	L, S, Sd	No	No	CABI, 2004; Farr et al., 2006
Alternaria solani Sorauer (syn. *Macrosporium solani* Ell. & G.Martin) (Fungi Imperfecti: Hyphomycetes)	IL, US	L, F, S	No	Yes	CABI, 2004
Arcyria insignis Kalchbr. & Cooke (Myxomycetes)	IL, US	S, L	No	No	Farr et al., 2006
Aspergillus flavus Link (Fungi Imperfecti: Hyphomycetes)	IL, US	F, L, R, S, Sd	No	Yes	CABI, 2004; Rath et al., 1993
Aspergillus niger Tiegh. (Fungi Imperfecti: Hyphomycetes)	IL, US	F, L, R, S, I, Sd	No	Yes	CABI, 2004

Scientific Name, Classification	Distri-bution[1]	Plant Part(s) Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway[4]	References
Botrytis cinerea Pers.: Fr [anamorph] (Fungi Imperfecti: Hyphomycetes) *Botryotinia fuckeliana* (de Bary) Whetzel [teleomorph]	IL, US	F, I, L, S, Sd	No	Yes	CABI, 2004
Chalara elegans Nag Raj & W.B. Kendr. (Fungi Imperfecti: Hyphomycetes) *Thielaviopsis basicola* (Berk. & Broome) Ferrari [synanomorph]	IL, US	F, R, Sd	No	Yes	CABI, 2004
Cladosporium cucumerinum Ellis & Arthur (Fungi Imperfecti: Hyphomycetes)	IL, US	F, I, L, S, Sd	No	Yes	CABI, 2004; Farr et al., 2006
Cladosporium fasciculatum (Fungi Imperfecti: Hyphomycetes)	IL, US	L, S	No	No	Farr et al., 2006
Cladosporium fulvum Cooke (Fungi Imperfecti: Hyphomycetes)	IL, US	F, I, L, Sd	No	Yes	CABI, 2004; Farr et al., 2006
Cladosporium herbarum (Pers.:Fr.) Link (Fungi Imperfecti: Hyphomycetes)	IL, US	L, S, F	No	Yes	Barkai-Golan et al., 1989; Farr et al., 2006
Cladosporium sp. [4] (Fungi Imperfecti: Hyphomycetes)	IL	F	Yes	Yes	PestID, 2007
Colletotrichum acutatum Simmonds ex Simmonds (Fungi Imperfecti: Coelomycetes)	IL, US	F, I, S, L, R	No	Yes	CABI, 2004; Farr et al., 2006

Scientific Name, Classification	**Distri-bution**[1]	**Plant Part(s) Affected**[2]	**Quaran-tine Pest**[3]	**Likely to Follow Pathway**[4]	**References**
Colletotrichum atramentarium (Berk. & Broome) Taubenhaus (syn. *Colletotrichum coccodes*) (Fungi Imperfecti: Coelomycetes)	IL, US	R, F, S, L	No	Yes	CABI, 2004; Farr et al., 2006
Colletotrichum circinans (Berk.) Voglino (Fungi Imperfecti: Coelomycetes)	IL, US	L, B	No	No	CABI, 2004; Farr et al., 2006
Corticium rolfsii Curzi (syn. *Athelia rolfsii*) [teleomorph] (Basidiomycetes: Aphyllophorales) *Sclerotium rolfsii* Sacc. [anamorph]	IL, US	L, I, R, S, F, Sd	No	Yes	CABI, 2004; Farr et al., 2006; Primo et al., 2003
Didymella lycopersici Kleb. [teleomorph] (Loculoascomycetes: Dothideales) *Ascochyta lycopersici* (Plowr.) Brunaud (syn. *Phoma lycopersici*) [anamorph]	IL, US	L, S, F, Sd	No	Yes	CABI, 2004; Farr et al., 2006
Epicoccum nigrum Link (Anamorph) (teleomorph: Ascomycete)	IL, US	S, I, L	No	No	Farr et al., 2006; Guiraud *et* al., 1995
Erysiphe cichoracearum DC. (Partial synonyms: *Erysiphe communis* auct. (Pyrenomycetes: Erysiphales)	IL, US	I, L, S	No	No	CABI, 2004; Farr et al., 2006
Fusarium equiseti (Corda) Sacc. (Fungi Imperfecti: Hyphomycetes)	IL, US	S, L	No	No	Farr et al., 2006

Scientific Name, Classification	**Distri-bution[1]**	**Plant Part(s) Affected[2]**	**Quaran-tine Pest[3]**	**Likely to Follow Pathway[4]**	**References**
Fusarium oxysporum lycopersici (Fungi Imperfecti: Hyphomycetes)	IL, US	R, B, L, S, F[13]	No	Yes	Duffy and Defago, 1997; Farr et al., 2006
Fusarium oxysporum f.s. melongena Matuo & K. Ishig. (Fungi Imperfecti: Hyphomycetes)	IL, US (FL, SC)	R, L, S, F[13]	No	Yes	Alfieri et al., 1984; CABI, 2004; PPIS, 2005b;
Fusarium semitectum Berk. & Rav. (syn. *Colletotrichum musae* (Berk. & M.A.Curtis) Arx)	IL, US	F, S, L	No	Yes	Farr et al., 2006; Joffe and Palti, 1977
Fusarium solani (Martius) Sacc. (Fungi Imperfecti: Hyphomycetes)	IL, US	F, L, S	No	Yes	Farr et al., 2006
Fusarium vasinfectum G.F. Atk. (Fungi Imperfecti: Hyphomycetes)	IL, US	L, S, R, F S, Sd	No	Yes	CABI, 2004; Farr et al., 2006
Gibberella fujikuroi (Sawada) Ito [teleomorph] *Fusarium moniliforme* J. Sheld. [anamorph]	IL, US	L, I, R, S, F, Sd	No	Yes	CABI, 2004
Glomerella cingulata (Stonem.) Spauld. & Schrenk [teleomorph] (Pyrenomycetes: Phyllachorales) *Colletotrichum gloeosporioides* (Penz.) Sacc. [anamorph]	IL, US	L, I, S, F, Sd	No	Yes	CABI, 2004
Lasiodiplodia theobromae (Pat.) Griffiths & Maubl. (syn. *Botryodiplodia theobromae*) [anamorph]	IL, US (AL, CA, FL)	L, I, R, S, F, Sd	No	Yes	CABI, 2004

Scientific Name, Classification	Distri-bution[1]	Plant Part(s) Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway[4]	References
Leveillula taurica (Lév.) G. Arnaud (syn. *Oidiopsis taurica* (Lév.) E.S. Salmon) (Pyrenomycetes: Erysiphales)	IL, US	L, S, F, I	No	Yes	CABI, 2004
Macrophomina phaseolina (Tassi) Goid (Fungi Imperfecti: Coelomycetes)	IL, US	F, I, L, S, Sd, R	No	Yes	CABI, 2004
Myrothecium roridum Tode (Pyrenomycetes: Hyphocreales) *Gliocladium nigrum* Moreau & Moreau) [anamorph]	IL, US	L, F, Sd, S	No	Yes	Farr et al., 2006; Gokkes et al., 1991
Penicillium citrinum Thom *(Syn:Penicillium steckii Zaleski)* (Fungi Imperfecti: Hypomycetes)	IL, US	L, Sd	No	No	Farr et al., 2006; Lisker et al., 1994
Peronospora hyoscyami f.sp. tabacina (D.B. Adam) Skalicky (Oomycetes: Peronosporales)	IL, US	R, L, S, I	No	No	CABI, 2004
Pestalotiopsis sp. [4] [anamorph] [Teleomorph: Ascomycetes]	IL, US	F	Yes	Yes	PestID, 2007
Phoma exigua var. exigua Desm. Syn: *Phyllosticta zahlbruckneri* Bäumler, *Phyllosticta calthae* Ellis & Everh.	Cosmopol.	L, S, R	No	No	CABI, 2004;
Phytophthora capsici Leonian (Oomycetes: Peronosporales)	IL, US	L, F, S, R	No	Yes	CABI, 2004; Farr et al., 2006

Scientific Name, Classification	Distri-bution[1]	Plant Part(s) Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway[4]	References
Phytophthora cryptogea Pethybr. & Laff. (Oomycetes: Peronosporales)	IL, US	F, I, L, R, S	No	Yes	CABI, 2004; Farr et al., 2006
Phytophthora hibernalis Carne (Oomycetes: Peronosporales)	IL, US	L, I, F, S, Sd	No	Yes	Farr et al., 2006
Phytophthora infestans (Mont.) de Bary (Oomycetes: Peronosporales)	IL, US	L, I, F, S, Sd	No	Yes	CABI, 2004
Phytophthora nicotianae Breda de Haan (syn. *Phytophthora melongena*, Sawada, *Phytophthora parasitica* Dastur, *Phytophthora nicotianae var. parasitica* (Dastur) G. M. Waterh.) (Oomycetes: Peronosporales)	IL, US	F, L, S, R, Sd	No	Yes	CABI, 2004
Pleospora herbarum (Pers.:Fr.) Rabenh. (Syn: *Pleospora frangulae)* (Anamorph: *Stemphylium herbarum* E.G. Simmons	IL, US	L, S, F, Sd	No	Yes	Farr et al., 2006
Pythium aphanidermatum (Edson) Fitzp. (Oomycetes: Peronosporales)	IL, US	R, S, F	No	Yes	CABI, 2004
Pythium irregulare Buisman (Oomycetes: Peronosporales)	IL, US	R, S	No	No	CABI, 2004
Pythium myriotylum Drechsler (Oomycetes: Peronosporales)	IL, US	R, S	No	No	CABI, 2004
Pythium spp. (Oomycetes: Peronosporales)	IL	R, S	Yes[4]	No	PPIS, 2005b

Scientific Name, Classification	**Distribution[1]**	**Plant Part(s) Affected[2]**	**Quarantine Pest[3]**	**Likely to Follow Pathway[4]**	**References**
Pythium ultimum Trow (Oomycetes: Peronosporales)	IL, US	R, S, L, F	No	Yes	Ali, 1984; Farr et al., 2006
Rhizopus stolonifer (Ehrenb.) Lind (= *Rhizopus nigricans* Ehrenb.) (Zygomycetes: Mucorales)	IL, US	F	No	No[18]	PPIS, 2005b
Sclerotinia sclerotiorum (Lib.) de Bary (Discomycetes: Helotiales)	IL, US	L, S, I, F, R, Sd	No	Yes	CABI, 2004
Septoria lycopersici Speg. (Coelomycetes)[Teleomorph:Ascomycete]	IL, US	L, S	No	No	CABI, 2004; Farr et al., 2006
Sphaerotheca fuliginea (Schltdl.:Fr.) Pollacci (Pyrenomycetes: Erysiphales)	IL, US	L, S, I	No	No	Farr et al., 2006
Stemphylium lycopersici (Enyoji) Yamam. (syn. *Stemphylium floridanum* Hannon & G.F. Weber) [Teleomorph: *Pleospora herbarum*]	IL, US	L	No	No	Farr et al., 2006; Rotem and Bashi, 1977
Stemphylium solani Weber (Fungi imperfecti: Hypomycetes)	IL, US	L	No	No	Farr et al., 2006; Rotem and Bashi, 1977
Thanatephorus cucumeris (Frank) Donk (syn. *Corticium solani*) [teleomorph] *Rhizoctonia solani* (Kuhn) [anamorph]	IL, US	F, I, L, S, R, Sd	No	Yes	CABI, 2004; Farr et al., 2006; Tsror *et a*l., 2004
Trichothecium roseum (Pers.:Fr.) Link (syn. *Cephalothecium roseum* Corda)	IL, US	L, S, F, R, I	No	Yes	Farr et al., 2006

Scientific Name, Classification	Distribution[1]	Plant Part(s) Affected[2]	Quarantine Pest[3]	Likely to Follow Pathway[4]	References
Verticillium dahliae Kleb. (Fungi Imperfecti: Hyphomycetes)	IL, US	L, S, F, I, Sd	No	Yes	CABI, 2004
NEMATODES[5]					
DORYLAIMIDA					
Longidoridae					
Longidorus sp. Micoletzky (Filpjev)	IL, US	R	No	No	CABI, 2004
Heteroderidae					
Meloidogyne arenaria (Neal) Chitwood (Meloidogynidae)	IL[28], US	R	No	No	CABI, 2004; Jain et al., 1993
Meloidogyne hapla Chitwood	IL, US	R	No	No	CABI, 2004; PPIS, 2005b
Meloidogyne incognita (Kofoid & White) Chitwood	IL, US	R	No	No	CABI, 2004
Meloidogyne javanica (Treub) Chitwood	IL, US	R	No	No	CABI, 2004
Pratylenchidae					
Pratylenchus brachyurus (Godfrey) Filipjev & Schuurmans Stekhoven	IL, US	R	No	No	CABI, 2004
TYLENCHIDA					
Hoplolaimidae					
Helicotylenchus dihystera (Cobb), Sher	IL, US	R	No	No	CABI, 2005
Helicotylenchus pseudorobustus (Steiner) Golden	IL, US	R	No	No	CABI, 2005
Rotylenchulus reniformis Linford & Oliveira (Hoplolaimidae)	IL, US	R	No	No	CABI, 2004
Trichodoridae					
Paratrichodorus minor (Colbran) Siddiqi (Trichodoridae)	IL, US	R	No	No	CABI, 2004; Cohn & Schilt, 1975
MOLLUSCA					
GASTROPODA					

Scientific Name, Classification	Distri-bution[1]	Plant Part(s) Affected[2]	Quaran-tine Pest[3]	Likely to Follow Pathway[4]	References
Achatina fulica Bowdich (Pulmonata: Achatinidae)	IL	F, L, R, S	Yes	No[19]	CABI, 2004; Mienis, 1993; Thakur, 2004

[1] Individual states are listed if the pest is reported in less than five states within the continental United States. Abbreviations: IL – Israel, US – United States (HI – Hawaii, AL – Alabama, CA – California, FL – Florida, LA – Louisiana, NY – New York, SC – South Carolina, TX – Texas, VI –Virginia, WA – Washington).
[2] F = Fruit (includes seed pod or capsule), I = Inflorescence, B = Bulb, L = Leaves, R = Root, S = Stem, Sd = Seed)
[3] Tenebrionidae are mostly pests of stored products and external feeders on fruits and seeds. Unlikely to follow the pathway since damaged fruit will be culled during packing house procedures. Most of the interceptions are not associated with particular fruits and vegetables (PestID, 2008 query).
[4] Organisms listed at the level of genus (or family), although regarded as quarantine pests because of their uncertain identity, are not considered for further analysis due to the lack of evidence of the specific risks posed.
[5] Agrios (1997) is used for nematode taxonomy.
[6] Transmitted by mechanical inoculation and grafting; not transmitted by seed (Brunt et al., 1996).
[7] Transmitted by a vector.
[8a] This species does not meet the definition of a quarantine pest (IPPC, 2002), but is currently under a provisional quarantine status and is being considered for an official Federal control program (Courneya, 2004).
[8b] *Thrips palmi* is actionable pest and is of limited distribution in the United States. It is also a quarantine pest for Israel. CABI (2004) listed this pest to be of limited distribution in Israel. There is no mentioning of Israel in the distribution record of *T. palmi* according to CABI (2006) There are, however, several records in the PestID database, the latest dated 2004 (Pest ID, 2007 query), of interceptions of this pest in permit and commercial cargo from Israel, mostly in flowers. Based on the information from Israel, (IAI. 2006) and since *T. palmi* is not reported from Israel recently, we removed this pest from the pathway. This evidence reported here for information purposes.
[9] Based on biology of *Pinnaspis strachani* (Cooley) which is also a pest of eggplant (CABI, 2004).
[10] External feeder that is unlikely to survive post-harvest procedures, *i.e*., visual culling.
[11] Fruit is rarely damaged; this species is an external feeder that feeds mainly on leaves (Avidov and Harpaz, 1969).
[12] The only records of distribution of *Leucinodes orbonalis* in Israel are from PestID (2005); there have been three interceptions on eggplant fruits in the passenger baggage. Often, it is not possible to determine the true origin of a passenger baggage; therefore, until other supportive information related to distribution of this species in Israel becomes available, *L. orbonalis* is not expected to be in the pathway of the commodity. (This information is included for information purposes.)
[13] Based on biology of *Fusarium oxysporum.*
[14] Pest of stored products (CABI, 2004).
[15] CABI (2005) lists fruit as a plant part liable to carry externally feeding larvae in international trade. Larvae may damage young fruit (Daricheva et al., 1983), but are unlikely to be present on or in mature, harvested eggplant. Only one interception of this insect associated with the eggplant fruit was recorded in PestID (2006 query) in permit cargo from the Netherlands.
[16] Virus transmitted by mechanical inoculation, not by seed (Brunt et al., 1996).
[17] Unlikely to follow the pathway since this species is generally a stem borer of eggplant. Record of fruit damage is based on a single interception of *Euzophera sp.* on the fruit of *Malus* (PestID record). (This data are included for information purposes.)
[18] The fungus needs a wound in a plant tissue to be able to penetrate inside.
[19] Limited distribution in Israel (Landshut, 2006). *Achatina fulica* is a large and conspicuous pest that is likely to be detected at the time of harvest (CABI, 2006). The pest has not been intercepted on eggplant (PestID, 2007); its establishment of a pathway is considered unlikely. If any interceptions occur on commercially produced eggplant, the pathway will be re-examined for this pest.
[20] Because eggplants from Israel will be grown in pest exclusionary structures (see introduction), this pest is unlikely to enter the pathway. Additionally, the available literature indicates that eggplant is a conditional, rather than preferred, host of *S. nongrioides*, and would be expected to attack eggplants only under specific conditions. The

main crops attacked by *S. nongrioides* include maize, sugarcane and rice (CABI, 2005). Only a few records exist of this pest damaging hosts other than wild and cultivated grasses (Berjon and Maison, 1971). Finally, no interceptions of *S. nongrioides* have been recorded by PPQ on eggplant from anywhere in the world (PestID, 2008 query). The occasional host status of eggplant for this pest, as well as production in pest exclusionary structures, leads us to conclude that the risk of this pest following the pathway is negligible.

[21] Because eggplants from Israel will be grown in pest exclusionary structures (see introduction), this pest is unlikely to enter the pathway. Additionally, the available literature indicates that eggplant is a conditional, rather than preferred, host of *C. gnidiella* and would be expected to attack eggplants only under specific conditions. For example, Swailem and Ismail (1973) noticed that larvae sometimes could develop on eggplant; however, only older larvae were able to infest the fruits. These infestations usually did not involve healthy fruits but rather appeared to be secondary invasions. In addition, PPQ has recorded no interceptions of *C. gnidiella* on eggplant from anywhere in the world (PestID, 2008 query). The occasional host status of eggplant for this pest, as well as production in pest exclusionary structures, leads us to conclude that there is a negligible risk of this pest following the pathway.

[22a] The pathogen on has been eradicated in Israel in 1972 (PPIS, 1993).This data are included for information purposes.

[22b] *Ralstonia solanacearum* Race 3, Biovar 2 is not present in the United States and is of quarantine significance. Other strains of this species are present in the United States (CABI, 2005; PestID, 2007).

[23] Eggplant is not a host for the virus (Brunt et al., 1996). The host status is still inconclusive based on Mansour et al. (1998). Under the circumstances, we consider that the virus will not follow the pathway. The data are presented in the pest list for information purposes only.

[24] Distribution entry is based on two interceptions in permit cargo of cut flowers.

[25] Distribution entry is based on one interception in permit cargo of cut flowers.

[26] Limited distribution (CABI, 2006).

[27] This pest is an external feeder and is not a pest of any commodity and extremely rare in Israel (Seplyarsky et al., 2007). The insect is considered to be a pest in some other regions of the world (e.g. Europe), no interceptions of this species was recorded in Pest ID (2008 Query).

[28] CABI (2006), in contrast to CABI (2004) originally cited here, do not list Israel in the distribution record for this pest.

[29] Restricted distribution in Israel (CABI, 2006).

[30] CABI (2006) listed fruit as a feeding plant part, but this pest is known to be an external feeder and primarily a defoliator (CABI, 2006; Frempong, 1979). Therefore, it is not expected to be in the pathway on eggplant fruit.

Pests likely to follow the pathway

The quarantine pests selected for further analysis are summarized in Table 5. We only analyzed those quarantine pests that were reasonably expected to follow the pathway of commercial shipments of exported eggplant. Other quarantine pests we did not include may be detrimental to U.S. agriculture, but we did not further analyze them for a variety of reasons. Often, the primary association of the pest was with plant parts other than the commodity at harvest, such as *Liriomyza bryoniae*, *L. huidobrensis*, *Phytomyza* sp., species of Aphididae, *Bemisia tabaci* (B biotype), *Asymmetrasca decedens*, *Empoasca decipiens*, *E. lybica*, *E. vitis*, *Macrosteles quadripunctulatus*, *Spilostethus pandurus*, *Icerya aegyptiaca*, *Agrotis segetum*, *Scrobipalpan heliopa*, *Udea ferrugalis*, *Acheronita atropos*, *Thrips flavus*, *Pythium* spp., *Radopholus similes*, *Euzophera osseatella*, and *Chrysodexis chalcites*, which are associated with leaf, stem, root, inflorescence or young fruit. For some (e.g., *Stenozygum coloratum*), fruit feeding is rare and, therefore, we listed fruit as a plant part affected for information purposes only. In other cases, the available information did not support a strong association with the host plant (*Sesamia nonagrioides* and *Cryptoblabes gnidiella*) or the origin from the exporting country (*Leucinodes orbonalis*). Other quarantine pests were not selected for further analysis because they are external feeders, produce obvious damage, are visible on commodities, can move off the fruit when disturbed, or the pest can be eliminated during post-harvest cleaning, washing and sorting procedures, *e.g*., *Achatina fulica*. For specifics about each pest, see references within Table 4 or footnotes associated with this table.

We did not assess the risk associated with pests identified only to the order, family or generic levels, but if pests identified to higher taxa levels are intercepted in the future, their risk may be reevaluated. In this risk assessment, this applied to the arthropods Gelechiidae, *Pulsia* spp. and the pathogens, *Cladosporium* sp. and *Pestalotiopsis* sp. Generally, the biological hazard of organisms not identified to the species level is not assessed because a genus contains many species, and assuming that the biology of all species within a genus is identical is not reasonable. The lack of species' identification may indicate the limits of the current taxonomic knowledge, the life stage, or the quality of the specimen submitted for identification. By necessity, pest risk assessments focus on the organisms for which biological information is available. The lack of identification at a specific level does not rule out the possibility that a high risk quarantine pest was intercepted or that the intercepted organism was not a quarantine pest. Conversely, developing detailed assessments for known pests that inhabit a variety of ecological niches, such as the surfaces and/or interiors of fruit, stems or roots, allows effective mitigation measures to eliminate known organisms, as well as similar, but incompletely identified organisms that inhabit the same niche.

We included *Ceratitis capitata* in the pest list and, consequently, in the pathway in spite of the inconclusive evidence regarding the host suitability of eggplant. Current evidence suggests that eggplant can become a field host for medfly (Liquido et al., 1990), as well as for other fruit flies (Liquido et al., 1994). PestID (2007) records include multiple interceptions in eggplant of fruit flies from the genera *Bactrocera*, *Ceratitis, Dacus* and those identified only to higher taxonomic taxa, such as a tribe or a sub-family. These interceptions are from African and Asian countries and mostly occurred in passenger baggage. A high degree of uncertainty exists about the host status of commercially harvested, green- house produced eggplant for *Ceratitis capitata*. Confirming this status for eggplant requires more evidence and should be experimentally derived. One option is a study like that used to identify the host status of Hass avocado for a complex of fruit flies from the genus *Anastrepha* (Aluja et al., 2004). In particular, we need to know if the host status of eggplant changes with the fruit ripeness, before and after the harvest, if it is different in commercial production cites versus back yard growing, etc. If such differences in plant acceptance by fruit flies exist, developing subsequent mitigation measures would be simpler and more informed.

APHIS requires, under Section 318.13-4b of the US Code of Federal Regulations, treatments of eggplant from Hawaii due to several fruit flies. APHIS' Treatment Manual states that eggplant must be treated for *Ceratitis capitata*, *Bactrocera dorsalis* and *B. curcubitae* by either vapor heat treatment (T-106-b-2) or irradiation (T105-a-10). Since *C. capitata* is specifically listed for treatment in eggplant, we consider that this pest is likely to remain in the pathway and selected it for further analysis.

Table 5. Quarantine pests likely to be associated with eggplant imported from Israel and selected for further analysis

Arthropods	Taxonomy
Ceratitis capitata	(Diptera: Tephritidae)
Eutetranychus orientalis	(Acari: Tetranychidae)
Frankliniella schultzei	(Thysanoptera: Thripidae)
Helicoverpa armigera	(Lepidoptera: Noctuidae)
Nipaecoccus viridis	(Hemiptera: Pseudococcidae)
Scirtothrips dorsalis	(Thysanoptera: Thripidae)
Spodoptera littoralis	(Lepidoptera: Noctuidae)

E. Analysis of Quarantine Pests

The undesirable consequences that may occur from the introduction of quarantine pests are assessed within this section. For each quarantine pest, we rated the potential Consequences of Introduction in five areas called Risk Elements (PPQ, 2000): Climate-Host Interaction, Host Range, Dispersal Potential, Economic Impact and Environmental Impact. These Risk Elements reflect the biology, host range and climatic/geographic distribution of each pest and are supported by biological information on each of the analyzed pests. For each Risk Element, we assigned pests a rating of Low (1 point), Medium (2 points) or High (3 points), using the criteria in the risk assessment guidelines. We then calculated a Cumulative Risk Value by summing the ratings, and interpreted them using the following scale: Low is 5-8 points; Medium is 9-12 points; and High is 13-15 points. We summarized the risk ratings below (Table 6)

Consequences of Introduction analyses and ratings

Ceratitis capitata **(Diptera: Tephritidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Ceratitis capitata* is found in southern Europe, west Asia, Africa, South and Central America, and northern Australia (CABI, 2005). This species can establish in U.S. Plant Hardiness Zones 8 – 10 (USDA-NA, 1990) where many of its hosts are available.	Medium (2)
Risk Element #2: Host Range This pest has been recorded on a wide variety of host plants in several families, including Rubiaceae (*Coffea* spp.), Solanaceae (*Capsicum annuum*), Rutaceae (*Citrus* spp.), Rosaceae (*Malus pumila*, *Prunus* spp.), Moraceae (*Ficus carica*), Myrtaceae (*Psidium guajava*), Sterculiaceae (*Theobroma cacao*), Arecaceae (*Phoenix dactylifera*) and Anacardiaceae (*Mangifera indica*) (CABI, 2005).	High (3)
Risk Element #3: Dispersal Potential These pests deposit six to eight eggs in host fruit (Hassan, 1977). Females can lay up to 300 eggs in their lifetime (Weems, 1981). In warm climates, breeding is continuous and there are several overlapping generations throughout the year (Hassan, 1977). Adults can fly distances over 20 kilometers (CABI, 2005).	High (3)

Ceratitis capitata (Diptera: Tephritidae)	Risk ratings
Transport of infested fruits is the major means of movement and dispersal to previously uninfested areas (CABI, 2005).	
Risk Element #4: Economic Impact *Ceratitis capitata* is an important pest in Africa, and can be spread in suitable climates worldwide, making it the single most important pest species in its family (CABI, 2005). In Mediterranean countries, the pest is particularly damaging to citrus and peach crops increasing cost of production due to expenses related to control programs. It may also transmit fruit-rotting fungi (CABI, 2005). *Ceratitis capitata* is of quarantine significance worldwide, especially for Japan and the United States, where we spent considerable resources in order to prevent introduction of this fly (CABI, 2005). Its presence can lead to severe constraints for fruit export leading to losses of foreign markets (CABI, 2005).	High (3)
Risk Element #5: Environmental Impact The introduction and establishment of *C. capitata* in the United States will trigger the initiation of chemical control, particularly bait sprays. The species is highly polyphagous, and can attack plants from the following genera which have species Federally listed as Threatened or Endangered (USFWS, 2006): *Prunus* (*P. geniculata*, FL), *Argemone* (*A. pleiacantha*, NM), *Asimina* (*A. tetramera*, FL), *Berberis* (*B. nevivii*, *B. pinnata*, *B. sonnei*, CA), *Cucurbita* (*C. okeechobeensis*, FL), *Echinocereus* (*E. chisoensis*, *E. reichenbachii*, *E. iridiflorus*, TX; *E. fendleri*, NM; *E. triglochidiatus*, AZ), *Euphorbia* (*E. telephioides*, FL), *Opuntia* (*O. treleasei*, CA, *Ribes* (*R. echinellum*, FL, SC), and *Ziziphus* (*Z. celata*, FL). Because species of *Opuntia* are hosts, their damage can cause disruption of critical habitats in the Southwest (Chavez-Ramirez et al., 1997).	High (3)

Eutetranychus orientalis (Acari: Tetranychidae)	Risk ratings
Risk Element #1: Climate-Host Interaction This mite is found in tropical savannahs and deserts where major hosts are cultivated and humidity is sufficient for egg survival (CABI, 2005). The species has been recorded in Asia (from Turkey and Iran, to India, Japan and China), Africa, and Europe. It can possibly establish in U.S. Plant Hardiness Zones 8-10 where one or more of its hosts are present.	Medium (2)
Risk Element #2: Host Range This pest is typically found on *Citrus* spp., but is considered polyphagous. Other hosts include grape (*Vitis* spp.), cotton (*Gossypium* spp.), papaya (*Carica papaya*), quince (*Cydonia oblonga*), walnut (*Juglans* spp.) and pear (*Pyrus* spp.) (CABI, 2005).	High (3)
Risk Element #3: Dispersal Potential High temperatures and humidity favor this species' development, particularly the egg, which is sensitive to dry conditions (Van den Berg et al., 2001). Females, on average, have a life-span of 15.2 days, laying between 6-8 eggs per	High (3)

***Eutetranychus orientalis* (Acari: Tetranychidae)**	**Risk ratings**
day, with a maximum of 35 eggs per female (CABI, 2005; PNKTO, 1983). Under optimal conditions, 25-27 generations per year are possible (CABI, 2005). The pest is capable to travel on fruit commodities and APHIS takes action (cold treatment) against this pest on pears, litchi, and carambola.	
Risk Element #4: Economic Impact *Eutetranychus orientalis* is an important pest of citrus. In India, of the seven species reported as pests on citrus, only *E. orientalis* was reported to be a major pest in all areas (CABI, 2005). The mite causes defoliation and dieback of twigs in nurseries and orchards, resulting in premature fruit drop and, therefore, lowering the yield of host crops (PNKTO, 1983). Presence of this pest requires implementation of control programs which causes the cost of production to increase. *Eutetranychus orientalis* is a pest on the EPPO A2 list (CABI, 2005). This pest is not known to occur in Western hemisphere and its introduction into the United States can cause loss of foreign and domestic markets.	High (3)
Risk Element #5: Environmental Impact Endangered species of the genera *Prunus* (e.g., *P. geniculata*, FL), *Manihot* (*M. walkerae*, TX), and *Ziziphus* (*Z. celata*, FL) are potential hosts for *E. orientalis* (USFWS, 2006). Biological and/or chemical control programs are likely to be implemented if the mite is introduced. Successful controls include release of predatory mites and a parasitic fungus found in Jordan and Israel (CABI, 2005). A number of acaricides are commonly used in different countries for the chemical control of this mite (CABI, 2005).	High (3)

***Frankliniella schultzei* (Thysanoptera: Thripidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Frankliniella schultzei* has a wide geographical distribution. It is found in both tropical and temperate climate zones including Europe (Great Britain, Italy, and the Netherlands), Asia, Africa, Central America, the Caribbean, South America, Oceania and Hawaii (CABI, 2005; Kormelink, 2004). It is unknown whether *F. schultzei* can over-winter in extremely cold climates, but regions with cold winters can become re-infested with *F. schultzei* from greenhouse populations. Its distribution corresponds to U.S. Plant Hardiness Zones 5-10 (USDA, 1990), where hosts are present.	High (3)
Risk Element #2: Host Range Major hosts of this species include Bromeliaceae (*Ananas comosus*), Fabaceae (*Arachis hypogaea, Cajanus cajan, Glycine max, Lens culinaris* ssp. *Culinaris, Vigna mungo, Vigna unguiculata*), Malvaceae (*Gossypium* sp), Liliaceae (*Hyacinthus* sp.), Asteraceae (*Lactuca sativa*), and Solanaceae (*Lycopersicon esculentum, Nicotiana tabacum*). Minor hosts are Cactaceae and Gesneriaceae (*Saintpaulia ionantha*) (CABI, 2004).	High (3)
Risk Element #3: Dispersal Potential *Frankliniella schultzei* inserts eggs into the tissue of green plants. Eggs hatch in 6-8 life. On cotton, females produce an average of 25 eggs during their lifetime	High (3)

Frankliniella schultzei **(Thysanoptera: Thripidae)**	**Risk ratings**
(CABI, 2005). The typical development time on cotton (28°C day/21°C night) for first-instar larvae, second-instar larvae, pre-pupa and pupa are 6-8, 6-8, 2-4 and 2-4 days, respectively (CABI, 2005). Like most thrips, *F. schultzei* is a weak flyer; however, its fringed wings enable it to remain airborne long enough to travel easily between neighboring fields that are sometimes long distances. This species can be transported in commercial commodities, including fresh fruits and vegetables, cut flowers, and plants for planting (CABI, 2005; Lewis, 1997).	
Risk Element #4: Economic Impact *Frankliniella schultzei* can cause both direct and indirect damage to host plants that lead to loss of yield in crops. Direct damage is caused by suction injury. Pale spots and stripes on the flowers of different plants can be the result of the suction activity by thrips. On fruits and pods, *F. schultzei* may cause lesions, abnormal shape, and premature drop (CABI, 2004). *Frankliniella schultzei* is a major pest of cotton in Argentina and Paraguay, often destroying the emerging plants. Feeding on young cotton plants causes symptoms deformation and destruction to young plants and seedlings (CABI, 2004). *Frankliniella schultzei* causes indirect damage to plants as a vector of several important plant tospoviruses. These viruses are considered limiting factors in the production of a large number of horticultural crops. *Frankliniella schultzei* is a vector of tomato spotted wilt tospovirus (TSWV), tomato chlorotic spot tospovirus (TCSV), groundnut ringspot tospovirus (GRSV), and tobacco streak ilarvirus (TSV) (CABI, 2005; Kormelink, 2004; Lewis, 1997). In most infected fields, however, the impact of *F. schultzei* virus transmission is unclear, due to the presence of other tospovirus vectors, such as *F. occidentalis* and *Thrips tabaci* (CABI, 2005). *Frankliniella schultzei* is already introduced in Florida but it is not a significant pest and no special control measures are recommended (Reitz, 2006). Several countries reject consignments infested with thrips, but specific quarantine measures directed at *F. schultzei* are rarely invoked (CABI, 2005).	Medium (2)
Risk Element #5: Environmental Impact We did not find any records of successful biological control for *F. schulzei*. Chemical control against other thrips usually controls this species as well (CABI, 2005). In Florida, where this pest is already introduced, no special control measures are implemented due to its insignificance (Reitz, 2006). The species is polyphagous, but does not have hosts in the genera of plants listed as Threatened or Endangered. The exception is *Vigna o-wahuensis*, which is only reported in Hawaii (NRCS, 2002), where *F. schulzei* is already present. Due to high uncertainty regarding the host status of Threatened and Enadangered species, we used methodology described in the Guidelines, that states that "if the pest attacks other genera within the family, and preference…tests have not been conducted with the listed plant and the pest, then the plant is assumed to be a host" (APHIS, 2000). *Opuntia treleasei* is listed to be Endangered in California, as well as multiple species of orchids in different	Medium (2)

Frankliniella schultzei **(Thysanoptera: Thripidae)**	**Risk ratings**
locations of continental United States (USFWS, 2006). Species of *Opuntia* are important plants in the ecosystems of the southwestern United States and their damage could cause an adverse effect on these ecosystems (Chavez-Ramirez et al., 1997). Since plants in the families Cactaceae and Orichidaceae, are minor hosts of this species (CABI, 2005), this species is rated as Medium for Environmental Impact.	

Helicoverpa armigera **(Lepidoptera: Noctuidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction This moth is found in western and eastern Europe, Siberia, the Far East, Asia, Africa and Oceania (CABI, 2005). This species has the potential to establish in U.S. Plant Hardiness Zones 4-10 (USDA-NA, 1990) where its numerous hosts are available.	High (3)
Risk Element #2: Host Range This pest attacks hosts from multiple plant families, such as Fabaceae (*Phaseolus vulgaris, Glycine max*), Liliaceae (*Allium*), Linaceae (*Linum usitatissimum*), Malvaceae (*Hibiscus*, *Gossypium*), Poaceae (*Avena sativa*), Rosaceae (*Prunus*), Rutaceae (*Citrus* spp.), Cucurbitaceae (*Cucurbita pepo*, *Cucumis melo*), Solanaceae (*Solanum tuberosum*, *S. melongena*), Brassicaceae (*Brassica oleracea*) and others (CABI, 2005).	High (3)
Risk Element #3: Dispersal Potential *Reproduction potential. Helicoverpa armigera* has a high reproductive potential. In southern Bulgaria, two complete generations a year and a partial third occur, and winter is passed in the soil in the pupal stage (CABI/EPPO, 1997). In Iran, up to six generations occur annually, depending on weather (CABI, 2005). “A female may lay up to 3,180 eggs” in her lifetime (CABI/EPPO, 1997). *Dispersal*. *Helicoverpa armigera* has a high dispersal potential, as evidenced by adults migrating over long distances by wind (CABI/EPPO, 1997). Dispersal through international trade has been observed on commodities such as cut flowers, cotton bolls, and tomato fruit (CABI/EPPO, 1997).	High (3)
Risk Element #4: Economic Impact Economic losses due to *H. armigera* larvae feeding on foliage, fruit, and grains can be serious (CABI, 2000). Several larvae on a single cotton plant will devour all of the bolls within two weeks, and larvae also reduce the yield of tomato fruit and maize kernels (CABI/EPPO, 1997). Lastly, infestation of *Pinus radiata* in New Zealand reduced the foliage of 60 percent of the trees by 50 percent (CABI/EPPO, 1997). Implementation of IPM programs to control this pest is usually required, which increases production costs. *Helicoverpa armigera* is listed as an A2 quarantine pest by the European Plant Protection Organization (EPPO); and a quarantine pest by the Caribbean Plant Protection Commission (CPPC), the Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA), and the country of Brazil (EPPO, 2000). Its introduction, therefore,	High (3)

Helicoverpa armigera **(Lepidoptera: Noctuidae)**	**Risk ratings**
will lead to losses of potential foreign and domestic markets.	
Risk Element #5: Environmental Impact The following Endangered or Threatened plants could be attacked by this insect: *Helianthus eggertii* (AL, KY, TN), *Helianthus schweinitzii* (NC, SC), *Prunus geniculata* (FL), and *Allium munzii* (CA) (USFWS, 2006). Species of *Pinus* are hosts and their damage can disrupt important forest ecosystems in the United States. Upon introduction, biological control measures, such as bioinsecticides, could be implemented (CABI, 2005). In most cases where *H. armigera* attacks high-value or staple crops, its control with chemical insecticides, alone or within the context of an IPM program, will be necessary (CABI, 2005).	High (3)

Nipaecoccus viridis **(Newstead) (Hemiptera: Pseudococcidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Nipaecoccus viridis* is widespread in tropical and subtropical Asia (from Iran to Japan, and Northern China), Africa, and Oceania; it has limited distribution in North America (Mexico) (CABI, 2005; Hua, 2000). It should be able to survive in the United States Plant Hardiness Zones 5-10 (USDA-NA, 1990) where one or more of its hosts are present.	High (3)
Risk Element #2: Host Range *Nipaecoccus viridis* has been recorded on hosts in 18 families (CABI, 2005). Primary hosts include species of *Citrus* (Rutaceae), *Coffea* (Rubiaceae), and *Gossypium* (Malvaceae). Other hosts include *Leucaena leucocephala* (Fabaceae), *Nerium oleander* (Apocynaceae), *Punica granatum* (Punicaceae), *Artocarpus heterophyllus* (Moraceae), *Corchorus capsularis* (Tiliaceae), *Asparagus officinalis* (Liliaceae), *Euphorbia hirta* (Euphorbiaceae), *Mangifera indica* (Anacardiaceae), *Jacaranda mimosifolia* (Bignoniaceae), *Vitis vinifera* (Vitaceae), *Clerodendrum infortunatum* (Verbenaceae), *Solanum tuberosum* (Solanaceae) (CABI, 2005), *Opuntia* (Cactaceae), *Helianthus* (Asteraceae), *Ziziphus* (Rhamnaceae), *Manihot* (Euphorbiaceae) (Ben-Dov et al., 2001).	High (3)
Risk Element #3: Dispersal Potential Fecundity ranges from 90 to 138 eggs per female, with up to three generations per year (CABI, 2005). Local dispersal is accomplished by crawlers. Individual insects often settle in cryptic places on plant material, such as under sepals of citrus fruits, and can easily be distributed on exported plants or plant products (CABI, 2005).	High (3)
Risk Element #4: Economic Impact Feeding of *N. viridis* on young twigs causes bulbous outgrowths, and heavy infestations may severely stunt the growth of young trees (CABI, 2005). Frequently, fruits turn yellow and then partly black around the stem end, finally dropping off the tree (CABI, 2005). This mealybug was responsible for losses up to 5 percent in vineyards in India and was long considered the most destructive mealybug species in Hawaii (CABI, 2005). In addition, fruits with deformities caused by mealybug feeding are culled in the packinghouse, resulting in further production losses (CABI, 2005).	High (3)

Nipaecoccus viridis (Newstead) (Hemiptera: Pseudococcidae)	Risk ratings
In certain areas, the mealybug may be controlled effectively by natural enemies without needing additional control measures (CABI, 2005; Venkatesha, 2006). However, in some regions, insecticides may be necessary (Myfruits, 2004), or even widely used (Franco et al., 2004), increasing the cost of production. *Nipaecoccus viridis* is a regulated pest for New Zealand and Korea, so its establishment in the United States could lead to the loss of these markets.	
Risk Element #5: Environmental Impact This pest represents a potential threat to endangered native plants in the United States, e.g. *Euphorbia* (*E. telephioides*, FL), *Opuntia* (CA), *Helianthus* (AL, KY, TN, NM, TX, NC, SC), *Manihot* (TX), *Ziziphus* (FL) (USFWS, 2006). Species of *Opuntia* are important plants in the ecosystems of the southwestern United States and their damage could cause an adverse effect on these ecosystems (Chavez-Ramirez et al., 1997). It is a serious pest of citrus (CABI, 2005), however, it seems likely that chemical control programs currently in place against other mealybugs could control *N. viridis*. Successful biological control is achieved for this pest (Bartlett, 1978; Meyerdirk et al., 1988) and therefore, could be initiated if *N. viridis* is introduced on the United States.	High (3)

Spodoptera littoralis (Lepidoptera: Noctuidae)	Risk ratings
Risk Element #1: Climate-Host Interaction The distribution of *S. littoralis* includes Africa, the Middle East, and southern Europe (CABI, 2005). This pest has the potential to establish within U.S. Plant Hardiness Zones 8 – 10 (USDA-NA, 1990), and one or more of its hosts occur in these climatic zones (NRCS, 2005).	Medium (2)
Risk Element #2: Host Range This pest attacks hosts from multiple plant families, such as Brassicaceae (*Brassica oleracea*), Cucurbitacae (*Cucurbita pepo*, *Citrullus lanatus*), Fabaceae (*Pisum sativum*, *Phaseolus vulgaris*), Liliaceae (*Allium*), Malvaceae (*Gossypium*), Poaceae (*Avena sativa*), Rutaceae (*Citrus*), Apiaceae (*Daucus carota*), Solanaceae (*Lycopersicon esculentum*, *Solanum tuberosum*) and others (CABI, 2005).	High (3)
Risk Element #3: Dispersal Potential Reproductive and dispersal potentials of *Spodoptera littoralis* are high. The moths can fly 1.5 km in four hours CABI/EPPO, 1997. Under optimal conditions, an adult female will produce 1,000 to 2,000 eggs; “the life-cycle can be completed in about 5 weeks” CABI/EPPO, 1997. The number of generations for this moth depends on the climate; for example, in Japan, four generations per year can occur, whereas in the tropics, eight generations are possible CABI/EPPO, 1997.	High (3)
Risk Element #4: Economic Impact *Spodoptera littoralis* has a significant economic impact in the Mediterranean,	High (3)

Spodoptera littoralis **(Lepidoptera: Noctuidae)**	**Risk ratings**
Africa, and the Middle East CABI/EPPO, 1997. In Italy, *S. littoralis* is most damaging to ornamentals and vegetable crops CABI/EPPO, 1997. Injury by this moth occurs from the defoliation of a plant by larval feeding; fruit and pods are also consumed by the larvae, rendering them unmarketable CABI/EPPO, 1997. "On tobacco, in India…two, four, and eight larvae per plant reduced yield by 23-24, 44.2 and 50.4 percent, respectively" CABI/EPPO, 1997. In addition to yield reduction, this pest causes the increase in costs of commodity production due to implementation of control programs. *Spodoptera littoralis* is an EPPO A2 quarantine pest; it is also listed as a quarantine pest by CPPC, OIRSA, and the countries of Belarus, Russia, Ukraine, and Turkey EPPO, 2000. Establishment of this pest in the United States will lead to losses of domestic and potential foreign markets, particularly in Western Hemisphere.	
Risk Element #5: Environmental Impact The following Endangered or Threatened species could be attacked by *S. littoralis*: *Allium munzii* (CA), *Amaranthus pumilus* (DE, MA, MD, NC, NJ, NY, RI, SC, VA), *Cucurbita okeechobeensis ssp. okeechobeensis* (FL), *Helianthus eggertii* (AL, KY, TN), *Helianthus paradoxus* (NM, TX), *Helianthus schweinitzii* (NC, SC), *Opuntia treleasei* (CA), *Prunus geniculata* (FL), *Quercus hinckleyi* (TX), *Senecio franciscanus* (AZ), *Senecio layneae* (CA), *Trifolium amoenum* (CA), *Trifolium stoloniferum* (AR, IL, IN, KS, KY, MO, OH, WV), *Trifolium trichocalyx* (CA), and *Verbena californica* (CA) (USFWS, 2006). Upon its introduction, biological control measures, such as bioinsecticides, as well as additional IPM (pheromone monitoring, lure and kill, sterile insect techniques), could be implemented (CABI, 2005). Species of *Quercus* are potential hosts for *H. armigera* and their damage could cause negative effect on major forest ecosystems. Species of *Opuntia* are also hosts and their damage can cause disruption of critical habitats in the Southwest.	High (3)

Scirtothrips dorsalis **(Thysanoptera: Thripidae)**	**Risk ratings**
Risk Element #1: Climate-Host Interaction *Scirtothrips dorsalis* is reported in Asia, west and south Africa, Oceania, China and Japan (CABI, 2005). It has the potential to establish in U.S. Plant Hardiness Zones 8-10 where available hosts of this species are present.	Medium (2)
Risk Element #2: Host Range *Scirtothrips dorsalis* is polyphagous. The host list includes species from families Amaranthaceae, Anacardiaceae, Asteraceae, Cucurbitaceae, Fabaceae, Euphorbiaceae, Liliaceae, Malvaceae, Rhamnaceae, Rosaceae, Rutaceae, Solanaceae, Vitaceae, and Theaceae (CABI, 2005; Ciomperlik and Seal, 2004).	High (3)
Risk Element #3: Dispersal Potential <u>Reproduction potential</u>: Fecundity depends on host plant quality. In castor, the total number of eggs laid by a female ranges from 40-66; in chilies, a female lays 2-4 eggs per day for about 32 days (CABI, 2005). The life-cycle is completed in 13-20 days, depending on host plant and season.	High (3)

Scirtothrips dorsalis **(Thysanoptera: Thripidae)**	**Risk ratings**
Dispersal: Records from USDA PestID database indicate 119 interceptions of *Scirtothrips* spp.; of these interceptions, 50 were *S. dorsalis*, including some on fresh fruit (PestID, 2007). New data indicate that number of interceptions of *S. dorsalis* could be significantly greater (Defra, 2006), particularly when identified by other than traditional visual inspections at the ports of entry (Skarlinsky, 2004). This information is important in assessing the dispersal potential of *S. dorsalis* via international trade of commodities.	
Risk Element #4: Economic Impact In its principal range of tropical Asia, *S. dorsalis* is a serious pest of vegetables in Taiwan and Thailand, *Capsicum*, groundnuts, flowers and onions in India, and cotton in India and Pakistan (EPPO/CABI, 1997). In Japan and Taiwan, citrus (especially *C. unshiu*) is seriously affected (EPPO/CABI, 1997). In Japan, *S. dorsalis* is a pest of grapevine and tea (EPPO/CABI, 1997). The damage caused is similar to that by *S. aurantii* (EPPO/CABI, 1997), distorting young leaves and scarring of fruit, and leading to crop yield reduction and the loss of crop quality. *S. dorsalis* is a vector of Peanut bud necrosis virus (PBNV), Peanut chlorotic fan virus (PCFV) (Campbell et al., 2005) and Peanut yellow spot virus (PYSV) (Campbell et al., 2005; Satyanarayana et al., 1996) (Campbell et al., 2005; Satyanarayana et al., 1996. Losses in chilies can reach 25-55 percent (CABI). Chemical control is often used against this species which increases the cost of production (CABI, 2005). In Japan, without insecticides, up to 90 percent fruit clusters in grapes could be damaged (60 percent damage occurs with insecticides) (Defra, 2006). *Scirtothrips dorsalis* is a quarantine pest for many countries in the Western Hemisphere and an A2 Regulated Pest for the EPPO region; its establishment in the United States could lead to losses of markets. Other evidence suggests that, in some locations (S. Lucia and S. Vincent islands), this pest is "widely distributed" but often "…numerically less abundant and ubiquitous than other pests in Trinidad, such as *Thrips palmi*" (Imperil and Seal, 2004). Not all hosts suffer economic damage. For example, multiple generations of *S. dorsalis* were observed in kiwifruit orchards from May until October in Japan, but no economic damage was caused (Sakakibara and Nishigaki, 1988). Given the preponderance of evidence that *S. dorsalis* may cause significant economic damage, we assigned it a risk rating of High.	High (3)
Risk Element #5: Environmental Impact The following Endangered or Threatened species could be attacked: *Allium munzii* (CA), *Amaranthus pumilus* (DE, MA, MD, NC, NJ, NY, RI, SC, VA), *Cucurbita okeechobeensis* ssp. *okeechobeensis* (FL) (USFWS, 2006). Additional chemical control would likely be implemented since it is often used against this pest (CABI, 2005; Mishra et al., 2005; Reddy e*t al*., 2005).	High (3)

Table 6. Summary of risk ratings and values for the Consequences of Introduction.

Pest	Climate /Host	Host Range	Dispersal Potential	Economic Impact	Environ-mental Impact	Cumulative risk rating
Ceratitis capitata	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Eutetranychus orientalis	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Frankliniella schultzei	High (3)	High (3)	High (3)	Med (2)	Med (2)	High (13)
Helicoverpa armigera	High (3)	High (3)	High (3)	High (3)	High (3)	High (15)
Nipaecoccus viridis	High (3)	High (3)	High (3)	High (3)	High (3)	High (15)
Scirtothrips dorsalis	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)
Spodoptera littoralis	Med (2)	High (3)	High (3)	High (3)	High (3)	High (14)

Likelihood of Introduction analyses

The value for the Likelihood of Introduction is the sum of the ratings for the Quantity Imported Annually and Pest Opportunity (Table 7). The following scale is used to interpret this total: Low is 6-9 points, Medium is 10-14 points and High is 15-18 points.

During the first year, importations of eggplants will be approximately 100 tons, with the amount changing later according to market demands. The sea shipping containers that are typically used for estimating the volume of commodity shipments are 40 feet (12.2 m) in length and hold approximately 40,000 pounds (18,182 kg or 20 tons) (FAS, 2003). The annual quantity of eggplants to be shipped from Israel is projected to fill approximately 5 of the 40-foot shipping containers. The rating for this risk factor is Low.

The ratings for **Pest Opportunity** are based on the biological characteristics exhibited by the pest's interaction with the commodity. Pest Opportunity represents a series of independent events that must take place before a pest outbreak can occur. The five components of Pest Opportunity consider the availability of post-harvest treatments, whether the pest can survive through the interval of normal shipping procedures, whether the pest can be detected during a port-of-entry inspection, the interactions among factors that influence the rate of establishment, and the factors that influence the rate of population establishment.

We rated *C. capitata*, *H. armigera*, and *Spodoptera littoralis* High for their ability to **Survive Post-harvest Treatment**. Larvae of *C. capitata* are internal feeders and larvae of noctuids could bore inside the fruit and, therefore, are not likely to be affected by a surface-cleansing post-harvest treatment, such as washing and culling, especially if the extent of damage is not obvious. Eggs of plant-feeding Lepidoptera are firmly attached to the substrate with a glue-like substance produced by the female accessory glands (Chapman, 1998). If these eggs are present on eggplant fruits, simple post-harvest treatment might not be sufficient for their removal.

We rated the pests *E. orientalis*, *N. viridis*, *F. schultzei*, and *Scirtothrips dorsalis* Medium because they are external feeders that may become dislodged by a surface-cleansing post-harvest treatment; however, depending on their developmental stage (egg, larva or nymph, adult) or instar, these diminutive insects might find shelter on fruit. For example, many scales and mealybugs prefer tight, protected areas, such as cracks and crevices (Kosztarab, 1996). Their cryptic behavior, small size (most scales are less than 5 mm long) (Gullan & Kosztarab, 1997), and water-repellent, waxy coverings could make them difficult to see or dislodge, especially since eggplant is harvested with its sepals attached. The average tetranychid mite is tiny (0.8 mm) (CABI, 2004), making it similarly difficult to detect on a host. Presence of a calyx and sepals and a portion of the stem in eggplant provide such shelters for miniature insects (e.g., *N. viridis* [CABI, 2005]) and the mite. Nevertheless, routine washing and cleaning procedures against the external pests might be more effective on eggplant fruit due to its morphology when compared to other commodities, such as grape, kiwi or litchi.

We rated all of the pests High for their ability to **Survive Shipment** because internal feeders are protected from adverse environmental conditions by plant part tissue, while other pests seek shelter in rough or pitted areas on the plant part surface. Numerous records demonstrate the ability of noctuid larvae to survive in permit cargo (PestID, 2007); however, interception records should be vigilantly observed since the low number of interceptions does not always guarantee a low rate of pest survival. A recent report on the implementation of other than visual techniques for inspection of fresh fruits and vegetables at ports-of-entry (Skarlinsky, 2004) indicates a much higher rate of survival of thrips and mealybugs in these commodities. In addition, the geographic range of *H. armigera* and *F. schultzei* includes temperate regions that experience colder winters, thus increasing their chances of survival under conditions of refrigeration. Eggplant is unlikely to be shipped at temperatures below 12^{o}C (PPIS, 2005a), as fruit damage could occur. APHIS-PPQ believes that the temperature conditions and time frames associated with un-refrigerated air or sea transport are insufficient to reduce the population level(s) of these pests.

As with assessing the probability of eggplant pests surviving post-harvest treatment, estimating the probability that these pests will be **Not Detected at the Port-of-Entry** involves the consideration of pest size, mobility, and degree of concealment. Depending on the age of infestation, the internal feeders could have a high probability of escaping detection at a port-of-entry unless the fruit is cut open (i.e., *C. capitata*). Thrips, mites and scales (mealybugs) are relatively small pests; at low population densities they may escape detection, despite color differences in the plant part. Large, conspicuous infestations could lead to the easy detection of scale insects; however, sparser populations of these small insects, particularly if concealed on fruit or in packing materials, would be more difficult to discover using standard visual inspection. Skarlinsky (2004) indicates that using a standard protocol on peppers from St. Lucia and St. Vincent, "no thrips were detected … during the 2 percent visual inspection, compared to an 80 percent detection rate of thrips with the shaker box plus alternative sampling and a 60 percent rate for the microscopic examination."

In addition to thrips, several other reportable pests were detected during the study, primarily mealybugs (Pseudococcidae) and aphids (Aphididae). When the two percent visual inspection technique was employed, reportable pests were detected in 30 percent of the shipments. These results were stark in contrast to those obtained using other inspectional methods. With the shaker box method, reportable pests were detected in 100 percent of the shipments, and the microscopic technique detected 80 percent reportable pests in shipments" (Skarlinsky, 2004). We rated all pests, except noctuids, High for this risk factor. Damage to eggplant by *H. armigera* and *Spodoptera littoralis* is likely to be either external or boring in the fruit will not be deep, and with noticeable holes. Even if the fruit damaged by noctuids was not culled in the packing house, such fruits would be eliminated during the port visual inspection. Therefore, these two noctuids are rated Medium for this risk factor.

Favorable habitats for most of the pests should exist only in the southern and western regions of the continental United States, comprising perhaps 12-18 percent of the total landmass of the country. Some species (*Spodoptera littoralis*) evidently have narrower climatic tolerances and could establish permanent populations in a narrow swath of territory, the extreme south, the California coast, and Florida and Hawaii. *Scirtothrips dorsalis* are capable to establish in Hardiness Zones 8-10 and *N. viridis* occurs in a province in Northern China with the Hardiness Zone 5 (Hua, 2000). *Frankliniella schultzei* is already present in Hawaii and the continental United States (Florida) however they do not seem to be spreading. Considering uncertainty related to a possible area of establishment versus the actual infested area in the USA (based on the above example) we evaluated risk for **Moved to Suitable Habitat** element as Medium for all of the pests except *H. armigera and N. viridis,* which we estimated to be High risk.

A pest's ability to come into **Contact with Host Material** varies among arthropods in their potential geographic range within the United States. Hosts of *C. capitata*, *H. armigera*, *Spodoptera littoralis*, *F. schultzei* and *Scirtothrips dorsalis* include temperate-zone or widely cultivated plants (CABI, 2005; NRCS, 2005), which should be available throughout the potential geographic range of pests in the United States. We rated these pests High for this risk factor.

The hosts of *E. orientalis* and *N. viridis* include citrus, cotton, corn, mango, grapes and other crops of warmer climates that are limited in distribution in the United States; thus, these hosts are less likely to be encountered and colonized within the pests' potential range (CABI, 2005; NRCS, 2005). We rated the mite Medium for this risk factor.

Even if hosts are available for colonization, biological attributes of some arthropods reduce their probability of successful establishment. Specifically, the sedentary (or sessile) nature of scale insects (Coccoidea) have limited possibilities of coming into contact with hosts (Miller, 1985; Gullan & Kosztarab, 1997). For these insects to successfully establish in a new environment, the following two conditions should co-occur: 1) insects must be in a close proximity to susceptible hosts, and 2) insects must be present on imported fruit in some mobile form in order to transfer to new hosts. Since these circumstances are highly unlikely to co-occur (Miller, 1985), scales, such as *N. viridis,* are ordinarily given a Low risk rating for this element.

Table 7. Summary of the ratings for the quantity imported annually, pest opportunity, and the Likelihood of Introduction. For all pests the rating for 'Quantity imported annually' was Low (1).

Pest	**Ratings for Pest Opportunity**					**Cumulative risk rating**
	Survive Post-harvest Treatment	**Survive Ship-ment**	**Not Detected at Port-of-Entry**	**Moved to a Suitable Habitat**	**Contact with Host Material**	
Ceratitis capitata	High (3)	High (3)	High (3)	Med (2)	High (3)	High (15)

Pest	Ratings for Pest Opportunity					Cumulative risk rating
	Survive Post-harvest Treatment	**Survive Ship-ment**	**Not Detected at Port-of-Entry**	**Moved to a Suitable Habitat**	**Contact with Host Material**	
Eutetranychus orientalis	Med (2)	High (3)	High (3)	Med (2)	Med (2)	Medium (13)
Frankliniella schultzei	Med (2)	High (3)	High (3)	Med (2)	High (3)	Medium (14)
Helicoverpa armigera	High (3)	High (3)	Med (2)	High (3)	High (3)	High (15)
Nipaecoccus viridis	Med (2)	High (3)	High (3)	High (3)	Low (1)	Medium (13)
Scirtothrips dorsalis	Med (2)	High (3)	High (3)	Med (2)	High (3)	Medium (14)
Spodoptera littoralis	High (3)	High (3)	Med (2)	Med (2)	High (3)	Medium (14)

F. Conclusion: Pest Risk Potential

The summation of the estimates for the Consequences of Introduction and the Likelihood of Introduction gives the values for the Pest Risk Potential (Table 8). The following scale is used to interpret this total: Low is 11-18 points, Medium is 19-26 points, and High is 27-33 points. This is a baseline estimate of the risks associated with this importation. The reduction of risk occurs through the use of mitigation measures.

All the pests within this risk assessment had ratings of **High** for Pest Risk Potential. High Pest Risk Potential means that port-of-entry inspection is not considered sufficient to provide phytosanitary security and specific phytosanitary measures are strongly recommended.

The conclusions from pest risk assessment are used to consider whether risk management is required and the strength of measures to be used (Stage 2 of PRA) (IPPC, 1996). Pest risk management (Stage 3 of PRA) is the process of identifying ways to react to a perceived risk, evaluating the efficacy of these procedures, and recommending the most appropriate options (IPPC, 1996, 2002). The Risk Management Section (below) describes risk mitigation options with discussions of their efficacy and application.

Table 8. Pest Risk Potential

Pest	Consequences of Introduction	Likelihood of Introduction	Pest Risk Potential
Ceratitis capitata	High (14)	High (15)	High (29)
Eutetranychus orientalis	High (14)	Medium (13)	High (27)
Frankliniella schultzei	High (13)	Medium (14)	High (27)
Helicoverpa armigera	High (15)	High (15)	High (30)
Nipaecoccus viridis	High (15)	Medium (13)	High (28)
Scirtothrips dorsalis	High (14)	Medium (14)	High (28)
Spodoptera littoralis	High (14)	Medium (14)	High (28)

3. Risk Mitigation Options

The appropriate level of protection for an imported commodity can be achieved by the application of a single phytosanitary measure, such as inspection, quarantine treatment, or a combination of measures. 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 may be 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, 2002).

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

Israel proposes to grow eggplants destined for export into the continental United States in insect-proof pest exclusionary structures (PPIS, 2006), with the main specifications of entry similar to conditions currently governing importation of peppers from Arava region of Israel in to the United States as described in 7 CFR § 319.56-2u (Revised January 1, 2003).

1. Phytosanitary Measures Prior to Harvesting

Pest-free Areas: Establishment of pest-free areas, pest-free places of production, and pest-free production sites, as well as areas of low pest prevalence, may be an effective alternative to post-harvest quarantine treatments or a component of systems approach (IPPC, 2002). Establishment and maintenance of such pest-free areas or production sites should be in compliance with ISPMs

4, 10 and 22 (IPPC 1996, 1999, and 2005) and NAPPO (2004a, b).

Eggplants should be grown the Arava Valley by growers registered with the Israeli Department of Plant Protection and Inspection (DPPI). The eggplants are to be grown in insect-proof plastic screenhouses with double doors, approved by the Israeli DPPI and APHIS (PPIS, 2006). Houses are examined periodically by authorized personnel from both countries to insure that there are no tears in either the plastic or screening. Recent studies show that plastic screens with UV-absorbency in the UV-A and UV-B range ('BioNets') are superior to conventional nets of the same mesh size. These plastics screens successfully protect fruits against vegetable insect pests and spread of virus diseases (Antignus et al., 1998).

Trapping for Mediterranean fruit fly (medfly), *C. capitata*, should be conducted by DPPI throughout the year in the agricultural region of the Arava Valley. The capture of a single medfly in a screenhouse should lead to an immediate cancellation of export from that house. Eggplants should not be exported until the source of the infestation is delimited, trap density is increased, pesticide sprays are applied or other measures are undertaken.

Control Program: Mechanical, cultural, or chemical controls (e.g., sanitation, soil fumigation, and pre-harvest insecticidal, fungicidal, and herbicidal sprays) should be used to manage pests within pest exclusionary structures to qualify as pest-free areas or pest-free production sites.

Sanitation and pesticidal applications, as essential components of best management practices, are mainstays of commercial fruit production (e.g., Kirk et al., 2001). For example, existing importation program for peppers from Arava valley requires application of Malathion bait sprays in the residential areas at 6-10-day intervals, beginning not less than 30 days before the harvest of backyard host material in residential areas, and continuing through harvest (see conditions governing importation of peppers from Arava region of Israel in to the United States as described in 7CFR319.56-2u, Revised January 1, 2003).

Certain pests such as thrips, flies, scales, moths, nematodes, bacterial and fungal pathogens *etc*., are known to become established in greenhouses (CABI, 2005). For example, *Spodoptera littoralis* is a habitual pest of Solanaceae in greenhouses in southeast Sicily (Zangheri and Ciampolini, 1980); therefore, surveys and control programs against this quarantine pest are essential for reducing the risk of its introduction with the imported commodity.

Phytosanitary Certification Inspections: Fruit should be sampled and inspected periodically during the growing season and after harvest for quality control and as phytosanitary precautionary measures. Production areas also should be subject to scheduled audits and periodic, unannounced inspections by certified inspectors from PPQ and DPPI; these inspections should insure that production areas meet stipulated requirements for the issuance of a phytosanitary certificate required for each consignment. This measure is useful for detecting pests present during the growing season that may be more difficult to detect post-harvest. Detection methods need to 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 (Barclay & Hargrove, 2005).

2. Mitigation Options Post-harvest and Prior to Shipping

Post-harvest Safeguards and Packinghouse Procedures: Removal of infected or infested plant material reduces the likelihood that quarantine organisms would be present with a shipment. Sorting and packing of eggplants should be done in the insect-proof packing houses (Landshut, 2006). Prior to movement from approved insect-proof packing houses, the eggplants must be packed in either individual insect-proof cartons or in non-insect-proof cartons that are covered by insect-proof mesh or plastic tarpaulins; covered non-insect-proof cartons must be placed in shipping containers.

In the packinghouse, fruit should undergo mechanical brushing or other treatments to remove external pests. Immersion of the fruit in a water bath containing surfactant and, perhaps, a surface sterilant, such as chlorine bleach, could remove external arthropods from the surface. The liquid in the bath must be able to penetrate the residual floral material at the stem end, and contact and kill any arthropods that may be concealed around the stem. Surfactants, such as simple dishwashing detergent, may show a high degree of insecticidal activity with minimal risk of phytotoxicity. For example, Liu and 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}.

All fruit should be inspected prior to packing. A random sample of fruit per lot should be inspected for external pests and cut to reveal internal pests; each sample should be of a sufficient size in order to detect pest infestations. During the grading process, any damaged, diseased, or infested fruit should be removed and separated from the commodity destined for export.

Mitigation Options during Shipping and at U.S. Ports-of-entry: Prior to shipping, and during the transportation, the fruit will be stored at 12ºC (PPIS, 2005a). The packaging safeguards should remain intact at all times during the movement of the eggplants to the United States and their arrival (IPPC, 2006b). Each shipment of eggplants is expected to be accompanied by a phytosanitary certificate issued by the Israeli national plant protection organization stating that all of the conditions of the work plan have been met.

Limits on Distribution and Transit within the United States: In some instances, the importation of commodities that might be harboring exotic pests is authorized for shipment to certain locations (e.g., Alaska or North Atlantic ports) or during a specific season (usually the one with the coldest temperatures). These additional measures limit the risk of establishment for many exotic pests. The importation of eggplant into the United States is anticipated during the harvest season in Israel, which is from December to May. December through March is the coldest season for the most of the continental United States., Thus, shortening the importation season as well as confining eggplant shipments to North Atlantic ports and limiting their distribution to the Northern states (i.e., located north of Plant hardiness zone 7) during these months could increase the level of protection.

Point-of-entry Sampling and Inspection: Consignments should be inspected upon arrival in the United States, with particular attention given to paperwork, to ensure that the chain of custody has remained intact. A random sample of fruit from each consignment might be inspected (depending on the work plan conditions) to detect a pest infestation rate of 10 percent or greater

(USDA, 2004).

Quarantine treatments: There are no approved treatments for eggplants that are specific to all quarantine pests identified in this Risk Assessment. Existing specific quarantine treatments for eggplant destined only for control of a few pests on this commodity. For example, to control fruit flies, including *C. capitata,* treatment T106-b-2 **Vapor heat** is used at 112°F for 8.75 hours with immediate cooling thereafter (USDA, 2006).

Another option for controlling medfly in eggplants is treatment T105-a-1 **Irradiation** that is mandatory for eggplants from Hawaii (USDA, 2006). Recently approved irradiation treatment with the generic dose of 400 Gy for all arthropods, excluding adults and pupae of the order Lepidoptera, could be another valuable option (Treatments for Fruits and Vegetables, 2006), depending on fruit tolerances. As mentioned above, irradiation of 150 Gy is used successfully against fruit flies. Using 150 Gy against the fruit flies (Treatments for Fruits and Vegetables, 2006) combined with the field control is also a possibility, leading to a low prevalence for other pests. In addition, an inspection should be required.

An approved treatment to control hitchhiker surface pests, such as thrips, scale insects, spider mites, and surface feeding caterpillars on eggplant or other various commodities, is T104-a-1 **fumigation** with Methyl-Bromide at NAP—tarpaulin or chamber at 50 °F or above (maximum dosage, 3 pounds/1,000 ft3) for 0.5 or 2 hours, depending on minimum concentration readings. An approved treatment destined for a specific control of mealybugs on various commodities, including eggplant, is T104-a-2 **fumigation** with Methyl-Bromide at NAP—tarpaulin or chamber at 70 °F or above. This treatment would supersede T104-a-1 as higher temperatures are used during the same duration of the treatment. This treatment should be effective for *N. viridis,* as well as for the surface pests identified as subject to treatment T104-a-1: spider mite, *E. orientalis*; thrips *Frankliniella schultzei, Scirtothrips dorsalis*; and moth caterpillars that could be feeding on the surface of eggplants at the time of treatment, such as *Spodoptera littoralis* and *H. armigera*.

More options for quarantine treatments are available to mitigate risk of specific pests (such as those identified in this risk assessment) on commodities other than eggplant. *Eutetranycus orientalis*, for example, is controlled by Treatment T107-f, **cold treatment** at 35 °F (1.67 °C) or below for 14 days or 32 °F (0 °C) or below for 10 days on Carambola, Litchi (Lychee), and Sand Pear. If the fruit is shipped from an area where Mediterranean fruit fly also occurs (in combination with melon fly and/or Oriental fruit fly) the recommended treatment is to use T107-a, which is a **cold treatment** of different duration traditionally used for citrus, stone and pome fruit (USDA, 2006).

For *H. armigera* and *Spodoptera littoralis* caterpillars on leafy vegetables, an approved treatment is T101-n-2, **fumigation** with Methyl-Bromide at NAP—tarpaulin or chamber, with the schedule of varying temperatures, dosage rates and minimum concentration (specifics of each schedule are available in APHIS Treatment Manual on line).
Scirtothrips dorsalis on asparagus from Thailand are subject to Treatment T101-b-1-1, MB **fumigation** (“Q” label only) at NAP—tarpaulin or chamber at temperatures from 60°F to 80°F, depending on dosage rates and concentrations. *Thrips* sp. on asparagus from other locations

undergo the same treatment with schedules slightly different from the one used for *S. dorsalis*.

3. Monitoring

Pre-shipment Programs: Inspection, treatment, or other mitigative measures performed in the field and packinghouse should be subject to the direct supervision of qualified APHIS and DPPI personnel, and in accordance with specified phytosanitary procedures. Such programs call for monitoring of all aspects for any required phytosanitary measures, in addition to identifying the shortcomings/opportunities for program modifications. Provisions 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.

Field Survey and Trapping: Survey procedures include visual inspection, fruit cutting, and trapping within and outside of the pest exclusionary structures. Surveys should be conducted at regular intervals during the growing season to determine the presence or absence of pests. For medfly monitoring, appropriate traps should be placed following guidelines in USDA (2003). Growers should receive or be denied certification for export on the basis of survey or trapping results.

Shipments Traceable to Place of Origin in Israel: A requirement that eggplant be packed in containers with identification labels indicating the specific place of origin is necessary to ensure traceability to each production site.

4. Conclusions

The number and diversity of pests that require mitigation make it unlikely that a single mitigative measure should be adequate to reduce risks of their introduction into the United States. For this reason, a combination of measures in a systems approach is most feasible. The system should include the following safeguards: monitoring of pest exclusionary structures (and area outside) and management programs to achieve and maintain area pest freedom; packinghouse inspection and post-harvest treatments; and maintenance of consignment security and traceability in transit. Table 9 summarizes the options for risk mitigation.

The specific implementation of measures, as would be present in an operational workplan, is beyond the scope of this document.

Table 9. Summary of risk mitigative options for eggplant, *Solanum melongena*, from Israel.

Measure(s)	**Pest**	**Efficacy**
Pest-free areas or places of production	All	Satisfies requirements for appropriate level of protection
Control program (pre-harvest), including production in pest exclusionary structures	All	Research required to demonstrate efficacy
Packinghouse procedures, including cleaning, visual culling, brushing, bath immersions	*Nipaecoccus viridis*, *Eutetranychus orientalis*, species of Thripidae, externally feeding larvae of noctuids	Research required to demonstrate efficacy
Point-of-entry sampling and inspection including fruit cuttings	Most of the external pests; most of the internal pests when fruit is cut	Detection rates are low for certain thrips and scales during routine visual inspections. The shaker-box technique and/or microscopic evaluations might be needed to reduce the level of risk. For cut fruit, the sample size should be adequate to detect infestation
Irradiation combined with low pest prevalence (T105-a-1)	*Ceratitis capitata*	Approved by APHIS to treat fruit flies in eggplant
Irradiation, generic dose 400 Gy, combined with low pest prevalence	All pests except pupae and adults of Lepidoptera	Approved by APHIS
Irradiation 150 Gy for fruit flies combined with low prevalence of other pests plus inspection	All pests	Research required to demonstrate efficacy
Methyl-Bromide fumigation (T104-a-2, schedule for mealybugs) combined with low pest prevalence	All surface pests	Approved by APHIS to treat surface pests on vegetables, including eggplant. Research required to demonstrate efficacy for internal pests, moth such larvae
Vapor heat (T106-b-2) combined with low pest prevalence	*Ceratitis capitata*	Approved by APHIS to treat fruit flies for eggplant. Research required to demonstrate efficacy for internal feeders such as moth larvae
Cold treatment (T107-a) combined with low pest prevalence	*Eutetranychus orientalis* and *Ceratitis capitata*	Approved by APHIS to treat these pests in citrus, pome and stone fruit. Research required to demonstrate efficacy in eggplant

4. Authors and Reviewers

USDA-APHIS-PPQ
Center for Plant Health Science and Technology
Plant Epidemiology and Risk Analysis Laboratory

Author:
Marina Zlotina, Entomologist

Reviewers:
Christie Bertone, Entomologist
Feridoon Mehdizadegan, Plant Pathologist

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