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

Risk Management Document

Importation of Fresh Guava (*Psidium guajava*) Fruit from Mexico into the United States treated with 400 gy irradiation

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Plant Health Programs (PHP)
Commodity Imports Analyses and Operations (CIAO)
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Introduction

The Government of Mexico requested permission to export guava, *Psidium guajava* L., fruit into the United States. Guava fruit has not been imported from Mexico before, so a pathway-initiated risk assessment (PRA) was conducted. A list of guava pests from Mexico was prepared based on United States Department of Agriculture (USDA)'s Animal and Plant Health Inspection Service (APHIS) records of intercepted pests, and scientific literature. The PRA document, *Importation of Guava,* Psidium guajava*, from Mexico into the United States, A Pathway-Initiated Commodity Risk Analysis* (USDA, 2008) identified three fungi, two mites, and 21 insect pests likely to follow the pathway on fresh guava fruit from Mexico into the United States.

Fungi:

Mycovellosiella psidii Crous (Ascomycetes, Mycosphaerellales)
Pestalotiopsis psidii (Pat.) Mordue (Ascomycetes, Xylariales)
Sphaceloma psidii Bitanc. & Jenk. (Ascomycetes, Myriangiales)

Mites:

Oligonychus biharensis (Hirst) (ACARI:Tetranychidae)
Oligonychus psidium Estébanes & Baker (ACARI:Tetranychidae)

Insects:

Aleurodicus dispersus Russell (HOMOPTERA: Aleyrodidae)
Aleurodicus maritimus Hempel (HOMOPTERA: Aleyrodidae)
Aleurodicus pulvinatus (Maskell) (HOMOPTERA: Aleyrodidae)
Anastrepha bahiensis Lima (DIPTERA:Tephritidae)
Anastrepha fraterculus Wiedemann (DIPTERA:Tephritidae)
Anastrepha ludens (Loew) (DIPTERA:Tephritidae)
Anastrepha obliqua (Macquart) (DIPTERA:Tephritidae)
Anastrepha serpentina (Wiedemann) (DIPTERA:Tephritidae)
Anastrepha striata Schiner (DIPTERA:Tephritidae)
Ceratitis capitata (Wiedemann) (DIPTERA:Tephritidae)
Coccus viridis (Green) (HOMOPTERA: Coccidae)
Conotrachelus dimidiatus Champion (COLEOPTERA:Curculionidae)
Conotrachelus psidii Marshall (COLEOPTERA:Curculionidae)
Dysmicoccus neobrevipes Beardsley (HOMOPTERA:Pseudococcidae)
Gymnandrosoma aurantianum Lima (LEPIDOPTERA: Tortricidae)
Maconellicoccus hirsutus (Green) (HOMOPTERA: Pseudococcidae)
Nipaecoccus viridis (Newstead) (HOMOPTERA: Pseudococcidae)
Phenacoccus psidiarum Cockerell (HOMOPTERA: Pseudococcidae)
Planococcus minor (Maskell) (HOMOPTERA: Pseudococcidae)
Pseudococcus solenedyos Gimpel & Miller (HOMOPTERA: Pseudococcidae)
Tetraleurodes truncatus Sampson & Drews (HOMOPTERA: Aleyrodidae)

The PRA (USDA, 2008) determined that the risk is **high** for eight pests: the Tortricid moth, *Gymnandrosoma aurantianum*, and seven fruit flies, *Anastrepha spp.* and *Ceratitis capitata*. The risk was determined to be **medium** for both mites *Oligonychus biharensis* and *O. psidium*, two weevils in the genus *Conotrachelus,* four whiteflies (Aleyrodidae), six mealybugs (Pseudococcidae), and one soft scale *Coccus viridis* (Coccidae). The risk was also determined to be medium for the three pathogens, *Mycovellosiella psidii*, *Pestalotiopsis psidii* and *Sphaceloma psidii*.

Mexico has proposed to treat guavas with an APHIS approved irradiation treatment that would mitigate risks from all insect pests except pupae and adult Lepidoptera. All of the insects except pupae and adult Lepidoptera will be effectively neutralized with the irradiation generic dose of 400 Gy (USDA, 2006). Other measures in addition to irradiation will be required to mitigate the risk from the mites *Oligonychus psidium* and *O. biharensis*. The irradiation treatment is expected to cause some mortality of these arthropod pests, but will not completely mitigate the risk. Other pests that are likely to follow the pathway include the three fungi, *Mycovellosiella psidii, Pestalotiopsis psidii,* and *Spaceloma psidii*. These three pathogens will be subject to inspection for symptoms at the United States port-of-entry.

The proposed importation of guava fruit from Mexico, if approved, would be regulated by an amendment to the existing fruits and vegetables regulations [7 CFR § 319.56]. This document outlines the phytosanitary measures that APHIS will require if the proposed importation of guavas from Mexico is approved and documents the evidence used by APHIS to conclude that these measures will effectively prevent the introduction of quarantine pests.

Standard Industry Practices

Post-harvest treatment of guava fruit in packinghouses in Mexico consists of a clear water bath, brushing with mechanical brushes, sorting, and culling defective or damaged fruits (USDA, 2008) and inmersed in a solution with a broad-spectrum fungicide (SAGARPA, 2008).

Pest Risk Mitigation Measures

APHIS proposes that guava fruit from Mexico may be imported into the United States only under the following conditions:

(1). Guavas may be imported into the United States in commercial consignments only.

(2). The fruit must be irradiated with a minimum absorbed dose of 400 Gy and follow requirements of 7CFR parts 305.31 and 319.56.

(3). Each shipment of fruit must be inspected by the Mexican NPPO inspectors and be accompanied by a Phytosanitary Certificate (PC) issued by the Mexican NPPO

certifying that the fruit received the required irradiation treatment. The PC must also include an Additional Declaration (AD) that states:

"The fruit in this shipment was treated by irradiation with a minimum absorbed dose of 400 Gy, inspected in and found free of *Oligonychus biharensis*, *Oligonychus psidium, Mycovellosiella psidii, Pestalotiopsis psidii* and *Sphaceloma psidii*."

(4) Fruits imported into the United States will also be subject to port-of-entry inspection and found free of *Oligonychus biharensis*, *Oligonychus psidium, Mycovellosiella psidii, Pestalotiopsis psidii* and *Sphaceloma psidii*.

Historical Performance of Importing Irradiated Fruits

Current regulations 7CFR 305.31 and 7CFR.319.56-4 (b)(3) allow the use of irradiation to treat fruit for importation into the United States. Beginning in April, 2007, India has shipped mangos to the United States irradiated with a minimum dose of 400 Gy targeting arthropod pests and with a systems approach for fungal pathogens. Regulation 7CFR318.13-4 (f) allows interstate movement of fifteen different fruits, including mangos from Hawaii, allowing irradiation using a minimum absorbed dose of 150 Gy and 400 Gy for fruit flies, seed weevils and other quarantine pests. Fruits and vegetables treated with irradiation moved interstate from Hawaii have had no pests of quarantine significance intercepted (AQAS-PestID, 2007). On very rare occassions when live fruit fly larvae were detected in irradiated shipments, they were always found to be moribund and never resulted in further development or completing life cycles (Uyeda, 2005).

Evidence for the Effective Removal of Pests of Concern from the Pathway

The following paragraph summarizes key mitigation measures for the importation of guava fruit from Mexico and provides a general discussion of their efficacy. The evidence APHIS uses to determine that the measures described above effectively remove pests of concern from the pathway are also discussed. The FAO (2002) defines “pathway” as “any means that allows the entry or spread of a pest.”

Arthropod Pests

Twenty one of the twenty six pests likely to follow pathway are insects. There are no records of importing irradiated guavas from Mexico, but records of interstate movement of mangos from HI into the United States treated with 300 Gy irradiation, show no interceptions of quarantine pests since 2000 (Uyeda, 2005). Additionally, reports of twelve shipments of mangos irradiated with 150 Gy imported from Australia into New Zealand since 2004, provide no record of quarantine pest interceptions from the irradiated mangos (Edwards, 2005). Although the pest complex in Hawaii or Australia is different from that described for Mexican guavas,

the 150 Gy minimum absorbed dose has been determined to be effective against all fruit flies (USDA, 2006).

As part of the United States requirements governing the use of irradiation as a phytosanitary treatment (7CFR305.31), APHIS and the NPPO of Mexico will jointly develop an operational work plan. The work plan shall incorporate details of treatment and preclearance activities including inspection of articles that APHIS may perform before or after the treatment. Inspection of the guava fruit for the presence of pests not targeted by irradiation during preclearance activities will further ensure that the pests of concern are removed from the pathway.

In the Mexican Hass avocado import program, packing house inspection has been successfully used to remove several pests from the pathway of avocado fruit, including weevils and a fruit boring moth (USDA, 2007; AQAS-PestID, 2007). Weevil larvae in guava fruits can be detected by ovipositon scars on fruits and the internal feeding damage causes abnormal fruit development (Boscán de Martínez & Cásares, 1980, 1981; González, 1991; Sánchez Soto, 2000). Larvae of *Conotrachelus* spp. cause premature fruit drop in guavas, so that marketable size guavas are either not infested, or the damage caused by the larvae is highly visible (González, 1991; Levine & Hall, 1977). This means that most guavas that are infested will not be harvested. Any infested guavas that reach the packing house will be culled or detected by phytosanitary inspections (USDA, 2008).

Infestations of mites produce visible damage, or bronzing, on leaves and fruit of guavas (Kwee & Chong, 1990). Infestations of mites are detectable and will be culled at the packing house or detected by phytosanitary inspection at the port-of-entry.

Fungal Pathogens

Three fungi, *Mycovellosiella psidii, Pestalotiopsis psidii* and *Sphaceloma psidii*, are rated in the PRA (USDA, 2008) as having a medium pest risk potential, and according to Pest Risk Assessment 5.02 guidelines (USDA, 2000) may require special measures beyond port-of-entry inspection.

Mycovellosiella psidii was described for the first time from Mexico (Crous, 1999) from collections previously identified as species of *Cercospora*. The biology of the fungus is not well known. Symptoms on fruit are circular lesions, 2-3 mm diam., brown with a raised dark brown border (Crous, 1999). *Pestalotiopsis psidii* was reported from Asia, Africa, Europe and tropical America (USDA, 2008). *P. psidii* symptoms consist of leaf spots and fruit cankers easily recognized by the circular, corky lesions (Keith *et al.*, 2006; Lim & Manicom, 2003; Mordue, 1976). *Sphaceloma psidii* was describe for the first time by Bitancourt and Jenkins on guava from Brazil (1950). *S. psidii* symptoms consist of leaf and fruit spots easily recognized (Bitancourt & Jenkins, 1950; TCA, 1999).

The only plausible pathway for the pathogens to become established in the United States is via discarded fruit or unused portions of the fruit or peel. Disease spread can only occur if temperature and moisture conditions are favorable for spore germination (USDA, 2008). Infected discarded fruit would need to be discarded in or near guava orchards or areas with suitable host material at a time when susceptible tissue is available and in a stressed conditon. The probability of discarded infected fruit being in close proximity to a cultivated or wild guava tree with favorable environmental conditions for spore germination is low.

Mycovellosiella psidii was reported only on *Psidium guajava* (Crous, 1999). *Pestalotiopsis psidii* was reported on *Feijoa sellowiana*, *Psidium* spp., and *Musa paradisica* (Farr *et al*., n.d.). *S. psidii* was reported on *Psidium guava* and *Feijoa sellowiana* from Mexico, New Zealand and Brazil (Farr *et al.*, n.d.)

Because of the limited host availability, limited inherent dispersal capabilities, and low availability of host material of *Mycovellosiella psidii*, *Pestalotiopsis psidii,* and *Sphaceloma psidii* mitigation measures beyond inspection/monitoring are not warranted (USDA, 2008). Symptoms of these fungi can be detected on guava fruit during packing house phytosanitary inspection. The PC with an AD is considered sufficient to mitigate the risk of introduction of these pathogens. Specifically listing the pests on the AD alerts APHIS and Mexican NPPO inspectors to the specific quarantine pests of concern.

Summary

The phytosanitary requirements described above include treatment of Mexican guava fruit with irradiation using a minimum absorbed dose of 400 Gy and preclearance inspections for pests not targeted by the irradiation treatment. APHIS finds that the safeguards of 7 CFR § 305.31 and 319.56, and the additional mitigations described here will result in the effective removal of the pests of concern from the pathway identified by the pest risk analysis for the importation of fresh guava fruit from Mexico.

Table 1. Summary of risk management measures for guava, *Psidium guajava*, from Mexico.

Mitigation Measures	**Pest**	**Efficacy**
(1) Only commercially produced guava fruit may be imported into the United States.	All, but must be used in conjunction with other measures.	Cultural, chemical, or mechanical means (e.g., field sanitation, pre-harvest application of pesticides, resistant cultivars) should be used to eliminate pests from fields or prevent fruit infestation. Sanitation,

		such as removing and discarding fallen fruit and pesticide applications, as essential components of good agricultural practices, are mainstays of commercial fruit production (e.g., Kirk *et al*., 2001).
(2) Irradiation at 400 Gy (T105-a-2).	All insects except pupae and adult Lepidoptera, but must be used in conjunction with other measures for mites.	Satisfies requirements for appropriate level of protection (USDA, 2006)
(3) Phytosanitary Certificate.	*Oligonychus biharensis*, *Oligonychus psidium, Mycovellosiella psidii, Pestalotiopsis psidii* and *Sphaceloma psidii*, but must be used in conjunction with other measures.	The phytosanitary certificate requires the NPPO to inspect the guavas for quarantine pests. All of these pests have stages that are visible upon inspection, or cause visible damage (Boscán de Martínez & Cásares, 1980; Crous, 1999; González, 1991; Gould & Raga, 2002; Kwee & Chong, 1990; Lim & Manicom, 2003).
(4) Phytosanitary inspection at United States port-of-entry.	All, but must be used in conjunction with other measures.	Inspection ensures that various stages of any pest that are present will be detected; this is particularly effective against those pests whose later life stages are larger and more readily detected (Borror *et al.*, 1989).

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