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Importation of *Citrus* spp. from Australia (Citrus Production Areas of Inland Queensland; Western Australia; and Bourke and Narromine, New South Wales) into the Continental United States

A Qualitative, Pathway-Initiated Pest Risk Assessment

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Executive Summary

The Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) prepared this risk assessment document to examine plant pest risks associated with importing commercially produced fresh fruit for consumption of *Citrus sinensis* (L.) Osbeck (orange), *C. limonia* Osbeck (Rangpur), *C. meyeri* Yu. Tanaka (lemon), *C. aurantiifolia* (Christm.) Swingle (Key lime), *C. latifolia* (Yu. Tanaka) Tanaka (lime), *C. paradisi* Macfad. (grapefruit), *C. reticulata* Blanco (mandarin), and their hybrids from citrus production areas in inland Queensland, Western Australia, and the Bourke and Narromine shires of New South Wales (NSW).

Title 7 of the Code of Federal Regulations 319, Part 56 (7 CFR § 319, 2014) provides regulatory authority for the importation of fruits and vegetables from foreign sources into the United States. This pest risk assessment was prepared in response to a request from the Government of Australia to change the Federal Regulation allowing the entry of Citrus fruit from new export areas. The Government of Australia requested the expansion of the existing export program beyond the currently-approved areas in the Riverina, Riverland, and Sunraysia Districts. Currently, C*itrus* fruit for consumption from Australia into the United States is authorized only from these export areas. The expansion areas for consideration are inland Queensland, Western Australia, and citrus production areas in the Bourke and Narromine shires of New South Wales

Citrus fruit imported from Australia into the United States currently is required to be commercially produced. The citrus must come from areas that are free of Mediterranean fruit fly (*Ceratitis capitata*) and Queensland fruit fly (*Bactrocera tryoni*) based on APHIS' recognition that Eastern Australia is free of Mediterranean fruit fly and Western Australia is free of Queensland fruit fly or they must be cold-treated. Additionally, the currently-approved production areas were established as free of *Phyllosticta citricarpa* (citrus black spot) and *Sphaceloma fawcettii* var. *scabiosa* (Tryon's scab) based on negative survey results. Lastly, the fruit must be inspected by Australian Department of Agriculture inspectors, found free of quarantine pests, and certified by Australian inspectors prior to departure from Australia. The existing requirements for oranges indicate the inspectors must provide an additional declaration stating that "The fruit in this consignment was subject to the appropriate phytosanitary measures to ensure the consignment is free of the light brown apple moth."

Based on the scientific literature, port-of-entry pest interception data, and information from the government of Australia, we developed a list of all potential pests with actionable regulatory status for the United States that occur in inland Queensland, Western Australia, and the citrus production areas of Bourke and Narromine in New South Wales (NSW), and are associated with the commodity plant species anywhere in the world.

From this list, we selected and further analyzed eight organisms that have a reasonable likelihood of being associated with the commodity following harvesting from the field and prior to any post-harvest processing.

The pathogen *Phyllosticta citricarpa* (citrus black spot) is of limited distribution in the United States and is considered a quarantine pest. USDA APHIS conducted pest risk assessments

examining the likelihood that these pathogens will spread through the movement of commercial citrus fruit intended for consumption (USDA APHIS, 2010b). USDA APHIS has determined that asymptomatic or commercially packed fruit is not an epidemiologically significant pathway for the introduction and establishment of this pathogens into new areas. Therefore, this pathogen was not analyzed in the pest risk assessment, however additional import requirements will be specified, in the risk management document, as a condition of entry for citrus fruit from Australia to the continental Unites States.

The following table includes pests analyzed in this PRA their likelihood of introduction rating:

Pest Type	**Taxonomy**	**Scientific Name**	**Likelihood of Introduction overall rating**
Arthropod	Acari: Eriophyidae	*Tegolophus australis*	Negligible
	Acari: Tetranychidae	*Eutetranychus orientalis*	Negligible
	Diptera: Tephritidae	*Bactrocera neohumeralis*	Medium
		Bactrocera tryoni	Medium
		Ceratitis capitata	Medium
	Hemiptera: Pseudococcidae	*Maconellicoccus hirsutus*	Negligible
	Thysanoptera: Thripidae	*Pezothrips kellyanus*	Negligible
Fungus		*Sphaceloma fawcettii* var. *scabiosa*	Negligible
		Phyllosticta citricarpa	Analyzed previously[a]

[a] Plant pests with limited distribution and under official control in the United States; therefore additional import requirements are required.

In our analysis, five pests received Negligible and three pests received Medium overall risk ratings for likelihood of introduction (i.e., entry and establishment) into the endangered area (the area at risk in the United States) via import pathway.

We determined that *B. neohumeralis, B. tryoni*, *Ceratitis capitata* are candidates for additional risk management, as shown below, because they met the threshold to likely cause unacceptable consequences of introduction, and they each received an overall likelihood of introduction risk rating above Negligible.

The risk ratings determined in this analysis are contingent on applying the packinghouse processes of culling, washing with brushes, fungicide application, and waxing considered in the analysis. If there are uncertainties regarding the full implementation of the prescribed procedures, additional safeguards or phytosanitary measures may be warranted. Detailed examination and choice of appropriate phytosanitary measures to mitigate pest risk are part of the pest risk management phase within APHIS and are not addressed in this document.

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1. Introduction

1.1. Background

This document was prepared by the Plant Epidemiology and Risk Analysis Laboratory of the Center for Plant Health Science and Technology, USDA Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), to evaluate the risks associated with the importation into the United States of commercially produced fresh fruit for consumption of *Citrus sinensis* (L.) Osbeck (orange), *C. limonia* Osbeck (Rangpur), *C. meyeri* Yu. Tanaka (lemon), *C. aurantiifolia* (Christm.) Swingle (Key lime), *C. latifolia* (Yu. Tanaka) Tanaka (lime), *C. paradisi* Macfad. (grapefruit), and *C. reticulata* Blanco (mandarin) from inland Queensland (QLD), Western Australia (WA), and the areas of Bourke and Narromine in New South Wales (NSW). The document follows the USDA-APHIS-PPQ Guidelines for Plant Pest Risk Assessment of Imported Fruit and Vegetable Commodities (Version 6.0) (USDA, 2012).

1.2. Initiating event

The Government of Australia requested the expansion of the existing export program beyond the areas in Riverina, Riverland, and Sunraysia Districts. The expansion areas for consideration are inland Queensland (Gayndah, Mundubbera, Emerald, Maryborough, Gin Gin, and Childers), Western Australia (Kununurra, Carnarvon, Wooramel, Northampton, Denmark, Capel, Gingin), and the Bourke and Narromine areas of New South Wales. Current importations are regulated under Title 7 of the Code of Federal Regulations, Part 319.56 (7 CFR § 319, 2014). Under this regulation, the entry of different species of *Citrus* fruit for consumption from Australia into the United States is authorized only from the above-mentioned existing export areas. This pest risk assessment was prepared in response to the request by the Government of Australia to change the Federal Regulation allowing the entry of *Citrus* fruit from new export areas (Australia, 2006; Australia, 2012a).

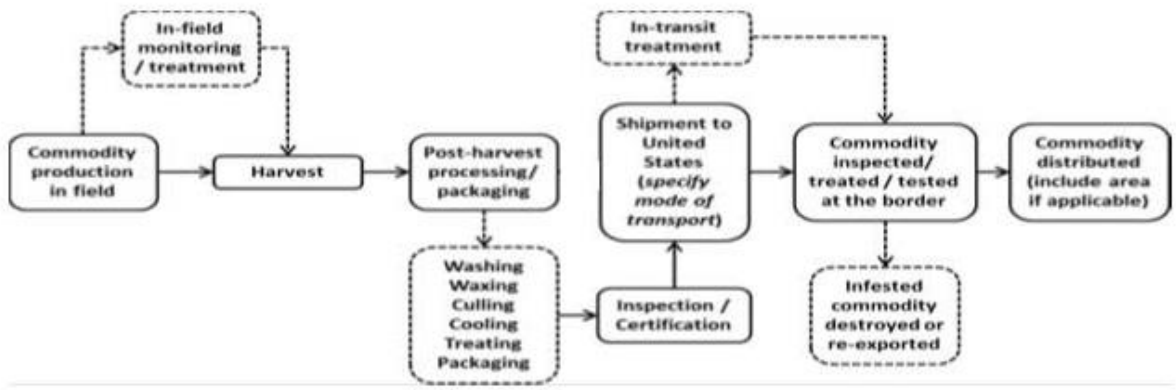
1.3. Determination of the necessity of a weed risk assessment for the commodity

Weed risk assessment is unnecessary for *Citrus* spp. because they are cultivated in the pest risk analysis (PRA) area and are already enterable into the PRA area from other countries.

1.4. Description of the pathway

The IPPC (2013) defines a pathway as "any means that allows the entry or spread of a pest." In the context of commodity pest risk assessments, the *pathway* is the commodity to be imported, together with all the processes the commodity undergoes that may have an impact on pest risk. In this risk assessment, the specific pathway of concern is the importation of fresh fruit of *Citrus sinensis*, *C. limonia*, *C. meyeri*, *C. aurantiifolia*, *C. latifolia*, *C. paradisi*, and *C. reticulata* for consumption from Bourke and Narromine areas of New South Wales, inland Queensland, and Western Australia into the United States. The movement of these commodities provides a potential pathway for the introduction and/or spread of plant pests following harvesting from the field to the consumer.

Figure 1. Pathway diagram for imports of fresh fruit of citrus from Australia into the continental United States.



1.4.1. Description of the commodity

Commercially produced fresh fruit for consumption of *Citrus sinensis* (L.) Osbeck (orange), *C. limonia* Osbeck, *C. meyeri* Yu. Tanaka (lemon), *C. aurantiifolia* (Christm.) Swingle, *C. latifolia* (Yu. Tanaka) Tanaka (lime), *C. paradisi* Macfad. (grapefruit), and *C. reticulata* (mandarin) from inland Queensland, Western Australia, and the Bourke and Narromine shires of New South Wales.

1.4.2. Citrus production in the exporting area

A map of Plant Hardiness Zones in Australia is presented in the Appendix 1.

Inland New South Wales. The Narromine and Bourkeshires of New South Wales are areas of low rainfall, providing a distinct benefit of infrequent occurrence of pests and diseases. As is the case for all areas of Australia, integrated pest management and cultural practices are the first line of defense against pests. Agrichemical inputs in this region are very minimal. A single copper spray in autumn is used as a preventative measure against fungal infections. While Queensland fruit fly (*Bactrocera tryoni*) is known to occur in the Bourke and Narromine regions, the marginal/hostile environment provides little opportunity for this species to establish itself as a production pest of citrus (Australia, 2014).

Inland Queensland. The main citrus production areas of Queensland are found within the Central Burnett region, which encompasses Gayndah and Mundubbera. Citrus is also sourced from the Central Highlands (Emerald) and the Wide Bay hinterland, which comprises the districts of Maryborough, Gin Gin and Childers (Smith et al., 1997; Australia, 2011b, 2014). Additional regions in coastal Queensland also produce commercial citrus but primarily focus on domestic markets. The main arthropod pests that affect Queensland citrus crops include mites, mealy bugs, scales, and Queensland fruit fly. The control of mites is achieved through close monitoring during spring and autumn, encouragement of natural enemies, and the use of selective miticides. Control of scale insects is achieved through release of parasitoids and chemical control measures that are timed to coincide with egg-hatching. Mealybug populations are closely monitored from early spring and may be controlled through the release and promotion of natural enemies. The well-timed use of oil sprays is also highly effective. Management of

Queensland fruit fly involves a three-pronged approach: monitoring, bait-spraying of commercial and non-commercial hosts, and the year-around male annihilation technique (MAT) carried out in both orchard and town areas. The application of these control measures resulted in overall suppression of fruit fly populations across the entire district: male trap catches at the peak activity time were reduced by 95 percent and overall fruit fly infestation in untreated backyard fruit of town areas reduced from 60.8 to 21.8 percent. This program is proven to be highly successful in managing Queensland fruit fly to ensure production of saleable, export-quality fruit (Australia, 2014).

Western Australia. Production areas include Kununurra in the far north, Carnarvon, Wooramel, and Northampton in the central coastal part of the state, Denmark in the far south, and areas surrounding Perth (Capel to Gingin). Cultural practices are widely adopted as the primary defense in disease management; copper-based fungicides are routinely applied 2-3 times per season as a preventive measure. The main arthropod pests of concern are mites, mealy bugs, scales, and Mediterranean fruit fly (*Ceratitis capitata*). Scale insects are effectively managed by releasing bio-control agents. Populations of Mediterranean fruit fly are monitored in orchards using male traps consisting of a pheromone and an insecticide. While trap counts are an informative tool in population monitoring, weekly bait sprays are routinely applied during the warmer months irrespective of trap data (Australia, 2014).

Some areas of citrus production have low fruit fly prevalence. Thus, Mediterranean fruit fly is rarely detected in the Moora citrus district and as such, routine bait-spraying is not required. A permanent trapping grid, overseen by the Department of Agriculture and Food Western Australia (DAFWA), has been installed as an early warning system. Significant plantings of citrus are also located in the Ord River Irrigation Area (ORIA) in the north-west of Western Australia, where the pressure from all arthropod pests is relatively low due to the extreme weather conditions. Accordingly, very few pesticide applications are required. The ORIA is free from Mediterranean fruit fly and other fruit flies of economic concern. DAFWA has been conducting fruit fly monitoring in the ORIA since the early 1990s. The movement of fresh fruit into the ORIA is prohibited under state legislation. Disease incidence in the ORIA is also low and is primarily managed through cultural practices. A single fungicide application early in the season is all that is required as a preventative measure against fungal diseases (Australia, 2014).

1.4.3. Harvesting and Post-harvest procedures in the exporting area

Harvest. Fruit is harvested when it reaches optimal maturity. Fruit is picked into bags that can hold approximately 15 kg. Mandarins are usually snipped with shears so that fruit retains the calyx. Any fruit with the calyx removed or damaged must be discarded. Mandarins are generally select-picked according to size and color. Navel oranges are simply hand-picked. We assume that the same practices are applied to other citrus fruit, such as grapefruit and lemon. Harvested fruit is transferred into plastic field bins where a preliminary sort is undertaken to remove any leaves, twigs, and other extraneous matter. Pickers are trained not to harvest split or decaying fruit. When harvesting navel oranges, the workers will strip/pick all fruit to reduce the overwintering potential of pests and diseases. Any unacceptable fruit is dropped to the orchard floor in the center of the row for mulching. It may take several passes through an orchard throughout the season before all fruit is harvested (Australia, 2014).

Packing. Fruit is transported to the packinghouse in field bins that hold 400 kg of fruit. Fruit is either packed within 24 hours or drenched with fungicide on arrival at the packinghouse to reduce the potential for post-harvest decay. The packinghouse quality controller ensures that fungicide levels in the drench are adequate, taking into account the strip-out rate and amount. Upon arrival at the packinghouse, the quality controller inspects fruit to ensure it meets market quality and phytosanitary requirements. A manual or automatic bin-tipper tips the fruit onto the first sorting table, which is located on the “wet” side of the packinghouse, which is separated from the clean side by a wall. The first sorting table is designed in such a way that leaves, trash, and twigs drop through the table. A team of between 1 and 4 staff manually pick through fruit for obvious signs of damage, undersize fruit, or any remaining extraneous matter. All material removed at this point is either sent to landfill or used as animal feed (Australia, 2014).

Fruit is then moved on a conveyer through an opening in the wall to the clean side of the packinghouse, where it undergoes brushing with water (and in some cases high-pressure washing) to remove dirt and sooty mold. The retention time under the brushes is determined by the packinghouse manager to optimize the initial cleaning. The fruit then moves to another set of brushes that use a recirculating water/fungicide emulsion. The fungicide level is checked regularly by the Quality Assurance supervisor to ensure that it is within the effective range without creating residue concerns. The next series of brushes is designed to wick away the water/fungicide emulsion. As a result, the fruit undergoes three rounds of washing and brushing, followed by a waxing procedure, prior to entering the drying tunnel, which is usually powered by a gas source (Australia, 2014).

Once dry, fruit falls into cups on a conveyor line where it is checked for a range of quality parameters. A color sorter checks for blemishes, greening, splits, and other defects. Fruit that does not meet class 1 requirements is diverted onto a second line for further assessment. Fruit that meets class 1 color requirements continues along the first line to be graded according to size. Each piece of fruit is weighed in the cups and deposited into accumulation bins according to size. Once fruit reaches the accumulation bins, it may be packed immediately or stored and packed according to order. Any fruit that does not meet size, color, or quality requirements is diverted to juicing. Fruit from the accumulation bins are tipped and conveyed to the packing area. Fruit is either packed by hand or with a high-speed automatic pattern packer. Prior to reaching the pattern packer, fruit is subject to further visual inspection and a range of quality checks. The pattern packer uses low vacuum air with soft rubber suction bellows to deposit fruit into the cartons. After fruit is packed, export cartons are palletized with corner-posts and strapping either by hand or by robot (Australia, 2014).

The conclusions for this analysis is dependent on applying the packinghouse processes of culling, washing with brushes, fungicide application, and waxing.

Export procedures. For exports to the United States, fruit is subject to an initial phytosanitary inspection in the packinghouse prior to being presented for export. Fruit is then inspected either in-line or at the end-point in a designated area of the export facility. Packinghouse quality controllers use magnifying glasses to ensure that the fruit is not blemished or scarred and meets phytosanitary requirements. Palletized/labelled fruit is stored in a secure area. Prior to loading the container, a Department of Agriculture Authorized Officer verifies the consignment to ensure it meets product description. A range of document checks are carried out to verify the source property (Australia, 2014).

Transit. Most fruit for export to the United States is subject to in-transit cold treatment for fruit flies (unless the production area is fruit fly free). Australian exporters have been utilizing the cold treatment pathway for over two decades and are well-versed in in-transit procedures. Prior to loading the container, temperature probes are inserted into the fruit in cartons on the pallets to ensure that they are below carriage temperature. The on-board temperature logging equipment is calibrated by a technician using USDA-approved methodology. As fruit is loaded into the container, temperature probes are inserted into the load in specific positions to record the temperature during the voyage. Once the container is loaded, it is sealed with a “bullet” seal (Australia, 2014). The temperature during transit corresponds to the USDA-approved treatments for *B. tryoni* or *C. capitata* in different species of citrus (USDA, 2014).

2. Pest List and Pest Categorization

In this section, we identify the plant pests with actionable regulatory status for the United States that could potentially become established in the United States as a result of the importation of fruit of *Citrus* species listed in the section 1.1 from the Bourke and Narromine areas of NSW, inland Queensland, and Western Australia and we determine which of these pests meet the criteria for further analysis. Pests are considered to be of regulatory significance if they are actionable at U.S. ports-of-entry. Actionable pests include quarantine pests, pests considered for or under official control, and pests that require evaluation for regulatory action.

2.1. Pests considered but not included on the pest list

2.1.1. Pests with questionable status as separate species, or with weak evidence for association with the commodity, or for presence in inland Queensland, Western Australia, and the Bourke and Narromine areas of New South Wales[1]

Fruit flies (Diptera: Tephritidae):
Bactrocera aquilonis. Cameron et al. (2010) were not able to trap any *B. aquilonis* in the area and questioned if the flies previously identified as *B. aquilonis* are present there at all since they were trapping in many different environments, including urban, horticultural, and bush areas and undisturbed natural habitats. Cameron et al. (2010) suggest that *B. aquilonis* and *B. tryoni* are likely to be the same species. Most of the host records since 1985 could be attributed to *B. tryoni* (Hancock et al., 2000).

Bactrocera cucumis. Single records of *B. cucumis* (French) exist for *Citrus limon, C. paradisi, C. reticulata,* and *C. sinensis,* respectively (Hancock et al., 2000[2]), but we found no further

[1] Some but not all of the pests in this section were present in the pest list provided by the exporting country. Others were found in reference databases accompanied by erroneous records. After reviewing all the evidence relevant to these pests, we identified those that should be excluded from Table 2 of this document for a variety of reasons.

[2] From Hancock et al. (2000): “Fruit fly species are frequently recorded from unusual hosts. In many cases these records are from overripe or damaged fruit, or that already infested by other species. Hence, a record from a particular fruit does not necessarily mean that it is a normal host for that fly species.”… “Large databases, (such as that for the QDPI Papaya fruit fly eradication programme from 1995-1999), contain a variety of suspected errors. Some may be attributed to misidentification of the fruit fly (especially general specimens) or plant.”

listings of this fruit fly as a commercial pest of citrus. We considered this insufficient evidence for a true host association and did not list the pest in Table 2.

***Bactrocera halfordiae*.** Drew (1989) wrote, "*B. halfordiae* appears to be of no economic importance, no commercial host records having been obtained since May (1953). The commercial host records of *B. halfordiae* may be incorrect as early workers confused the identity of this species with *B. tryoni*." In cases where records do refer to this particular species in association with citrus, it is listed as an incidental pest of no economic importance (NSWG I&I, n.d.).

Bactrocera kraussi. This fruit fly occurs in northeastern QLD (Hancock et al., 2000), in rainforests along the eastern coast of North QLD and Torres Strait (Drew, 1989). In QLD, citrus production for export to the United States occurs in the Central Burnett region, which comprises Gayndah and Mundubbera, the Central Highlands (Emerald), and the Wide Bay hinterland (the districts of Maryborough, Gin Gin and Childers) (Australia, 2011b). These areas are very distant to the south of the presently known distribution of *B. kraussi*, which does not extend below Townsville (Royer and Hancock, 2012). We found no information about any economic effects of this fly. In previous APHIS risk assessments, this pest was not analyzed for its economic impact due to the lack of information (USDA, 2013).

Bactrocera melas. At present, there is a lack of consensus about whether *B. melas* is a true species (Drew et al., 1982; Hancock et al., 2000). Most specimens named *B. melas* in the Department of Primary Industry collection fit the description of *B. tryoni*, with some differences in pigmentation (Drew at el., 1982). Hancock et al. (2000) consider this fly to be a darker form of *B. tryoni* or a hybrid between *B. tryoni* and *B. neohumeralis*. This fruit fly was bred from ten hosts (including citrus fruit), all of which are also hosts of *B. tryoni* (Drew et al., 1982). Its area of distribution is the eastern coast of QLD (Drew et al., 1982), away from the area where citrus for export is grown. Given a lack of the reliable scientific or industry information about this pest, we consider additional analysis for this fruit fly to be unnecessary; the assessments of *B. tryoni* and *B. neohumeralis* should adequately address the risk posed by *B. melas* on the Australian citrus pathway. Currently, there are no records of *B. melas* in PestID (2014).

Bactrocera musae. A single specimen of *B. musae* (Tryon) was recorded from grapefruit, while another infestation record is recorded from a ripe mandarin (Hancock et al., 2000). We considered this insufficient evidence for a true host association and did not list the pest in Table 2.

Bactrocera mutabilis. The host of the fruit fly *B. mutabilis* (May) is kumquat, *Fortunella* spp. Swingle [Rutaceae] (NSWG I&I, n.d.), so we did not list it in Table 2.

Bactrocera pallida. *Bactrocera pallida* (Perkins & May) occurs in northeast Queensland (QLD) (Hancock et al., 2000); however, no species of citrus are listed as hosts.

Bactrocera papayae (synonym of the currently valid name is *B. dorsalis*)[3]. The fruit fly, formerly named *B. papayae* Drew & Hancock, has been eradicated from mainland Australia since 1999 (CSIRO, 2004).

Bactrocera philippinensis (synonym of the currently valid name is *B. dorsalis*)[3]. The fruit fly, formerly named *B. philippinensis* Drew & Hancock, has been eradicated from Australia since 1999 (CSIRO, 2004; Walker, 2005a).

Dacus aequalis. We found only one record for *D. aequalis* Coquillett on orange (Drew et al., 1982). Moreover, it is not a pest of economic significance (Drew et al., 1982; NSWG I&I., n.d.; White and Elson-Harris, 1992). We found no other evidence that this fruit fly infests any commercial hosts.

Other arthropods:

Amblypelta nitida. In Australia, *A. nitida* Stål (Hemiptera: Coreidae) is an occasional pest of orange jessamine, *Murraya paniculata* (Rutaceae) (Waite and Huwer, 1998). We found no evidence that this fruit-spotting bug is a pest of the citrus species proposed for export, and therefore did not list it.

Chrysodeixis eriosoma. A few inconclusive records exist of an association of *C. eriosoma* (Doubleday) (Lepidoptera: Noctuidae) with *Citrus* species. Robinson et al. (2010) indicate one instance of presence on "*Citrus*," while Herbison-Evans and Crossley (2010) report this pest on "…the young shoots and fruit of various types of *Citrus*: e.g. Lemon, Orange (*RUTACEAE*)". On other hosts, this organism is only associated with leaves (Mau and Kessing, 1991). Because no scientific names for citrus hosts were given, and we found no interceptions of this pest on any *Citrus* spp. fruit (PestID, 2014), we did not list this pest in Table 2.

Conopomorpha cramerella. *Conopomorpha cramerella* (Snellen) (Lepidoptera: Gracillariidae) has been eradicated from Australia (DAFF, 2014a).

Haplothrips angustus. A single record exists for *H. angustus* Hood (Syn. *Haplothrips anceps* Hood) (Thysanoptera: Phlaeothripidae) on citrus in NSW (Australia, 2006). This species has only once been intercepted on *Citrus* sp. from Australia (PestID, 2014). Because it is a pest of grasses (Australia, 2012b); however, we think the interception is a rare incident, and we did not list the pest in Table 2.

Haplothrips victoriensis. *Haplothrips victoriensis* Bangall (Thysanoptera: Phlaeothripidae) was intercepted once in citrus fruit from Australia (PestID, 2014). We did not list it in Table 2 because it is a predatory thrips that does not damage citrus (Purvis and Moulds, N.D.), and was presumably a contaminating (hitchhiking) pest that is highly unlikely to follow the pathway.

Icerya seychellarum. *Icerya seychellarum* (Westwood) (Hemiptera: Monophlebidae) is reported from the Northern Territory (Smith et al., 1997). One dubious record lists it as occurring in NSW

[3] Schutze et al., 2014. The old names are used herein strictly in their relation to the references documenting the eradication of these fruit flies in Australia.

(CABI, 2014b), but other references state it does not occur (Smith et al., 1997; Ben-Dov et al., 2012; CSIRO 2004). Therefore, we did not include it in the Table 2.

Pathogens:
Xanthomonas citri* subsp. *citri. The pathogen *X. citri* subsp. *citri* occurred previously in Australia (DAFF, 2014b), but it has since been eradicated (IPPC, 2011). In 2018, Australia confirmed the presence of the Asian strain in two retail nursery locations in Darwin, Northern Territory (DAFF, 2018). Host material from infested properties was quarantined and destroyed. Surveillance activites in the citrus production areas of Western Australia have not detected the disease. Because we have no evidence that the disease occurs in the environment, we conclude that this was a regulatory incident and that the disease is not established in Australia.

2.1.2. Organisms not included in the pest list for a variety of other reasons
Aithaloderma ferrugineum. *Aithaloderma ferrugineum* L. Fraser is an epifoliar fungus-like sooty mold that lives on excretion left on the surface of plant tissue by different organisms, including the host. They are not plant parasites and therefore, they are not considered pathogens, so we did not list this species.

Alternaria interna. Since the initial description of *Alternaria interna* (McAlpine) Joly as *Macrosporium internum* McAlpine (McAlpine, 1902), there have been no reports of *A. interna* infecting citrus in Australia. Its association with exported citrus fruit from Australia is therefore questionable. This pest has never been intercepted on any host (PestID, 2014). In addition, this pathogen description shares similarities to *A. citri* (Simmons, 2007) and *A. alternata* (Peever et al., 2005), which are already established in the United States and infect *Citrus* spp. (e.g., Peever et al., 2005; UC IPM, 2008). Hence, the fungus might not be a new species for the United States. Based on these factors, we did not include *A. interna* on the pest list.

Candida krusei. *Candida krusei* (Castell.) Berkhoat may be an opportunistic post-harvest organism associated with the fruit. It has been reported in California and Florida (Farr and Rossman, 2015; Sandin et al., 1993). It is not considered a plant pathogen, so we did not list it below.

***Polistes* spp**. *Polistes humilis* spp. *synoecus* Saussure and other *Polistes* spp. (Hymenoptera: Vespidae) are present in NSW in Australia but are not plant pests (Smith et al., 1997).

Torbia perficita. *Torbia perficita* Walker (Orthoptera: Tettigoniidae) is not a pest of economic importance of citrus, but sometimes oviposits on twigs (Hely et al., 1982).

2.1.3. Pests with doubtful pathway associations
We did not include some organisms because they have been intercepted two or fewer times on commercially produced citrus fruit imported from Australia (PestID, 2014) and we found no other evidence indicating that they are associated with the production of citrus fruit in the proposed export areas. We therefore consider those interceptions to be insufficient evidence for a true host association[4]. Currently available evidence implies that the following pests are highly

[4] We included some organisms with a few interceptions in Table 2, however. These were often based on the expert judgment of the analyst; we provided a justification for inclusion in the remarks column.

unlikely to be present in the pathway: *Agrypnus* sp. (Coleoptera: Elateridae), *Brevipalpus* sp. (Acari: Tenuipalpidae), *Cernuella virgata* (Da Costa) (Mollusca), *Cochlicella acuta* (Müller) (Mollusca), *Dindymus versicolor* (Herrich-Schaeffer) (Hemiptera: Pyrrhocoridae), *Dorytomus longimanus* Forster (Coleoptera: Curculionidae), *Dysmicoccus* sp. (Hemiptera: Pseudococcidae), *Haplothrips* sp. (Thysanoptera: Thripidae), *Helix aspersa* (Müller) (Syn. *Cornu aspersum*, *Cantareus apertus*) (Mollusca), *Maconellicoccus hirsutes* (Green) (Hemiptera: Pseudococcidae), *Nysius* sp. (Hemiptera: Lygaeidae), *Perperus* sp. (Coleoptera: Curculionidae), *Prietocella barbara* (L.) (Mollusca), *Pseudococcus* sp. (Hemiptera: Pseudococcidae), *Pyrausta* sp. (Lepidoptera: Crambidae), *Remaudiereana annulipes* (Baerensprung) (Hemiptera: Rhyparochromidae), *Sitona discoideus* (Curculionidae), *Theba pisana* (Müller) (Mollusca), *Thrips* sp., and *T. flavus* (Thysanoptera: Thripidae). If future interceptions on imported citrus fruit from Australia warrant it, we may re-assess the risk status of these organisms.

2.1.4. Organisms with non-actionable regulatory status

In this document, we did not create a special pest list for non-actionable organisms typically placed in an appendix at the end of a risk assessment (USDA, 2012). Instead, many of these pests are listed in separate documents: Appendices 1 (arthropods) and 2 (pathogens), provided by Australia (2006).[5]

All armored scales (Hemiptera: Diaspididae) listed in Australia (2006) are not actionable when intercepted on fresh fruits and vegetables for consumption (Cavey, 2007) and therefore are not included. Other non-actionable organisms can also be found in Appendices 1 and 2, provided by Australia (2006).

2.1.5. Organisms identified only to the genus level

In commodity import risk assessments, the taxonomic unit for pests selected for evaluation beyond the pest categorization stage is usually the species (IPPC, 2012), as assessments focus on organisms for which biological information is available. Therefore, generally, we do not assess risk for organisms identified only to the genus level, in particular if the genus in question is reported in the import area. Often there are many species within a genus, and we cannot know if the unidentified species occurs in the import area and, consequently, whether it has actionable regulatory status for the import area. On the other hand, if the genus in question is absent from the import area, any unidentified organisms in the genus can have actionable status.

In light of these issues, we usually do not include organisms identified only to the genus level in the main pest list. Instead, we address them separately in this sub-section. The information here can be used by risk managers to determine if measures beyond those intended to mitigate fully identified pests are warranted. Often, however, the development of detailed assessments for known pests that inhabit a variety of ecological niches, such as internal fruit feeders or foliage pests, allows effective mitigation measures to eliminate the known organisms as well as similar but incompletely identified organisms that inhabit the same niche.

[5] The regulatory status of the organisms is not listed in the documents provided by Australia but identified by us during the review of the documents from the exporting country. Thus, the pests listed only in the documents from Australia but not included in this risk assessment are non-actionable for U.S. regulatory purposes.

For organisms identified to the genus level that are reported on the commodity in the export area and have actionable or undetermined regulatory status, we list them in Table 1.

Table 1. Organisms identified to the genus level that are reported on species of *Citrus sinensis*, *C. limonia*, *C. meyeri*, *C. aurantiifolia*, *C. latifolia*, *C. paradisi*, and *C. reticulata* to be imported in the United States and that have actionable or undetermined regulatory status.

Pest Name	Evidence of presence on citrus in NSW, QLD, WA[6]	Genus present in the United States?	Regulatory status[7]	Plant part(s) association[8]	On harvested plant part(s)?[9]	Remarks
Aplosporella sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Twig (Australia, 2006)	No	
Ascochyta sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Twig (Australia, 2006)	No	
Aureobasidium sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Leaf (Australia, 2006)	No	
Austropeplus sp. (Hemiptera: Miridae)	Smith et al., 1997	No	A	Flowers, Shoots (Smith et al., 1997)	No	
Blastobasis spp. (Lepidoptera: Blastobasidae)	Smith et al., 1997	Yes (Opler et al., 2012)	U	Fruit (Smith et al., 1997)	Yes	Exact species is unknown. Actionable pests may be present. Internal fruit borer.
Botrytis sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	A	Fruit, Leaf (Australia, 2006)	Yes	Exact species is unknown. Actionable pests may be present.

[6] NSW–New South Wales, QLD–Queensland, WA–Western Australia

[7] A=Actionable, U=Undetermined. If the genus does not occur in the United States, the organism has actionable status. If the genus occurs in the United States, the organism has undetermined regulatory status, because we cannot know if the unidentified species is one that occurs in the United States.

[8] The plant part(s) listed are those for the plant species under analysis. If the information is extrapolated, such as from plant part association on other plant species, this is noted.

[9] "Yes" indicates the pest has a reasonable likelihood of being associated with the harvested plant part(s).

Pest Name	Evidence of presence on citrus in NSW, QLD, WA[6]	Genus present in the United States?	Regulatory status[7]	Plant part(s) association[8]	On harvested plant part(s)?[9]	Remarks
Caedicia spp. (Orthoptera: Tettigoniidae	Smith et al., 1997	No (Arnett, 2000)	A	Leaves, Flowers, Fruit (Smith et al., 1997)	No	This pest is a mobile, external feeder on young fruit. It is highly unlikely to remain after harvest.
Cecidomyia sp. (Diptera: Cecidomyi-idae)	Smith et al., 1997	Yes (Arnett Jr., 2000; Gagne and Hibbard, 2008)	U	Flowers (Smith et al., 1997)	No	
Cercospora sp.	CABI, 2014b	Yes (Farr and Rossman, 2015)	U	Leaf (Farr and Rossman, 2015)	No	
Coprinus sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Root (Farr and Rossman, 2015)	No	
Dothiorella sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	A	Fruit, Stem (Farr and Rossman, 2015)	Yes	Reported only once in the literature (Australia, 2006). Exact species is unknown. Actionable pests may be present.
Epicoccum sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	N	Fruit, Stem (Farr and Rossman, 2015)	Yes	Reported only once in the literature (Australia, 2006). Exact species is unknown. Actionable pests may be present.
Fusicoccum sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Stem, Root (Farr and Rossman, 2015)	No	

Pest Name	**Evidence of presence on citrus in NSW, QLD, WA[6]**	**Genus present in the United States?**	**Regulatory status[7]**	**Plant part(s) association[8]**	**On harvested plant part(s)?[9]**	**Remarks**
Hysterograph-ium sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Fruit (Farr and Rossman, 2015)	Yes	Reported only once in the literature (Australia, 2006). Exact species is unknown. Actionable pests may be present.
Merulius sp.	Western Australia (Shivas, 1989)	Yes (Farr and Rossman, 2015)	U	Trunk rot (Shivas, 1989)	No	Not in export area.
Lophiotrema sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Fruit (Farr and Rossman, 2015)	Yes	Reported only once in the literature (Australia, 2006). Exact species is unknown. Actionable pests may be present.
Nectria sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	A	Fruit (Farr and Rossman, 2015)	Yes	Exact species is unknown. Actionable pests may be present.
Peniophora sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Wood (Farr and Rossman, 2015)	No	
Pestalotiopsis sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	A	Leaf (Farr and Rossman, 2015)	No	
Pholiota sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Wood rot (Farr and Rossman, 2015)	No	
Pleospora sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	A	Leaf (Farr and Rossman, 2015)	No	

Pest Name	**Evidence of presence on citrus in NSW, QLD, WA[6]**	**Genus present in the United States?**	**Regulatory status[7]**	**Plant part(s) association[8]**	**On harvested plant part(s)?[9]**	**Remarks**
Polyporus sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	U	Wood rot (Farr and Rossman, 2015)	No	
Sclerotinia sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	A	Die back (Farr and Rossman, 2015)	No	
Sphaceloma sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	A	Leaf (Farr and Rossman, 2015)	No	
Stenella sp.	Australia, 2006	No (Farr and Rossman, 2015)	A	Leaf (Farr and Rossman, 2015)	No	
Tarsonemus sp.	PestID, 2014	Yes (Lombard-ero et al., 2000; PestID, 2014)	U	Fruit (PestID, 2014)	Yes	Intercepted 16 times (from 1985 to 2012) in commercial or permit cargo from Australia on *Citrus* spp. fruit for consumption (PestID, 2014).
Verticillium sp.	Australia, 2006	Yes (Farr and Rossman, 2015)	A	Fruit (Farr and Rossman, 2015)	Yes	Exact species is unknown. Actionable pests may be present.

2.2. Pest list

In Table 2 we list the actionable pests associated with different species of citrus that occur in NSW, QLD, and WA on any host and are reported to be associated with species of citrus whether in the above mentioned areas or elsewhere in the world. Reported evidence (e.g., scientific literature, reports by local governments) for these plant pests often indicates the area of their distribution as NSW rather than specific areas of the Bourke and Narromine regions. Therefore, in this risk assessment, all citrus pests are reported from NSW. For each pest, we indicate 1) the part of the imported plant species with which the pest is generally associated, and 2) whether the pest has a reasonable likelihood of being associated, in viable form, with the commodity following harvesting from the field and prior to any post-harvest processing. If the actionable pest is associated with the plant part other than commodity (i.e., fruit), we usually list the evidence of the distribution as a single record (e.g., NSW, QLD or WA). For those pests that are likely to be associated with the commodity at the time of harvest, we list all relevant production areas for their distribution record. We developed this pest list based on the scientific literature, port-of-entry pest interception data from 1985 to 2014 (PestID, 2014), and information provided by the Government of Australia. Pests in shaded rows are pests identified for further evaluation, as we consider them reasonably likely to be associated with the harvested commodity. We summarize these pests in a separate table (Table 3).

Table 2. Actionable pests reported on *Citrus sinensis*, *C. limonia*, *C. meyeri*, *C. aurantiifolia*, *C. latifolia*, *C. paradisi*, and *C. reticulata* (in any country) and present in New South Wales (NSW), Queensland (QLD), and Western Australia (WA) (on any host).

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
ACARI: Eriophyidae					
Tegolophus australis (Keifer)	Smith et al., 1997 (NSW, QLD, WA); Australia, 2006 (NSW)	Type 1 (Smith et al., 1997)	Fruit, Leaves, Twigs (Smith et al., 1997)	Yes	
ACARI: Tetranychidae					
Aplonobia citri Meyer	Gutierrez, 1983 (NSW)	Type 1 (Frost and Bailey, (n.d.))	Bark (Gutierrez, 1983)	No	Most spider mites are leaf feeders, but some occur on fruit (Frost and Bailey, n.d.). Bark may be the only feeding site listed for this mite because eggs were found there. This species does not appear to be a major pest anywhere in the world (Vacante, 2010).

[10] Type 1 is a natural host, i.e., a plant species that becomes infested or infected by a plant pest in nature under natural conditions (e.g., natural, cultivated and/or unmanaged plants), and the plant pest is sustained on that plant species. Type 2 is a conditional host, i.e., a plant species that is only a host or a non-host under certain conditions. Type 3 is a natural non-host (pests for which the plant has this status are not included in the pest list). Type 4 refers to situations when the plant is not a food source but serves as a fomite, which is an object or material (including a harvested plant part) that may be contaminated with a pest and that could transmit that pest from one place to another.

[11] The plant part(s) listed are those for the plant species under analysis. If the information is extrapolated, such as from plant part association on other plant species, this is noted.

[12] "Yes" indicates simply that the pest has a reasonable likelihood of being associated with the harvested commodity. We assess the level of pest prevalence on the commodity as part of the likelihood of introduction assessment (section 3).

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Eutetranychus orientalis (Klein)	Smith et al., 1997 (NSW, QLD); CSIRO, 2004 (NSW, QLD, WA); Australia, 2006 (NSW)	Type 1 (Smith et al., 1997)	Fruit (damaged only by heavy populations (Smith et al., 1997), Leaves, Twigs (Australia, 2006; Smith et al., 1997; Vacante, 2010)	Yes	The mites are mainly a problem in QLD.
INSECTS					
Coleoptera: Bostrychidae					
Bostrychopsis jesuita (F.)	Hely et al., 1982 (NSW)	Type 1 (Smith et al., 1997)	Trees (Australia, 2006)	No	Pest of minor importance.
Coleoptera: Cerambycidae					
Acalolepta vastator (Newman) (= *Dihammus vastator* (Newman))	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Twigs, Branches, Trunk (Smith et al., 1997)	No	
Paradisterna plumifera (Pascoe)	Smith et al., 1997; Australia, 2006 (NSW)	Type 1 (Smith et al., 1997)	Branches, Trunk (Smith et al., 1997)	No	
Platyomopsis pulverulens (Boisduval)	Australia, 2006 (NSW)	Type 1 (Australia, 2006)	Trunk (Australia, 2006)	No	
Skeletodes tetrops Newman	Smith et al., 1997; Australia, 2006 (NSW)	Type 1 (Smith et al., 1997)	Twigs, Branches, Trunk (Smith et al., 1997)	No	
Strongylurus thoracicus (Pascoe)	Smith et al., 1997; Australia, 2006 (NSW)	Type 1 (Smith et al., 1997)	Twigs, Branches, Trunk (Smith et al., 1997)	No	
Uracanthus cryptophagus (Olliff)	Smith et al., 1997; Australia, 2006 (NSW)	Type 1 (Smith et al., 1997)	Twigs, Branches, Leaves (Smith et al., 1997)	No	
Coleoptera: Chrysomelidae					
Geloptera porosa Lea	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Twigs, Fruit (on rind) (Hely et al., 1982)	No	Occasional pest. Fruits with superficial external skin damage are highly unlikely to be harvested for export.

Pest Name	**Evidence of presence in NSW, QLD, WA**	**Host status**[10]	**Plant part(s) association**[11]	**On harvested plant part(s)?**[12]	**Remarks**
Monolepta australis (Jacoby)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Flowers, Leaves, Twigs, Fruit (Smith et al., 1997)	No	Only adults feed on citrus causing external damage to young fruit (Smith et al., 1997). Damaged fruit are highly unlikely to be harvested for export.
Coleoptera: Curculionidae					
Eutinophaea bicristata (Lea)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Roots, Leaves (Smith et al., 1997)	No	
Leptopius squalidus (Boheman)	Hely et al., 1982 (NSW)	Type 1 (Hely et al., 1982)	Roots (Hely et al., 1982); Leaves (Australia, 2001)	No	
Maleuterpes spinipes (Blackburn)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Fruit (rind), Roots (Smith et al., 1997)	No	Only adults feed on the rind of young fruits; larvae feed on roots (Smith et al., 1997). This is a pest of minor importance (Smith et al., 1997). Fruit with damaged rinds are highly unlikely to be harvested for export.
Orthorhinus cylindrirostris (F.)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Twigs, Branches, Trunk, Roots (Smith et al., 1997)	No	
Perperus lateralis (Boisduval)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Foliage (Smith et al., 1997)	No	
Coleoptera: Scarabaeidae					
Protaetia fusca (Herbst)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Flower (Smith et al., 1997); Branches, Trunk (Australia, 2006)	No	

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Diptera: Tephritidae					
Bactrocera frauenfeldi (Schiner)	CSIRO, 2004 (QLD)	Type 1 (Hancock et al., 2000)	Fruit (White and Elson-Harris, 1992)	No.	This fly is not known to be an economic pest of *Citrus* spp. or even associated with citrus in some areas of its distribution, such as in Australia (SPC, 2002; White and Elson-Harris, 1992; Smith et al., 1997). Therefore, it is highly unlikely to be associated with the areas of citrus production and with harvested commodity. See section 2.3 for more information
Bactrocera jarvisi (Tryon)	Australia, 2006 (NSW), CSIRO, 2004 (QLD, WA)	Type 2 (Smith et al., 1988)	Fruit (White and Elson-Harris, 1992)	No	Citrus is only an occasional host (Hancock et al., 2000; Smith et al., 1988). Not reported from citrus-producing areas (Smith et al., 1997). Hosts that are reportedly infested are deciduous fruits, mangoes, guavas, persimmons (NSWG I&I, n.d.). No interceptions in the existing citrus export program (PestID, 2014). See discussion in section 2.3.
Bactrocera neohumeralis (Hardy)	Australia, 2006 (NSW), CSIRO, 2004 (QLD)	Type 1 (NSWG I&I, n.d.)	Fruit (White and Elson-Harris, 1992)	Yes	
Bactrocera tryoni (Froggatt)	Australia, 2006 (NSW), Hancock et al., 2000 (QLD)	Type 1 (NSWG I&I, n.d.)	Fruit (White and Elson-Harris, 1992)	Yes	
Ceratitis capitata (Wiedemann)	CSIRO, 2004 NSWG I&I, n.d; Walker, 2006 (WA)	Type 1 (Liquido et al., 2013)	Fruit (White and Elson-Harris, 1992)	Yes	Occurs only in Western Australia.

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Dirioxa pornia (Walker)	Smith et al., 1997 (NSW), CSIRO, 2004 (QLD), Hancock et al., 2000 (WA)	Type 1 (Smith et al., 1997; White and Elson-Harris, 1992)	Fruit (White and Elson-Harris, 1992)	No	This is a secondary pest that usually infests ripe or overripe fruit, or fruit damaged by other flies or moths (Hely et al., 1982; Hancock et al., 2000; Smith et al., 1997; White and Elson-Harris, 1992). Any fruit that is split and damaged is highly likely to be discarded during harvest and packinghouse procedures (Australia, 2014; SACIDB, 2007).
Hemiptera: Aleyrodidae					
Bemisia afer Priesner & Hosny (= *B. hancocki* Corbett)	Australia, 2012b (NSW)	Type 1 (Ghahari et al, 2009)	Leaves (Munthali, 1992; PestID, 2014)	No	Restricted distribution in NSW (Australia, 2012b). Association with leaves is extrapolated from rearing on cassava (Munthali, 1992). It has not been intercepted on any fruit (PestID, 2014).
Bemisia giffardi (Kotinsky)	Australia, 2006; Mound and Halsey, 1978 (NSW)	Type 1 (Mound and Halsey, 1978)	Leaves (Australia, 2006)	No	Occurs in NSW (Mound and Halsey, 1978) but not at Bourke and Narromine (Australia, 2006).
Orchamoplatus citri (Takahashi)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves (Smith et al., 1997)	No	
Orchamoplatus mammaeferus (Quaintance and Baker)	Australia, 2012b (NSW)	Type 1 (Evans, 2007)	Leaves, Fruit (PestID, 2014)	No	This pest has been intercepted at U.S. ports-of-entry about 2,300 times, but only six times on fruit, and only one interception on *Citrus* sp. fruit (in baggage) (PestID, 2014). It is highly unlikely to be present on commercially grown commodity.

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Hemiptera: Aphididae					
Sinomegoura citricola (van der Goot)	Australia, 2012b (NSW)	Type 1 (Holman, 2009)	Leaves (based on mango; Australia, 2001)	No	Present in southern California (Halbert, 2009).
Toxoptera citricidus (Kirkaldy)	Australia, 2006; Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Flowers, Leaves, Twigs (Smith et al., 1997), Fruit (PestID, 2014)	No	Present in FL (Halbert and Brown, 2014). Most literature reports do not mention this aphid feeding on fruit. Sometimes, young fruit is mentioned (EPPO, 2006). It has been intercepted ten times on fruit, but only in baggage (from Puerto Rico) (PestID, 2014). It is highly unlikely to be present in commercially produced fruit.
Hemiptera: Cicadellidae					
Empoasca smithi Fletcher & Donaldson	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Fruit, Shoots (Smith et al., 1997)	No	It is highly unlikely to be present because eggs are laid on leaves, and the nymphs and adults that feed on the rind are very mobile and easily disturbed (Smith et al., 1997).
Hemiptera: Cicadidae					
Cytosoma schmeltzi Distant	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Twigs, Stems (Smith et al., 1997)	No	
Hemiptera: Coccidae					
Ceroplastes destructor (Newstead)	Ben-Dov et al., 2012; Smith et al., 1997 (NSW)	Type 1 (Ben-Dov et al., 2012; Smith et al., 1997)	Leaves (Smith et al., 1997)	No	
Ceroplastes rubens (Maskell)	Ben-Dov et al., 2012; Smith et al., 1997 (NSW)	Type 1 (Ben-Dov et al., 2012; Smith et al., 1997)	Leaves, Twigs (Smith et al., 1997)	No	Occurs in TX (Burke et al., 1994).

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Pulvinaria decorata Borchsenius[13]	Ben-Dov et al., 2012 (NSW)	Type 1 (Ben-Dov et al., 2012)	Leaves (USDA, 1922)	No	
Pulvinaria polygonata (Cockerell) (= *P. cellulosa* Green)	Smith et al., 1997 (NSW)	Type 1 (Ben-Dov et al., 2012; Smith et al., 1997)	Stem, Leaf (Smith et al., 1997; Rung et al., 2007)	No	
Hemiptera: Coreidae					
Mictis profana (F.)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaf (Smith et al., 1997)	No	
Hemiptera: Flatidae					
Colgar peracutum (Walker)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Fruit stalks, Twigs (Smith et al., 1997)	No	This pest is highly unlikely to remain with the fruit because it feeds mostly on leaves and twigs (Smith et al., 1997) and is very mobile. May make some feeding marks on fruit and cause sooty molds (Smith et al., 1997).
Colgaroides acuminata (Walker)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Fruit, Twigs (Smith et al., 1997)	No.	See remarks for *Colgar peracutum.*
Siphanta acuta (Walker)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Fruit, Twigs (Smith et al., 1997)	No.	See remarks for *Colgar peracutum.*
Siphanta hebes (Walker)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Fruit, Twigs (Smith et al., 1997)	No	See remarks for *Colgar peracutum.*
Hemiptera: Lygaeidae					
Nysius clevelandensis (Evans)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Twigs (Smith et al., 1997)	No	
Nysius vinitor Bergroth	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Twigs (Smith et al., 1997)	No	

[13] Original name was *Pulvinaria ornata* Froggatt (collected on lemon trees in Sydney, Australia).

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Hemiptera: Monophlebidae					
Icerya aegyptiaca (Douglas)	Australia, 2006; Waterhouse, 1993 (NSW)	Type 1 (Beardsley, 1966; Hill, 1983)	Leaves (Hill, 1983), Stems, Fruit (Australia, 2006; Waterhouse, 1993)	No	This organism does not commonly feed on fruit (Waterhouse, 1993). It was intercepted 11 times in permit or general cargo, but never on fruit (PestID, 2014). This pest is highly unlikely to be on fruit in commercially grown citrus.
Hemiptera: Pentatomidae					
Biprorulus bibax Breddin	Smith et al., 1997 (NSW)	Type 1 (Hely et al., 1982; Smith et al., 1997)	Fruit (Hely et al., 1982; Smith et al., 1997)	No.	Minor external pest in commercial orchards (Hely et al., 1982; Smith et al., 1997). This organism is a strong flyer that is highly unlikely to remain with the fruit through harvesting.
Hemiptera: Pseudococcidae					
Maconellicoccus hirsutus (Green)	Williams, 1985 (QLD, WA)	Type 1 (Garcia Morales et al. 2016)	Leaf (on Citrus) (Marsaro Júnior et al., 2016). Stem, leaf, bud, and fruit of many host plants (Hoy et al., 2018)	Yes	This pest occurs in the continental United States (e.g., California, Florida, Georgia, Louisiana, Texas) (Garcia Morales et al. 2016).
Rastrococcus truncatispinus Williams	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves (Smith et al., 1997)	No	
Hemiptera: Ricaniidae					
Scolypopa australis (Walker)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Twigs, Leaves, Fruit stalks (Smith et al., 1997)	No	This pest is highly unlikely to remain through harvest because both adults and nymphs hop or fly when disturbed (Smith et al., 1997).

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Hemiptera: Tessaratomidae					
Musgraveia sulciventris (Stål)	Hely et al., 1982; Smith et al., 1997 (NSW)	Type 1 (Hely et al., 1982; Smith et al., 1997)	Leaves, Flowers, Fruit (Hely et al., 1982; Smith et al., 1997)	No	This pest is not common in commercial citrus production (Smith et al., 1997). Not recorded in PestID (2014). It damages stalks of young fruit, causing them to drop (Hely et al., 1982; Smith et al., 1997). It is highly unlikely to remain on harvested fruit.
Hymenoptera: Eurytomidae					
Bruchophagus fellis (Girault)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Twigs (Smith et al., 1997)	No	
Lepidoptera: Carposinidae					
Coscinoptycha improbana Meyrick	CSIRO, 2004 (NSW, QLD)	Type 1 (Froud and Dentener, 2002)[14]	Fruit (Mille et al., 2012)	No	This moth is not reported as a pest in Australia (Hely et al., 1982; Smith et al., 1997; Dymock, 2012; Jamieson et al., 2004). It is highly unlikely to be present in the areas of commercial citrus for export. See section 2.3 for more information.

[14] Froud and Dentener (2002) suggested that mandarins and lemons are hosts (in New Zealand collections) while orange and grapefruit are "likely hosts as larvae were collected from these fruit (no adults emerged to confirm the identification)."

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Lepidoptera: Gracillariidae					
Phyllocnistis citrella Stainton	Smith et al., 1997; Robinson et al., 2001 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Twigs, Fruit (Smith et al., 1997)	No	Present in United States in TX, FL, AL, LA, CA, and HI (Heppner and Fasulo, 2013). All pest damage is on leaves of *Citrus* spp. (including the species assessed here) (Robinson et al., 2001, and 2010). Only intercepted once on fruit of *C. sinensis* in permit cargo (PestID, 2014). This pest is highly unlikely to be present on the commodity because fruit mining “is very uncommon” and such fruit will be culled (Smith et al., 1997).
Lepidoptera: Noctuidae					
Achaea janata (L.)	CSIRO, 2004 (NSW)	Type 1 (Ngampongsai et al., 2005)	Leaves (Mau et al., 2007)	No	Larvae feed on leaves, adults only pierce fruit for juices (Herbison-Evans and Crossley, 2012).
.*Eudocima fullonia* (Clerck) (= *Othreis fullonia* (Clerck)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Fruit (Smith et al., 1997)	No	Highly unlikely to be present on the commodity: larvae develop on native vines of the family Menispermaceae (Smith et al., 1997); adults are active flying insects, and only pierce the fruit to suck out its pulp, and feed only at night but rest outside of orchard by day (Smith et al., 1997).
Eudocima materna (L.)	CSIRO, 2004 (NSW)	Type 1 (Smith et al., 1997)	Fruit (Smith et al., 1997)	No.	See remarks for *Eudocima fullonia.*

Pest Name	**Evidence of presence in NSW, QLD, WA**	**Host status**[10]	**Plant part(s) association**[11]	**On harvested plant part(s)?**[12]	**Remarks**
Eudocima salaminia (Cramer)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Fruit (Smith et al., 1997)	No.	See remarks for *Eudocima fullonia.*
Helicoverpa armigera (Hubner)	Smith et al., 1997; Robinson et al., 2001 (NSW)	Type 1 (Smith et al., 1997)	Flowers, Fruit, Leaves (Smith et al., 1997)	No	Occasionally infests flowers and very young fruit; sometimes larger fruit are also damaged (Smith et al., 1997). Larvae feed on newly set fruit and make holes up to 40 mm in diameter, causing fruit drop. This pest has been intercepted 79 times on fruits of mostly field crops (i.e., eggplant, okra, pepper). It has been intercepted only twice “with *Citrus* sp.,” including once in permit cargo, but neither were from Australia (PestID, 2014). Thus, this pest is highly unlikely to be present on the harvested commodity.
Helicoverpa punctigera (Wallengren)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Flowers, Fruit, Leaves (Smith et al., 1997)	No	Larvae feed on newly set fruit producing holes up to 40 mm in diameter, causing fruit drop; sometimes larger fruit are also damaged (Smith et al., 1997). It has been intercepted twice; once in fruit of *Fragaria* sp., but never on *Citrus* (PestID, 2014). This pest is highly unlikely to be present on the harvested commodity.

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Spodoptera litura (F.)	CSIRO, 2004 (NSW)	Type 1 (Robinson et al., 2010)	Fruit, Leaves (Hill, 1983; Robinson et al., 2010) [based on fruit of commodities other than *Citrus* (Hill, 1983)]	No.	This pest produces obvious damage and rarely bores into the fruit (Schreiner, 2000). Intercepted about 700 times overall, but only once on *Citrus* on leaves in baggage (PestID, 2014). This pest is highly unlikely to be present on the harvested commodity.
Tiracola plagiata (Walker)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Flowers, Fruit, Leaves (Smith et al., 1997)	No	Larvae consume young fruit creating large holes (up to 30 mm diameter); "many damaged fruit drop" (Smith et al., 1997). Fruit damage is external. It has never been intercepted (PestID, 2014). This pest is highly unlikely to be associated with the harvested commodity.
Lepidoptera: Oecophoridae					
Psorosticha zizyphi (Stainton)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves (Smith et al., 1997)	No	
Lepidoptera: Papilionidae					
Papilio aegeus (Donovan) Macleay (= *Princeps aegeus* (Donovan))	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves (Smith et al., 1997)	No	
Papilio anactus W.S. Macleay (= *Eleppone anactus* (W.S. Macleay))	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves (Smith et al., 1997)	No	
Papilio demoleus (L.)	CABI, 2014b (NSW)	Type 1 (CABI, 2014b)	Leaves (CABI, 2014b)	No	

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Lepidoptera: Psychidae					
Hyalarcta huebneri (Westwood)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves (Smith et al., 1997)	No	
Metura elongatus (Saunders) Macleay (= *Oiketicus elongatus* (Saunders))	Hely et al., 1982 (NSW)	Type 1 (Robinson et al., 2010)	Leaves (Hely et al., 1982; Robinson et al., 2010)	No	
Lepidoptera: Pyralidae					
Conogethes punctiferalis (Guenee)	Smith et al., 1997 (NSW); CSIRO, 2004 (QLD)	Type 1 (Smith et al., 1997)	Fruit (Smith et al., 1997)	No	This pest is uncommon in citrus (Smith et al., 1997). Larvae make shallow excavation holes in the rind which are visible and cause fruit drop (Smith et al., 1997).
Cryptoblabes adoceta Turner	Smith et al., 1997 (NSW); CSIRO, 2004 (QLD)	Type 1 (Smith et al., 1997)	Fruit (Smith et al., 1997)	No	Larvae feed externally between touching fruit (Smith et al., 1997), sometimes causing fruit drop. Damage is shallow disfiguring gouging that is highly likely to be culled (Australia, 2014).
Cryptoblabes hemigypsa Turner	Horak, 1994 (NSW)	Type 1 (Australia, 2006)	Flower, Shoots, Fruit (young) (Horak, 1994)	No	Only one interception on citrus fruit (Australia, 2006), and none recorded by APHIS (PestID, 2014). This pest is highly unlikely to be present because larvae feed on flowers and buds (Herbison-Evans and Crossley, 2012), or on young nuts and shoots during periods of high infestations (Horak, 1994).

Pest Name	**Evidence of presence in NSW, QLD, WA**	**Host status**[10]	**Plant part(s) association**[11]	**On harvested plant part(s)?**[12]	**Remarks**
Lepidoptera: Tortricidae					
Adoxophyes templana (Pagenstecher)	CSIRO, 2004; Herbison-Evans and Crossley, 2012 (QLD)	Robinson et al., 2010[15]	Fruit, Leaves (Smith et al., 1997[16])	No	Little information is available about this species. Based on extrapolation from *Adoxophyes* spp., larvae feed on fruit rinds and fruit are likely to drop (Smith et al., 1997); *Adoxophyes orana* feeds on the surface of the fruit, for example (Hill, 1987). Larvae do not penetrate inside the fruit and damage is usually under a leaf webbed onto the fruit surface (CABI, 2014b). Large larvae are highly unlikely to remain on harvested fruit , and damaged fruit are likely to be culled.
Cryptophlebia ombrodelta (Lower)	CSIRO, 2004; Zhang, 1994 (NSW)	Type 1 (Gilligan and Epstein, 2014; Robinson et al., 2010)	Fruit (Gilligan and Epstein, 2014; Robinson et al., 2001)[17]	No	While this pest can impact macadamia nut in HI (Jones, 1994), it is not a pest of citrus (e.g., Hely et al., 1982; Smith et al., 1997; Zhang, 1994). It has never been intercepted on citrus from any country, even in baggage (PestID, 2014). Thus, it is highly unlikely to be present on the harvested commodity.
Epiphyas postvittana (Walker)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Flowers, Leaves, Fruit (Smith et al., 1997)	Yes	See section 2.3 for additional information.

[15] Host is listed as "*Citrus*" without identifying any specific species
[16] Based on *Adoxophyes* sp.
[17] Robinson et al. (2010) report *Citrus sinensis* as a host but do not mention the plant part. Robinson et al. (2001) indicate this insect on fruit of *Citrus* without reporting the host species and type of fruit damage. We extrapolated that this pest can be associated with fruit of other citrus species based on Robinson et al. (2001, 2010).

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Isotenes miserana (Walker)	Smith et al., 1997 (NSW); CSIRO, 2004 (QLD)	Type 1 (Hely et al., 1982)	Leaves, Flowers, Fruit (Common, 1990; Hely et al., 1982; Smith et al., 1997)	No	Larvae bore visible holes through the rind, particularly between touching fruit or where a leaf touches fruit (Smith et al., 1997; Hely et al., 1982). Damaged fruit are highly likely to be culled. More information is found in the section 2.3.
Lepidoptera: Yponomeutidae					
Prays nephelomina Meyrick	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Flower, Fruit buds (Smith et al., 1997)	No	This pest is highly unlikely to be present because larvae penetrate very young fruit, preventing their development (Smith et al., 1997).
Prays parilis (Turner)	Hely et al., 1982; Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Flower, Fruit buds (Hely et al., 1982; Smith et al., 1997)	No	See remarks for *Prays nephelomina.*
Orthoptera: Acrididae					
Austracris guttulosa (Walker)	Hely et al., 1982; Smith et al., 1997 (NSW)	Type 1 (Hely et al., 1982; Smith et al., 1997)	Leaves (Hely et al., 1982; Smith et al., 1997)	No	
Chortoicetes terminifera (Walker)	Hely et al., 1982 (NSW)	Type 1 (Hely et al., 1982; Smith et al., 1997)	Leaves (Hely et al., 1982)	No	
Phaulacridium vittatum (Sjöstedt)	Hely et al., 1982 (NSW)	Type 1 (Australia, 2006; Hely et al., 1982). Pest is very polyphagous (Hely et al., 1982).	Leaves, Fruit (Hely et al., 1982)	No	This pest is highly unlikely to remain with the commodity through harvest because it is a very mobile, external feeder.
Valanga irregularis (Walker)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Fruit (Hely et al., 1982; Smith et al., 1997)	No	See remarks for *Phaulacridium vittatum.*

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Orthoptera: Tettigoniidae					
Caedicia simplex (= *C. olivacea* (Brunner von Wattenwyl) (Walker))	Hely et al., 1982 (NSW)	Type 1 (Hely et al., 1982)	Fruit, Leaves (Hely et al., 1982)	No	This pest is highly unlikely to remain with the commodity through harvest because the nymphs are mobile and feed externally on the rind (Hely et al., 1982).
Caedicia strenua (Walker)	Hely et al., 1982 (NSW)	Type 1 (Hely et al., 1982)	Fruit, Leaves (Hely et al., 1982), Flowers (Smith et al., 1997)	No	See remarks for *Caedicia simplex.*
Ephippityha trigintiduoguttata (Serville)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Fruit, Leaves, Flowers (Smith et al., 1997)	No	See remarks for *Caedicia simplex.*
Thysanoptera: Thripidae					
Pezothrips kellyanus (Bagnall) (= *Megalurothrips kellyanus* (Bagnall))	Australia, 2006; EPPO, 2004 (NSW); CSIRO, 2004 (QLD, WA)	Type 1 (Vassiliou, 2010)	Flowers, Fruit (Vassiliou, 2010)	Yes	Mature fruit damaged by this thrips have rind discoloration (Vassiliou, 2010). This pest has been intercepted on citrus fruit from Australia three times (PestID, 2014).
Pseudanaphothrips achaetus (Bagnall)	Mound and Tree, 2012 (NSW)	Type 1 (Australia, 2006)	Flowers (Mound and Tree, 2012; PestID, 2014), Leaves (Australia, 2006)	No	Present in California (Hoddle et al., 2004).

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Scirtothrips albomaculatus (Bianchi)	Smith et al., 1997 (NSW); Hoddle and Mound, 2003 (QLD)	Type 1 (Smith et al., 1997)	Fruit, Leaves, Flowers (Smith et al., 1997)	No	Feeds on young small fruit (Smith et al. 1997). Although it prefers protected areas under calyx and between touching fruit, it disfigures fruit, causes scarring and scurfing. Such fruit are highly likely to be culled during harvest (Australia, 2014). This pest has never been intercepted on citrus fruit from Australia (PestID, 2014).
Scirtothrips aurantii Faure	CSIRO, 2004; Mound, 2005 (QLD)	Type 1 (CABI, 2014b; Mound, 2005)	Leaves, Fruit (CABI, 2014b)	No	This pest is exotic for Australia, has limited distribution, and is regulated (CSIRO, 2004; Mound, 2005). As such, it is unlikely to be present in the area of commercial citrus production. This pest has not been intercepted on fruit of any commodity (PestID, 2014).
Scirtothrips dorsalis (Hood)	Smith et al., 1997 (NSW); CSIRO, 2004 (QLD)	Type 1 (Smith et al., 1997)	Fruit, Leaves, Flowers (Smith et al., 1997)	No	See remarks for *S. albomaculatus*. This pest has never been intercepted on citrus fruit from Australia (PestID, 2014). Occurs in FL and TX (Kumar et al., 2014).

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Thrips imaginis (Bagnall)	Smith et al., 1997 (NSW)	Type 1 (Smith et al., 1997)	Leaves, Flowers (Smith et al., 1997), Root, Stem (PestID, 2014)	No	Although this pest was intercepted once on citrus fruit from Australia (PestID, 2014), that is insufficient evidence to justify its association with fruit. There are no literature records of this pest feeding on fruit.
Thrips setipennis (Bagnall)	Mound and Masumoto, 2005 (NSW)	Type 1 (Australia, 2006)	Flowers (Mound and Masumoto, 2005)	No	
MOLLUSCA					
Helicoidea: Hygromiidae					
Microxeromagna lowei (Potiez & Michaud) (=Syn. M. *armillata*)	Hopkins, n.d. (NSW)	Type 1 (PestID, 2014)	Fruit (PestID, 2014)	No	This pest is highly unlikely to be associated with citrus fruit during harvest. See discussion in section 2.3.
Microxeromagna vestita (Rambur)	Lush, 1999; Hopkins, n.d. (NSW)	Type 1 (Lush, 1999)	Trunk, Fruit (Lush, 1999; PestID, 2014)	No	This pest is highly unlikely to be associated with citrus fruit during harvest. See discussion in section 2.3.
FUNGI					
Armillaria luteobubalina Watling & Kile	Plant Health Australia, 2006; CABI, 2014b; Farr and Rossman, 2015; Whiteside et al., 1988 (NSW)	Type 1 (Plant Health Australia, 2006; CABI, 2014b; Whiteside et al., 1988)	Root (Plant Health Australia, 2006; CABI, 2014b; Whiteside et al., 1988)	No	
Ascochyta corticola McAlpine	Farr and Rossman, 2015; CABI, 2014a (NSW)	Type 1 (CABI, 2014a)	Stem (CABI, 2014a)	No	
Athelia rolfsii (*Sclerotium rot*)	CABI, 2014b (QLD)	Type I (CABI, 2014a)	Leaf, Stem, Root (CABI, 2014a)	No	
Botryosphaeria ribis	CABI, 2014b (NSW, QLD)	Type I (CABI, 2014b)	Leaf, Fruit, Stem (CABI, 2014b)	No	

Pest Name	**Evidence of presence in NSW, QLD, WA**	**Host status**[10]	**Plant part(s) association**[11]	**On harvested plant part(s)?**[12]	**Remarks**
Capnodium salicinum Mont. (Anamorph: *Fumagospora capnodioides* G. Arnaud)	CABI, 2014b; Farr and Rossman, 2015 (NSW)	Type 1 (CABI, 2014b)	Leaves, twigs (CABI, 2014b)	No	
Ceratocystis fimbriata	CABI, 2014b (NSW, QLD)	Type 1 (CABI, 2014b)	Leaf, Fruit, Stem, Root (CABI, 2014b)	No	
Coniothyrium cervinum McAlpine	Australia, 2006 (NSW)	Type 1 (Australia, 2006; Farr and Rossman, 2015)	Leaf (Australia, 2006; Farr and Rossman, 2015)	No	
Coniothyrium fusco-atrum Penz.	da Costa and da Camara, 1953; Nakhutsrishvili, 1986; Penzig, 1882; Australia, 2006; Farr and Rossman, 2015	Type 1 (da Costa and da Camara, 1953; Nakhutsrishvili, 1986; Penzig, 1882; Australia, 2006; Farr and Rossman, 2015),	Leaves (Nakhutsrishvili, 1986), Branches (Penzig, 1882), Fruit (Australia, 2006)	No	See discussion in 2.3
Corticium salmonicolor Berk & Broome	Australia, 2006; Farr and Rossman, 2015 (NSW)	Type 1 (Australia, 2006; Farr and Rossman, 2015)	Stem (Australia, 2006; Farr and Rossman, 2015)	No	
Corynespora citricola M.B. Ellis	Australia, 2006; Farr and Rossman, 2015 (NSW)	Type 1 (Ellis, 1971)	Leaf (Ellis, 1971)	No	
Curvularia lunata (Wakker) Boedijn	Australia, 2006; Farr and Rossman, 2015 (NSW)	Type 1 (Australia, 2006; Farr and Rossman, 2015)	Leaf (Australia, 2006; Farr and Rossman, 2015)	No	
Diplodia destruens McAlpine	Farr and Rossman, 2015; CABI, 2014a (NSW)	Type 1 (CABI, 2014a)	Leaves (CABI, 2014a)	No	

Pest Name	**Evidence of presence in NSW, QLD, WA**	**Host status[10]**	**Plant part(s) association[11]**	**On harvested plant part(s)?[12]**	**Remarks**
Erythricium salmonicolor (Berk. & Broome) Jülich) (= *Phanero-chaete salmonicolor* (Berk. & Broome) Jülich 1975)	Farr and Rossman, 2015; Hyde and Alcorn, 1993 (NSW)	Type 1 (Hyde and Alcorn, 1993)	Leaf spot (Hyde and Alcorn, 1993)	No	
Hapalopilus placodes (Kalchbr.) N.Walters & DaCosta	Australia, 2006 (only one record) (NSW)	Type 1 (Australia, 2006)	Stem (Australia, 2006)	No	
Microdiplodia heteroclita Gonz. Frag.-	Australia, 2006 (NSW)	Type 1 (Australia, 2006)	Leaf (Australia, 2006)	No	
Neofusicoccum parvum (Pennycook & Samuels) Crous, Slippers & A.J.L. Phillips	Australia, 2006; Farr and Rossman, 2015 (NSW)	Type 1 (Australia, 2006)	Stem (Australia, 2006)	No	
Perenniporia ochroleuca (Berk.) Ryvarden [syn: *Fomitopsis ochroleuca* (Berk.) Imazeki]	Australia, 2006 (NSW)	Type 1 (Australia, 2006)	Stem and root (Australia, 2006)	No	
Phoma macrophoma McAlpine	Farr and Rossman, 2015; GBIF, 2012; CABI, 2014a (NSW)	Type 1 (CABI, 2014a)	Branches (CABI, 2014a)	No	
Phyllosticta arethusa	Farr and Rossman, 2015; CABI, 2014a (NSW)	Type 1 (CABI, 2014a)	Leaves (CABI, 2014a)	No	

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
Phyllosticta citricarpa (Kiely) [Anamorph: *Guignardia citricarpa* McAlpine] (= *P. citrícola*; *Phoma citricarpa*)	EPPO, 1997, 2006a; Farr and Rossman, 2015 (NSW)	Type 1 (EPPO, 1997; Sutton and Waterston, 1964)	Fruit (EPPO, 1997; Sutton and Waterston, 1964)	Yes	Present in the United States (FL) (USDA APHIS, 2010a; USDA APHIS, 2011). Under official control, and regulated under Federal Order DA-2012-09 (USDA APHIS, 2012). Not expected to follow the pathway. See discussion in section 2.3
Phyllosticta scabiosa McAlpine	Australia, 2006 (NSW)	Type 1 (Australia, 2006)	Stem (Australia, 2006)	No	
Pleospora disrupta	Farr and Rossman, 2015; McAlpine, 1899 (NSW)	Type 1 (McAlpine, 1899)	Leaves (McAlpine, 1899)	No	
Pycnoporus coccineus (Fr.) Bondartsev & Singer	Australia, 2006; Farr and Rossman, 2015 (NSW)	Type 1 (Australia, 2006; Farr and Rossman, 2015)	Wood rot (Australia, 2006; Farr and Rossman, 2015)	No	
Pyrenochaeta destructive	Farr and Rossman, 2015; Watson, 1971 (NSW)	Type 1 (Watson, 1971)	Leaf spots (Watson, 1971)	No	
Pythium spinosum Sawada (= *Globisporangium spinosum* (Sawada) Uzuhashi, Tojo & Kakish.))	Farr and Rossman, 2015 (NSW)	Type 1 (Farr and Rossman, 2015)	Downy mildew, Blight, damping off, root and crown rots (Farr and Rossman, 2015)	No	
Sphaceloma fawcettii var. *scabiosa* (McAlpine & Tryon) Jenkins	Australia, 2006; Farr and Rossman, 2015 (NSW)	Type 1 (Australia, 2006; Farr and Rossman, 2015)	Fruit, Stem (Australia, 2006; Farr and Rossman, 2015)	Yes	This pathogen is only important in lemons; other citrus species are less susceptible (EPPO/CABI, 1997).
Ustulina deusta (Hoffm. : Fr.) Lind.	Simmonds, 1966; Farr and Rossman, 2015 (NSW)	Type 1 (Simmonds, 1966)	Root and trunk rot (Simmonds, 1966)	No	

Pest Name	Evidence of presence in NSW, QLD, WA	Host status[10]	Plant part(s) association[11]	On harvested plant part(s)?[12]	Remarks
VIRUS					
Citrus tristeza virus	Barkley et al., 2012 (QLD)	Type 1 (Australia, 2006)	Leaf, stem (Australia, 2006; CABI, 2014b; Fraser and Broadbent, 1979)	No	

2.3. Notes on pests identified in the pest list

Bactrocera frauenfeldi. This pest is native to the Pacific region. In Australia, it is established in the Torres Strait islands and northeast QLD, as far south as Townsville (Hancock et al., 2000). In QLD, production of citrus for export to the United States will be inland, within the Central Burnett region, which encompasses Gayndah and Mundubbera, the Central Highlands (Emerald) and the Wide Bay hinterland (the districts of Maryborough, Gin Gin, and Childers) (Australia, 2011b; Australia, 2014). These areas are located significantly south from the presently known distribution of *B. frauenfeldi*.

***Bactrocera jarvisi*.** *Citrus* is a conditional host of *B. jarvisi*. Both wild and cultivated hosts of this fly are considered to be within plant families Lecythidaceae (Barringtoniaceae), Myrtaceae, and Rosaceae (Fitt, 1986). This fly usually attacks fruit of any cultivated plant only outside of the fruiting season of its preferred host, *Planchonia careya* (Lecythidaceae) (Smith et al., 1988). Data from the Northern Territory suggest that even during the season when fruits of *P. careya* were limited, larval emergence occurred from each sampled fruit of this host, while for citrus, one fly emerged out of 26 grapefruits (*C. paradisi*) and no flies emerged from any of eight sampled oranges (*C. sinensis*) (Smith et al., 1988). Sources such as NSWG I&I (n.d.) and Drew (1989)[18] do not list *Citrus* as a host of this fly at all. While the fly was reported as a pest of orange in home gardens in Northern Territory (Smith, 1997), there were no such reports from the commercial citrus production. The pest was never intercepted in citrus fruit from existing export areas in Australia (PestID, 2014).

***Coniothyrium fusco-atrum*.** This pathogen is considered a quarantine pest for the United States. *Coniothyrium fusco-atrum* was first described by Penzing in 1882 from dry twigs of *Citrus aurantii*; later da Costa (1953) mentioned it infecting lemons in Portugal and Nakhutsrishvili (1986) reported this pathogen infecting citrus leaves in Georgia. No additional description or information was provided. There are no reports of *C. fusco-atrum* infecting citrus in any Australian territory in the past 98 years (McAlpine 1899; NSW-AU, 2015; Hoffman et al., 2008; Queensland-AU, 2003). There is no evidence that *C. fuscoatrum* will be introduced into the United States as the fungus is not present in Australia.

[18]Also see White and Elson-Harris (1992) on host specialization in *B. jarvisi* fruit flies.

This fungus was detected 100 years ago on a sweet orange shoot and on a lemon fruit (two known records). However, this has not been substantiated by any further detections or records anywhere in Australia. According to an official with Australia's Plant Division-Plant Biosecurity the two records of this fungus both reported in Australian Plant Disease Database (APPD) (APPD, 2006) were single detections in NSW metropolitan area (Sydney) in 1917 and 1918. One of the APPD records was on lemon fruit (*Citrus lemon*) and the other was on sweet orange (*Citrus sinensis*) associated with the shoot. These records are old, no details on the detection or confirmation are available now (Saverimuttu, 2015). There is no other record of this fungus associated with citrus or on any other crops in Australia. This fungal species has never been found during export inspections by the Australian regulatory officials despite years of trade of various citrus fruit varieties to different destinations, including the USA. In addition, it has never been detected by Australian State authorities as part of their internal domestic movement controls. Furthermore, this fungus has never been detected on consignments of Australian citrus on arrival in overseas destinations (Saverimuttu, 2015). Given the absence of new records for presence of this fungus in Australia in the literature for nearly 100 years and absence of any observations of any damage to the citrus industry combined with no records of any economic impact known, it is unlikely this fungus occurs on citrus in Australia (Saverimuttu, 2015).

Coscinoptycha improbana. "Due to its non-pest status in Australia, minimal research has been carried out on guava moth and little is known of its host plants and life cycle" (Jamieson et al., 2004). In Australia, the larvae have been found boring into the fruits of native and exotic species, including citrus (Common, 1990); however, this moth is not mentioned as a pest, particularly a pest of citrus (Hely et al., 1982; Smith et al., 1997; Dymock, 2012). It is reported to cause seasonal damages to ripening guava fruit (Hely et al., 1982). In the Australian National Insect Collection (ANIC), material of *C. improbana* is mostly from rain forest habitats from the Atherton region to the Bateman's Bay area (Dymock, 2012). This moth is very unlikely to be present in the areas of the commercial citrus production in Australia infesting the fruit and therefore will not be associated with the harvested commodity.

Dirioxa pornia**.** As noted above, this fly usually infests ripe or overripe fruit, or fruit damaged by other flies or moths (Hely et al., 1982; Hancock et al., 2000; Smith et al., 1997; White and Elson-Harris, 1992; SACIDB, 2007). This pest has been intercepted twice in permit cargo of *Citrus* from Australia, indicating that this could be an occasional, if unlikely pathway (PestID, 2014).

Epiphyas postvittana. Studies of the development of *E. postvittana* on leaves and fruit of several varieties of orange trees indicated very low larval survival rate (<20%) compared with that on non-citrus hosts (Mo et al, 2006) and citrus is considered a suboptimal host, especially when populations of *E. postvittana* are low (APHIS, 2013). Population pressure is sometimes high in Australia, however, and larvae suspected to be *E. postvittana* have been intercepted from Australia on permit cargo of citrus (Barr, 2014). Among the four types of orange tissues, young orange leaves and fruit afforded larvae higher survival rates than mature orange leaves and fruit. The damaged young fruit, however, bears halo damage around the calyx and is very likely to be eliminated during the harvest process. Excessive damage of young fruit or borrowing of larvae into mature fruit causes fruit drop (Smith et al., 1997). Under normal population conditions and strict adherence to good harvest and packing procedures, *E. postvittana* is unlikely to follow the pathway of commercial fruit.

Isotenes miserana. Despite its wide distribution in coastal areas of QLD, this is a minor, sporadic pest (Smith et al., 1997; DAFF QLD, 2012). Evidence of injury is most common in maturing or ripe fruit when premature color development points out the fruit infestation (Hely et al., 1982). Fruit damage consists of holes through the rind to the pulp and eaten out cavities between touching fruit growing in clusters and where leaves touch fruit. On young green fruit, gum may exude from the wounds. The damage can cause premature fruit drop, by which the pest's presence is often monitored (Smith et al., 1997). The examination of the fallen fruit often reveals a small hole in the rind and beneath it a shallow excavation into the flesh. If no such damage is apparent, there will be a pinhole in the calyx area; in navel oranges, the entry could be through the navel (Hely et al., 1982). This pest is not listed in PestID and was never intercepted (PestID, 2014).

Microxeromagna lowei* and *M. vestita. Since 1996, these pests were intercepted several times both on or with citrus fruit, as well as on containers from Australia (PestID, 2014). These snails are not expected to be associated with the fruit at the time of harvest and are not pests specific to citrus production. The snails, however, are opportunistic pests and their presence in the pathway of commercially produced citrus indicates certain shortcomings with the storage of either already packed fruit or with the packing material itself. There are several snail-controlling procedures at different points in the pathway, including those in the field and the packinghouse (Australia, 2014). Therefore, any snail interceptions should be considered accidental and are subject to verification of the existing risk management measures.

Phyllosticta citricarpa. The pathogen *Phyllosticta citricarpa* (the causal agent of citrus black spot) has a limited distribution in the United States and is considered quarantine pest. This pest has been analyzed by USDA-APHIS in stand-alone pest risk assessments examining the likelihood of its spread through the movement of commercial citrus fruit intended for consumption (USDA-APHIS, 2010b). The conclusion of this risk assessment is that fruit is not epidemiologically significant as a pathway for the introduction of *P. citricarpa* or establishment of CBS disease. However, to reduce any lingering uncertainty USDA APHIS determined that a fungicide treatment that eliminates any spores present on the fruit at the time of packinghouse processing provides an appropriate additional safeguard for *P. citricarpa*. Based on the above conclusions this disease was not further analyzed, however additional import requirements will be specified in the risk management document as a condition of entry for citrus fruit from Australia to the continental Unites States.

Scirtothrips aurantii. This is a regulated pest of limited distribution in Australia. It distorts fruit and causes brown frass markings; grey or black markings on fruits often form a ring around the apex (CABI, 2014b). If this pest is accidentally introduced to areas of commercial citrus production, it would produce visible external damage on the fruit. During harvest or packinghouse activities, any damaged or distorted fruit is highly likely to be discarded (Australia, 2014).

2.4. Pests selected for further analysis

We identified pests for further analysis (Table 3). All of these organisms are actionable pests for the United States and have a reasonable likelihood of being associated with the commodity plant part(s) at the time of harvest and remaining with the commodity, in viable form, throughout the harvesting process.

Table 3. Pests selected for further analysis

Pest Type	Taxonomy	Scientific Name
Arthropod	Acari: Eriophyidae	*Tegolophus australis*
	Acari: Tetranychidae	*Eutetranychus orientalis*
	Diptera: Tephritidae	*Bactrocera neohumeralis*
		Bactrocera tryoni
		Ceratitis capitata
	Hemiptera: Pseudococcidae	*Maconellicoccus hirsutus*
	Thysanoptera: Thripidae	*Pezothrips kellyanus*
Fungus		*Sphaceloma fawcettii* var. *scabiosa*

3. Assessing Pest Risk Potential

3.1. Introduction

For each pest selected for further analysis, we estimate its overall pest risk potential. Risk is described by the likelihood of an adverse event, the magnitude of the consequences, and uncertainty. In general, we first determine for each pest if there is an endangered area within the import area. However, in this risk assessment, the available information led to the assumption that five of the eight pests under analysis are likely to have a negligible likelihood of introduction (Australia, 2006, 2011a, 2011b, 2011c, 2012a, 2012b, 2014; PestID, 2014). Therefore, we did not need a detailed assessment of the endangered areas for these pests. The overall risk of each pest is determined by two separate components: 1) the likelihood of its introduction into the endangered area on the imported commodity (i.e., the likelihood of an adverse event), and 2) the consequences of its introduction (i.e., the magnitude of the consequences). In general, we assess both of these components for each pest. However, if we determine that the risk of either of these components is negligible, it is not necessary to assess the other, as the overall pest risk potential would be negligible regardless of the result of the second component. In other words, if we determine that the introduction of a pest is unlikely to have unacceptable consequences, we do not assess its likelihood of being introduced. Likewise, if we determine there is negligible likelihood of a pest being introduced, we do not assess its consequences of introduction.

The likelihood and consequences of introduction are assessed using different approaches. For the consequences of introduction, we determine if the pest meets the threshold (Yes/No) of likely causing unacceptable consequences of introduction. This determination is based on estimating the potential consequences of introduction in terms of physical losses (rather than monetary losses). The threshold is based on a proportion of damage rather than an absolute value or

amount. Pests that are likely to impact at least 10 percent of the production of one or more hosts are deemed "threshold pests."
For likelihood of introduction, which is based on the likelihoods of entry and establishment, we qualitatively assess risk using the ratings Negligible, Low, Medium, and High. The risk factors comprising the model for likelihood of introduction are interdependent and, therefore, the model is multiplicative rather than additive. Thus, if any one risk factor is rated as Negligible, then the overall likelihood will be Negligible. For the overall likelihood of introduction risk rating, we define the different categories as follows:

High: Pest introduction is highly likely to occur.

Medium: Pest introduction is possible, but for that to happen, the exact combination of required events needs to occur.

Low: Pest introduction is unlikely to occur because one or more of the required events are unlikely to happen, or the full combination of required events is unlikely to align properly in time and space.

Negligible: Pest introduction is highly unlikely to occur given the exact combination of events required for successful introduction.

3.2. Assessment results

3.2.1. *Bactrocera neohumeralis*

We determined the overall likelihood of introduction to be Medium. We present the results of this assessment in the table below.

We determined that the establishment of *B. neohumeralis* in the continental United States is likely to cause unacceptable impacts. We also present the results of this assessment in a table below.

Determination of the portion of the United States endangered by *B. neohumeralis*

Climatic suitability	*Bactrocera neohumeralis* is native to Australia. It occurs in northern NSW, as well as in inland localities of Emerald and Clermont and in isolated areas west of Cape York Peninsula, QLD (Hancock et al., 2000; SPC, 2013). *Bactrocera neohumeralis* is a sibling species of *B. tryoni* with its geographic distribution being wholly contained within the greater geographic distribution of *B. tryoni* (Pike et al., 2003; PERAL/CIPM, 2008 - Appendix 2). This fly is more prevalent in northern wet tropical areas than the cooler southern areas of Queensland and New South Wales (Drew et al., 1982; Royer and Hancock, 2012). Based on this distribution, which corresponds to Plant Hardiness Zones 9-13 (Magarey et al., 2008), we estimate that *B. neohumeralis* could become established in the wet areas of the continental United States within Plant Hardiness Zones 9-11 (Magarey et al., 2008) where its hosts are available.
Potential hosts at risk in PRA Area	*Bactrocera neohumeralis* has been recorded to attack multiple species in multiple families, including Anacardiaceae (*Anacardium occidentale*, *Bouea macrophylla*, *Mangifera indica*, *Pleiogynium timorense*, *Spondias* spp.); Annonaceae (*Annona* spp., *Cananga*

	odorata, *Miliusa horsfieldi*, *Rauwenhoffia leichhardtii*, *Rollinia deliciosa*); Apocynaceae (*Alyxia ruscifolia*); Arecaceae (*Normanbya normanbyi*, *Phoenix dactylifera*); Basellaceae (*Basella* sp.); Cactaceae (*Opuntia* sp.); Capparaceae (*Capparis lucida*, *Crateva religiosa*); Caricaceae (*Carica papaya*); Celastraceae (*Cassine australis*); Chrysobalanaceae (*Chrysobalanus icaco*); Clusiaceae (*Calophyllum inophyllum*, *Garcinia mangostana*); Combretaceae (*Terminalia* spp.); Davidsoniaceae (*Davidsonia pruriens*); Elaeocarpaceae (*Elaeocarpus bancroftii*, *Muntingia calabura*); Euphorbiaceae (*Drypetes lasiogyna*); Flacourtiaceae (*Dovyalis hebecarpa*, *Flacourtia* spp.); Hippocrateaceae (*Salacia chinensis*); Lauraceae (*Cryptocarya erythroxylon*, *Endiandra* spp., *Persea americana*); Leeaceae (*Leea indica*); Lecythidaceae (*Barringtonia calyptrata*); Malpighiaceae (*Malpighia emarginata*); Melastomataceae (*Melastoma affine*); Meliaceae (*Aglaia sapindina*, *Sandoricum indicum*); Musaceae (*Musa* spp.); Moraceae (*Morus nigra*, *Ficus* spp.); Myrtaceae (*Psidium* spp., *Syzgium aqueum*); Olacaceae (*Ximenia americana*); Passifloraceae (*Passiflora* spp.); Rosaceae (*Malus domestica*, *Pyrus* spp., *Prunus* spp., *Eriobotrya japonica*, *Rubus* spp., *Fragaria* spp.); Rubiaceae (*Coffea arabica*); Rutaceae (*Citrus* spp., *Fortunella japonica*, *Casimiroa edulis*); Santalaceae (*Castanospora alphandii*, *Ganophyllum falcatum*); Sapotaceae (*Chrysophyllum cainito*, *Manilkara zapota*, *Niemeyera chartacea*, *Pouteria* spp.); Solanaceae (*Solanum* spp; *Solanum lycopersicum; Cyphomandra betacea*); and Vitaceae (*Vitis labrusca*) (Hancock et al., 2000; White and Elson-Harris, 1992; CABI, 2014b).
Economically important hosts at risk[a]	In the United States, potential economic hosts of *Bactrocera neohumeralis* include avocado, apple, apricot, bell peppers, grapefruit, guava, lemon, mango, nectarine, orange, peach, pear, plum, tangerine, tomato, and strawberry (Hancock et al 2000).
Pest potential on economically important hosts at risk	In Australia, *B. neohumeralis* is considered a major pest of most commercial food crops (Drew et al., 1982). While there are no specific data for crop losses from *B. neohumeralis*, other *Bactrocera* species have been known to damage up to 100 percent of unprotected fruit (CABI, 2014b). Its presence in the United States, even as a temporary adventive population, could lead to severe export restrictions of host commodities to markets outside of this pest’s known distribution (Drew et al., 1982). The fly can also cause damage to threatened and endangered species, i.e., *Prunus geniculata* (in Florida) and *Opuntia treleasei* (in California). (USFW, 2014).
Defined Endangered Area	Rainforest and areas where suitable hosts are cultivated (CABI, 2014b). Portions of the continental United States that are climatically suitable for establishment of *B. neohumeralis* include Florida, southern Louisiana, southern Texas, and portions of California, Oregon, and Washington (within Plant Hardiness Zones 9-11) with the significant

	rainfall (about 760 mm) that would be similar to its native areas of distribution (CABI, 2014b). One or more hosts grow in these areas.

[a] As defined by ISPM No. 11, supplement 2, "economically" important hosts refers to both commercial and non-market (environmental) plants (IPPC, 2013).

Assessment of the likelihood of introduction of *Bactrocera neohumeralis* into the endangered area via the importation of *Citrus* spp. from inland Queensland, Western Australia and the Bourke and Narromine districts in New South Wales

Risk Element	Risk Rating	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty (and other notes as necessary)
Likelihood of Entry			
Risk Element A1: Pest prevalence on the harvested commodity (= the baseline rating for entry)	Low	MC	*Bactrocera neohumeralis* is native to Australia, but not distributed across the country. It occurs in northern NSW, as well as in inland localities of Emerald and Clermont, and in isolated areas west of Cape York Peninsula, QLD (Hancock et al., 2000; SPC, 2013). *Bactrocera neohumeralis* is a sibling species of *B. tryoni* with its geographic distribution being wholly contained within the greater one of *B. tryoni* (Pike et al., 2003; PERAL/CIPM, 2008 - Appendix 2). *Bactrocera neohumeralis* occurs as significant lower levels than *B. tryoni* (Osborne et al., 1997). Evidence indicates that Australian growers regularly survey for the presence of fruit flies of economic importance, and employee management strategies to suppress populations (NFFS, 2010). Therefore, that the prevalence of *B. neohumeralis* in the field is Low.
Risk Element A2: Likelihood of surviving post-harvest processing before shipment	Low	C	*Bactrocera neohumeralis* is an internal feeder, and existing post-harvest and packinghouse procedures are mostly ineffective for removing fruit infested by these insects from the pathway. There is no change from the previous risk rating (A1).
Risk Element A3: Likelihood of surviving transport and	Low	MC	*Bactrocera neohumeralis* is more prevalent in northern wet tropical areas than the cooler southern areas

Risk Element	**Risk Rating**	**Uncertainty Rating[a]**	**Justification for rating and explanation of uncertainty (and other notes as necessary)**
storage conditions of the consignment			of Queensland and New South Wales (Royer and Hancock, 2012). The two species are closely related genetically (Blacket et al., 2012) and can form hybrids in the laboratory, while the species isolation mechanisms exist in the field (Pike et al., 2003). No studies have been conducted to determine if existing treatments approved by APHIS for other fruit flies would also be effective against *B. neohumeralis*. Therefore, the risk rating remains unchanged.
Risk Element A: Overall risk rating for likelihood of entry	Low	N/A	N/A
Likelihood of Establishment			
Risk Element B1: Likelihood of coming into contact with host material in the endangered area	High	MC	Commercially produced hosts of *B. neohumeralis*—apple, apricot, bell peppers, citrus, peach, pear, plum, tomato, and strawberry—are available in the endangered area throughout the year (NASS, 2013). In addition, wild hosts are also present (NRCS, 2014). Emerging adults are active fliers and can easily find the host. Given that this fruit fly has not spread outside of its endemic area of distribution, the uncertainty level is increased.
Risk Element B2: Likelihood of arriving in the endangered area	High	C	Citrus is usually supplied in proportion to the size of the consumer population. More than 25 percent of the U.S. population lives within the area endangered by *B. neohumeralis;* therefore, this risk element is rated High.
Risk Element B: Combined likelihood of establishment	High	N/A	
Overall Likelihood of Introduction			
Combined likelihoods of entry and establishment	Medium	N/A	

Assessment of the consequences of introduction of *Bactrocera neohumeralis* into the continental United States via the importation of *Citrus* spp. from inland Queensland, Western Australia and the Bourke and Narromine districts in New South Wales

Criteria	Meets criteria? (Yes/No)	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty (and other notes as necessary)
Direct Impacts			
Risk Element C1: Damage potential in the endangered area	Yes	MC	*Bactrocera neohumeralis* is a significant pest in its native range (Drew et al., 1982) in QLD; in some crops it occurs in equal abundance to *B. tryoni* (CABI, 2014b). However, we found no direct estimates of crop damage caused by this pest. Introduction of *B. neohumeralis* in the United States is likely to lead to eradication programs and establishment of quarantined areas, as previously happened with introductions of other fruit flies (CABI, 2014b). These activities will significantly increase the costs of production and maintaining pest-free areas for continued trade (Drew et al., 1982). *Bactrocera neohumeralis* may have direct impacts on Federally listed endangered species such as *Prunus geniculata* (in Florida) and *Opuntia treleasei* (in California) (USFWS, 2014).
Risk Element C2: Spread potential	Yes	MU	*Bactrocera neohumeralis* adults can fly and larvae move on infested fruit (CABI, 2014b). Outside Australia, this pest is only reported from Papua New Guinea. *Bactrocera neohumeralis* has not spread outside of its native area (Torres Strait islands, QLD and NSW) to other parts of the region or other parts of the world. This indicates possible limiting factors preventing its spread. On the other hand, the species could have been overlooked and mistaken for *B. tryoni*, particularly in its larval stage inside fruit where the

Criteria	**Meets criteria? (Yes/No)**	**Uncertainty Rating[a]**	**Justification for rating and explanation of uncertainty (and other notes as necessary)**
			existing identification techniques, including molecular, are not accurate enough to distinguish these two species with certainty.
Risk Element C: Pest introduction is likely to cause unacceptable direct impacts	Yes	N/A	
Trade Impacts			
Risk Element D1: Export markets at risk	N/A	N/A	
Risk Element D2: Likelihood of trading partners imposing additional phytosanitary requirements	N/A	N/A	
Risk Element D: Pest is likely to cause significant trade impacts	N/A	N/A	
Conclusion			
Is the pest likely to cause unacceptable consequences in the PRA area?	Yes	N/A	

3.2.2. *Bactrocera tryoni*

We determined the overall likelihood of introduction to be Medium. We present the results of this assessment in the table below.

We determined that the establishment of *B. tryoni* in the continental United States is likely to cause unacceptable impacts. We also present the results of this assessment in a table below.

Determination of the portion of the United States endangered by *B. tryoni*

Climatic suitability	*Bactrocera tryoni* is found in Australia (eastern Queensland [Cape York, Jericho], eastern New South Wales [Penrith, Tenterfield], extreme east Victoria [East Gippsland], Northern Territory [Alice Springs, Darwin, Katherine]); Papua New Guinea, French Polynesia, and New Caledonia, the Cook Islands and the Pitcairn Islands (Drew et al., 1982; White and Elson-Harris, 1992; CABI, 2014). Based on this distribution, which corresponds to Plant Hardiness Zones 9-13 (Magarey et al., 2008), we estimate that *B. tryoni* could become established in the areas of the continental United States corresponding to Plant Hardiness Zones 9 through 11 (Magarey et al., 2008). One or more of its potential hosts occurs in these zones (NRCS, 2014).

Potential hosts at risk in PRA Area	*Bactrocera tryoni* has been recorded to attack multiple species in multiple families, including Anacardiaceae (*Anacardium occidentale, Bouea macrophylla, Mangifera indica, Pleiogynium timorense, Spondias* spp.); Annonaceae (*Annona* spp., *Cananga odorata, Polyalthia* sp., *Rauwenhoffia leichhardtii, Rollinia* sp.); Apocynaceae (*Alyxia ruscifolia, Carissa ovata, Nerium oleander, Ochrosia* spp., *Thevetia* sp.); Arecaceae (*Normanbya normanbyi, Phoenix dactylifera*); Basellaceae (*Basella* sp.); Cactaceae (*Opuntia* sp.); Capparaceae (*Capparis* spp.); Caricaceae (*Carica papaya*); Celastraceae (*Cassine australis, Siphonodon australe*); Clusiaceae (*Calophyllum inophyllum, Garcinia* spp.); Combretaceae (*Terminalia* spp.); Curcubitaceae (*Curcubita moschata, Diplocyclos palmatus, Momordica charantia, Trichosanthes anguina*); Cunoniaceae (*Schizomeria ovata*); Davidsoniaceae (*Davidsonia pruriens*); Ebenaceae (*Diospyros* spp.); Elaeocarpaceae (*Elaeocarpus* spp.); Ericaceae (*Vaccinium* sp.); Euphorbiaceae (*Drypetes lasiogyna*); Fabaceae (*Castanospermum australe);* Goodeniaceae (*Scaevola taccada*); Hippocrateaceae (*Salacia chinensis*); Juglandaceae (*Juglans regia*); Lauraceae (*Cryptocarya erythroxylon, Endiandra* spp.); Lecythidaceae (*Barringtonia calyptrata*); Loganiaceae (*Fagraea cambagei*); Malpighiaceae (*Malpighia emarginata*); Melastomataceae (*Melastoma affine*); Meliaceae (*Aglaia sapindina, Owenia venosa, Sandoricum indicum*); Musaceae (*Musa* spp.); Moraceae (*Artocarpus* spp., *Morus nigra, Ficus* spp.); Musaceae (*Musa x paradisiacal*); Myrtaceae (*Acmena* spp., *Eugenia* spp., *Feijoa* spp., *Psidium* spp., *Syzgium aqueum*); Oleaceae (*Notalaea longifolia, Olea europaea*); Oxalidaceae (*Averrhoa* spp.); Passifloraceae (*Passiflora* spp.); Punicaceae (*Punica granatum*); Rhamnaceae (*Rhamnella vitiensis, Ziziphus mauritiana*); Rosaceae (*Cydonia oblonga, Eriobotrya japonica, Malus domestica, Pyrus* spp., *Prunus* spp., *Rubus* spp.); Rubiaceae (*Coffea arabica*); Rutaceae (*Acronychia* spp., *Casimiroa* spp., *Citrus* spp., *Clausena lansium, Eremocitrus glauca, Fortunella japonica, Glycosmis trifoliate, Murraya exotica*); Santalaceae (*Santalum lanceolatum*); Sapindaceae (*Blighia sapida, Castanospora alphandii, Euphoria longan, Litchi chinensis, Nephelium lappaceum*); Sapotaceae (*Chrysophyllum cainito, Manilkara zapota, Niemeyera chartacea, Pouteria* spp.); Smilacaceae (*Ripogonum papuanum*); Solanaceae (*Capsicum* spp., *Cyphomandra betacea, Solanum* spp., *Lycopersicon esculentum, Cyphomandra betacea*); Thymeliaceae (*Phaleria clerodendron*), Tiliaceae (*Grewia asiatica*); Verbenaceae (*Premna serratifolia*); and Vitaceae (*Ciccus* spp., *Vitis labrusca*) (Hancock et al., 2000; White and Elson-Harris, 1992; CABI, 2014b).
Economically important hosts at risk[a]	In the United States, potential economic hosts of *Bactrocera tryoni* include olives, several species of pome fruit, bell peppers, tomatoes, and different species of citrus (Hancock et al 2000; White and Elson-Harris, 1992).

Pest potential on economically important hosts at risk	*Bactrocera tryoni* is the most destructive insect pest of fruit and vegetable crops in Australia: it infests all commercial fruit crops there, except pineapple and strawberries, as well as many vegetable crops (Drew et al., 1982). In Australia, it has been known to damage up to 100 percent of unprotected fruit (CABI, 2014b). *Bactrocera tryoni* may have direct impacts on Federally listed endangered species, such as *Prunus geniculata* (in Florida), *Opuntia treleasei* (in California), and *Cucurbita okeechobeensis* ssp. *okeechobeensis* (in Florida). These species are closely related to other hosts known to be attacked by *B. tryoni*.
Defined Endangered Area	Portions of the continental United States that are climatically suitable for establishment of *B. tryoni* include Florida, southern Louisiana, southern Texas, and portions of California, Oregon, and Washington (within Plant Hardiness Zones 9-11) that would be similar its native areas of distribution (CABI, 2014b). At least one or more hosts grow in these areas.

Assessment of the likelihood of introduction of *Bactrocera tryoni* into the endangered area via the importation of *Citrus* spp. from Bourke and Narromine districts in New South Wales, inland Queensland, and Western Australia

Risk Element	Risk Rating	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty (and other notes as necessary)
Likelihood of Entry			
Risk Element A1: Pest prevalence on the harvested commodity (= the baseline rating for entry)	Low	MC	*Bactrocera tryoni* is native to Australia. It has been eradicated from New South Wales and Victoria, and has a restricted distribution in South Australia and Western Australia (EPPO, 2014; White and Elson-Harris, 1994; Hancock et al. 2000). Modelled analysis of *B. tryoni* trap data reflected relatively low dispersal distances (Meats 1998; 2007; Meats and Edgerton 2008; Meats et al. 2006). Evidence indicates that Australian growers regularly survey for the presence of fruit flies of economic importance, and employee management strategies to suppress populations (NFFS, 2010). Therefore, the prevalence of *B. tryoni* in the field is Low.
Risk Element A2: Likelihood of surviving post-harvest processing before shipment	Low	C	*Bactrocera tryoni* is an internal feeder and existing post-harvest and packinghouse procedures are mostly

Risk Element	**Risk Rating**	**Uncertainty Rating[a]**	**Justification for rating and explanation of uncertainty (and other notes as necessary)**
			ineffective for removing fruit infested by these insects from the pathway. There is no change from the previous risk rating (A1).
Risk Element A3: Likelihood of surviving transport and storage conditions of the consignment	Low	MC	APHIS has approved cold treatment schedules for *B. tryoni* to use in those cases when citrus fruit originates outside of a pest-free area of Australia (USDA, 2014). It is not known, however, if the treatment will be consistently applied or if any other risk management options will be in effect instead of the cold treatment. Therefore, we make no change in risk rating from the previous risk element.
Risk Element A: Overall risk rating for likelihood of entry	Low	N/A	N/A
Likelihood of Establishment			
Risk Element B1: Likelihood of coming into contact with host material in the endangered area	High	C	Commercially produced hosts of *B. neohumeralis* (pome fruit, bell pepper, citrus, tomato) are available in the endangered area throughout the year (NASS, 2013). In addition, wild hosts are also present (NRCS, 2014). Emerging adults are active fliers and can easily find the host.
Risk Element B2: Likelihood of arriving in the endangered area	High	C	Citrus is usually supplied in proportion to the size of the consumer population. More than 25 percent of the U.S. population lives within the area endangered by *B. tryoni;* therefore, this risk element is rated High (USDA, 2012).
Risk Element B: Combined likelihood of establishment	High	N/A	
Overall Likelihood of Introduction			
Combined likelihoods of entry and establishment	Medium	N/A	

Assessment of the consequences of introduction of *Bactrocera tryoni* into the continental United States via the importation of *Citrus* spp. from inland Queensland, Western Australia and the Bourke and Narromine districts in New South Wales

Criteria	Meets criteria? (Yes/No)	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty (and other notes as necessary)
Direct Impacts			
Risk Element C1: Damage potential in the endangered area	Yes	MC	*Bactrocera tryoni* is a significant pest in its native range in QLD, where it can damage up to 100 percent of unprotected fruit (CABI, 2014b; Drew et al., 1982). Introduction of *B. tryoni* to the United States is likely to lead to eradication programs and establishment of quarantined areas, as previously happened with introductions of other fruit flies (CABI, 2014b). These activities will significantly increase the costs of production and maintaining pest-free areas for continued trade (Drew et al., 1982). *Bactrocera tryoni* is a quarantine pest for India, Japan, Korea, New Zealand, South Africa, and the European Union (EPPO, 2007). Thus, its introduction could curtail access to these markets for U.S. citrus and other economically important fruits.
Risk Element C2: Spread potential	Yes	MU	*Bactrocera tryoni* adults can fly and larvae move on infested fruit (CABI, 2014b).
Risk Element C: Pest introduction is likely to cause unacceptable direct impacts	Yes	N/A	
Trade Impacts			
Risk Element D1: Export markets at risk	N/A	N/A	
Risk Element D2: Likelihood of trading partners imposing additional phytosanitary requirements	N/A	N/A	
Risk Element D: Pest is likely to cause significant trade impacts	N/A	N/A	

Criteria	Meets criteria? (Yes/No)	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty (and other notes as necessary)
Conclusion			
Is the pest likely to cause unacceptable consequences in the PRA area?	Yes	N/A	

3.2.3. *Ceratitis capitata*

We determined the overall likelihood of introduction of *C. capitata* (Medfly) to be High. We present the results of this assessment in the table below.

We determined that the establishment of Medfly in the United States is likely to cause unacceptable impacts. We present the results of this assessment in the table below.

Determination of the portion of the United States endangered by *Ceratitis capitata*

Climatic suitability	*Ceratitis capitata* (Medfly) is widely distributed in the Mediterranean region, South and Central America, west Asia, and Australia (CABI, 2014b). Based on its current distribution, we estimate that Medfly could establish in areas of the continental United States corresponding to Plant Hardiness Zones 8-11 (Magarey et al., 2008).
Potential hosts at risk in PRA Area	Medfly feeds on over 400 hosts (CABI, 2014b), many of which are common within Plant Hardiness Zones 8-11 in the United States.
Economically important hosts at risk	Economically important hosts widely present in the area of concern include bell peppers, several species of pome fruit, and citrus (CABI, 2014b).
Pest potential on economically important hosts at risk[a]	*Ceratitis capitata* is a serious pest on *Citrus* spp., *Ficus carica*, *Mangifera indica*, and *Prunus persica*; damage to fruit crops may reach 100 percent (CABI, 2014b). Medfly therefore could impact several of the economically important hosts listed above.
Defined Endangered Area	The area endangered by Medfly comprises Plant Hardiness Zones 8-11, as this area is both climatically suitable and contains economically important hosts.

Assessment of the likelihood of introduction of *Ceratitis capitata* into the endangered area via the importation of citrus fruit from Australia

Risk Element	Risk Rating	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty (and other notes as necessary)
Likelihood of Entry			
Risk Element A1: Pest prevalence on the harvested commodity (= the baseline rating for entry)	Low	MC	*Ceratitis capitata* occurs only in Western Australia. Populations of Medfly are monitored in orchards using male traps consisting of a pheromone and an insecticide. Weekly bait sprays are

Risk Element	Risk Rating	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty (and other notes as necessary)
			routinely applied during the warmer months irrespective of trap data (Australia, 2014). Evidence indicates that Australian growers regularly survey for the presence of fruit flies of economic importance, and employee management strategies to suppress populations (NFFS, 2010). Where the pest-free areas for the fruit fly are not recognized, the field prevalence of *C. capitata* is Low.
Risk Element A2: Likelihood of surviving post-harvest processing before shipment	Low	C	Medfly is an internal feeder and existing post-harvest and packinghouse procedures are mostly ineffective for removing fruit infested by these insects from the pathway. There is no change from the previous risk rating (A1).
Risk Element A3: Likelihood of surviving transport and storage conditions of the consignment	Low	MC	It is not known if cold or other mitigation treatments will be consistently applied or if any other risk management options will be in effect.
Risk Element A: Overall risk rating for likelihood of entry	Low	N/A	
Likelihood of Establishment			
Risk Element B1: Likelihood of coming into contact with host material in the endangered area	High	C	Medfly has an expansive host range (CABI, 2014b). Suitable hosts are widely and regularly distributed throughout the entire endangered area.
Risk Element B2: Likelihood of arriving in the endangered area	High	C	More than 25 percent of the U.S. population lives within the endangered area (USDA, 2012).
Risk Element B: Combined likelihood of establishment	High	N/A	
Overall Likelihood of Introduction			
Combined likelihoods of entry and establishment	Medium	N/A	

[a]C=Certain, MC=Moderately Certain, MU=Moderately Uncertain, U=Uncertain

Assessment of the consequences of introduction of *Ceratitis capitata* into the United States (i.e., the PRA area)

Criteria	Meets criteria? (Yes/No)	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty (and other notes as necessary)
Direct Impacts			
Risk Element C1: Damage potential in the endangered area	Yes	C	Medfly is a serious pest on numerous hosts including *Citrus* spp., *Ficus carica*, and *Prunus persica*; damage to fruit crops may reach 100 percent (CABI, 2014b).
Risk Element C2: Spread potential	Yes	C	Medfly adults can fly and larvae move on infested fruit (CABI, 2014b). Medfly has spread to and established in several new areas throughout the world. (CABI, 2014b). Medfly has repeatedly attempted to invade and been eradicated in the United States.
Risk Element C: Pest introduction is likely to cause unacceptable direct impacts	Yes		
Trade Impacts			
Risk Element D1: Export markets at risk	N/A		
Risk Element D2: Likelihood of trading partners imposing additional phytosanitary requirements	N/A		
Risk Element D: Pest is likely to cause significant trade impacts	N/A		
Conclusion			
Is the pest likely to cause unacceptable consequences in the PRA area?	Yes	N/A	

[a]C=Certain, MC=Moderately Certain, MU=Moderately Uncertain, U=Uncertain

3.2.4. *Tegolophus australis*[19], *Eutetranychus orientalis*, *Maconellicoccus hirsutus*, and *Pezothrips kellyanus*

We determined the overall likelihood of introduction of *Tegolophus australis*, *Eutetranychus orientalis*, *Maconellicoccus hirsutus*, and *Pezothrips kellyanus* is Negligible. We present the

[19] A Negligible likelihood of introduction of this organism in the commercial *Citrus* pathway due to the existing packinghouse procedures was recognized in the original pest risk assessment (USDA, 1992). We found no interceptions of this pest in PestID (2014 query).

results of this assessment in a table below. Because the likelihood of introduction is Negligible, we did not analyze the consequences of introduction, nor determine the endangered area.

Assessment of the likelihood of introduction of *Tegolophus australis, Eutetranychus orientalis, Maconellicoccus hirsutus,* and *Pezothrips kellyanus* into the endangered area via the importation of *Citrus* spp. from inland Queensland, Western Australia, and the Bourke and Narromine districts in New South Wales

Risk Element	Risk Rating	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty
Likelihood of Entry			
Risk Element A1: Pest prevalence on the harvested commodity (= the baseline rating for entry)	Low	C	Occurrence of pests is infrequent in the export area (Australia, 2014). Based on the evidence outlined in section 1.4.3 and 1.4.4, integrated pest management and cultural practices are growers' first line of defense (Australia, 2014), reducing the prevalence of these pests on the harvested commodity. This is also supported by the absence or low numbers of interceptions of these four pests (PestID, 2014). The control of mites is achieved by close monitoring during spring and autumn, encouragement of natural enemies, and the use of selective miticides (Australia, 2014; Smith et al., 1997). Mealybug and thrips populations are closely monitored from early spring and may be controlled through the release and promotion of natural enemies. The well-timed use of oil sprays is also highly effective (Australia, 2014; Smith et al., 1997).
Risk Element A2: Likelihood of surviving post-harvest processing before shipment	Negligible	C	Based on the evidence outlined in sections 1.4.3 and 1.4.4 (i.e., triple washing and brushing, waxing, drying, enhanced visual inspections, and culling), we decreased the previous rating by one level from Low to Negligible.
Risk Element A3: Likelihood of surviving transport and storage conditions of the consignment	N/A	N/A	N/A

Risk Element	**Risk Rating**	**Uncertainty Rating[a]**	**Justification for rating and explanation of uncertainty**
Risk Element A: Overall risk rating for likelihood of entry	Negligible	N/A	
Likelihood of Establishment			
Risk Element B1: Likelihood of coming into contact with host material in the endangered area	N/A	N/A	
Risk Element B2: Likelihood of arriving in the endangered area	N/A	N/A	
Risk Element B: Overall risk rating for likelihood of establishment			
Overall Likelihood of Introduction	N/A	N/A	
Combined likelihoods of entry and establishment	Negligible	N/A	

3.2.5. *Sphaceloma fawcettii* var. *scabiosa*

We determined the overall likelihood of introduction to be Negligible. We present the results of this assessment in the table below.

Because the likelihood of introduction of *Sphaceloma fawcettii* var. *scabiosa* is Negligible, no analysis of consequences of introduction was necessary.

Determination of the portion of the United States endangered by *Sphaceloma fawcettii* var. *scabiosa*

Climatic suitability	*Sphaceloma fawcettii* var. *scabiosa* occurs in Asia (Hong Kong, Indonesia, Malaysia, Sri Lanka), Africa (Comoros, Madagascar, Malawi, Zambia, and Zimbabwe), and Oceania ([Australia: New South Wales, Queensland], Fiji, New Caledonia, Papua New Guinea, Salomon Islands) (EPPO/CABI, 1997; Tan et al., 1996). Based on its current distribution, it would likely survive in Plant Hardiness Zones 9-11 (Magarey et al., 2008).
Potential hosts at risk in PRA Area	*Sphaceloma fawcettii* var. *scabiosa* principally affects *Citrus limon* (lemon), *C. jambhiri* (rough lemon) rootstock in Australia (EPPO/CABI. 1997; Timmer et al., 2000), *C. aurantifolia* (key lime), *C. aurantium* (sour orange), *C. limonia* (limon cravo, rangpur lime), *C. reticulata* (Dancy tangerine) (Farr and Rossman 2015; Timmer et al., 2000), *C. bergamia* (bergamot), *C. indica* (indian wild orange), and *Citrus reshnii* (Cleopatra mandarin) (Timmer et al., 2000).

Economically important hosts at risk[a]	*Citrus limon* is the most susceptible plant species and the most economically important host for *S. fawcettii* var. *scabiosa* (EPPO/CABI, 1997; Timmer et al., 1996; Cooke at al. 2009). *Citrus reticulata* reacts differently to *S. fawcettii* var. *scabiosa*. Timmer et al. (2000) indicated that not all isolates of *S. fawcettii* var. *scabiosa* were able to infect and develop scab symptoms after inoculations.
Pest potential on economically important hosts at risk[a]	*Sphaceloma fawcettii* var. *scabiosa* principally affects lemon (*C. limon*) and rough lemon (*C. jambhiri*) rootstock in Australia (EPPO/CABI, 1997; Timmer et al., 2000). The only commodity that will be affected on citrus imported from Australia will be *C. limon*.
Defined Endangered Area	The area endangered by *S. fawcettii* var. *scabiosa* is in Plant Hardiness Zones 9-11 (Magarey et al., 2008).

Assessment of the likelihood of introduction of *Sphaceloma fawcettii* var. *scabiosa* into the endangered area via the importation of *Citrus* spp. from Australia

Risk Element	**Risk Rating**	**Uncertainty Rating[a]**	**Justification for rating and explanation of uncertainty (and other notes as necessary)**
Likelihood of Entry			
Risk Element A1: Pest prevalence on the harvested commodity (= the baseline rating for entry)	Low	MC	Fruit remain susceptible to infection for about three months after petal falls. Infection requires only five to six hours of leaf wetness and temperatures between 21-30°C (Cooke, et al, 2009). The structures of the pathogen, the acervuli, are produced in infected tissue either fruit, leaves, or twigs, and are epidermal to subepidermal and often confluent (Holliday, 1980). As a result the pathogen is easily detected at harvest time. Infected fruit readily express symptoms after infection, but tissue susceptibility decreases rapidly as fruits mature. Fruits, which are infected in the early stages of their development, grow misshapen and are subject to premature fall and are consequently unmarketable (Agostini et al. 2003; EPPO/CABI. 1997) and unlikely to be harvested.

Risk Element	**Risk Rating**	**Uncertainty Rating[a]**	**Justification for rating and explanation of uncertainty (and other notes as necessary)**
Risk Element A2: Likelihood of surviving post-harvest processing before shipment	Negligible	C	In the unlikely event that infected, scabby fruit are harvested and enter the packinghouse process, the post-harvest procedure of the culling of blemished and scabby fruit most likely will eliminate them on the packing line by visual inspection. Fruit infected with *S. fawcettii* var. *scabiosa* develop obvious light brown corky scabs on the surface of the fruit (Cooke et al., 2009), that should be easily detected during culling. Only young citrus tissue is susceptible to infection (Agostini et al. 2003), and symptoms are expressed 5-14 days after during (Etebu and Nwauzoma, 2014). Since all citrus requires more than 3 months for fruit to develop and mature, infected fruit will show symptoms well before they are harvested. If mature fruit does not show scab symptoms at harvest, it is not infected. In the unlikely event any infected fruit does escape culling it will be subjected washing with detergent, brushing, and surface disinfesting processes, which reduce the viability of fungal conidia.. Korf et al. 2001 demonstated the effectiveness of this process for another citrus fungi *Phyllosticta citricarpa*-. In addition, the wax-fungicide spray treatment will further inactivate spores. For example, imazalil a common fungicide is active against a large number of imperfect fungi, and some fungi of the class "Ascomycetae" (IPCS, 1977).-

Risk Element	Risk Rating	Uncertainty Rating[a]	Justification for rating and explanation of uncertainty (and other notes as necessary)
Risk Element A3: Likelihood of surviving transport and storage conditions of the consignment	Negligible	C	Transport and storage are unlikely to positively or negatively affect pest prevalence in the commodity.
Risk Element A: Overall risk rating for likelihood of entry	Negligible	N/A	
Likelihood of Establishment			
Risk Element B1: Likelihood of coming into contact with host material in the endangered area	N/A	N/A	
Risk Element B2: Likelihood of arriving in the endangered area	N/A	N/A	
Risk Element B: Combined likelihood of establishment	N/A	N/A	
Overall Likelihood of Introduction			
Combined likelihoods of entry and establishment	Negligible	N/A	

4. Summary and Conclusions of Risk Assessment

Of the organisms associated with citrus worldwide and reported in inland Queensland, Western Australia and the Bourke and Narromine areas in New South Wales, we identified organisms that are actionable pests for the United States and have a reasonable likelihood of being associated with the commodity following harvesting from the field and prior to any post-harvest processing. USDA APHIS has determined that asymptomatic or commercially pack fruit is not an epidemiologically significant pathway for the introduction and establishment of *Phyllosticta citricarpa* (causal agent of citrus black spot) into new areas. Therefore, this pathogen was not analyzed in the pest risk assessment, however additional import requirements will be specified in the risk management document as a condition of entry for citrus to the continental Unites States.

We further evaluated eight organisms for their likelihood of introduction (i.e., entry plus establishment) and their potential consequences of introduction. We determined the overall likelihood of introduction for five pests is Negligible (Table 4) and for three pests is Medium (Table 5). *Bactrocera neohumeralis, Bactrocera tryoni,* and *Ceratitis capitata* have Medium probability of introduction into the endangered areas of the United States. These pests met the threshold for unacceptable consequences of introduction and require the implementation of the adequate risk management measures. The Negligible and Medium likelihoods of introduction for the above-listed arthropods are based on the pathway described in this risk assessment. If those processes are not followed, we reserve the right to re-evaluate the risk of all the pests in this risk assessment.

Detailed examination and choice of other phytosanitary measures to mitigate pest risk that are not addressed in the requirements for the currently-approved Australian citrus production areas are part of the pest risk management phase within APHIS and are not addressed in this document.

Table 4. Summary for pests selected for further evaluation and determined ***not*** to be candidates for additional risk management

Pest	**Reason the pest is *not* a candidate for risk management**	**Uncertainty statement (optional)[a]**
Eutetranychus orientalis	Negligible likelihood of introduction	
Maconellicoccus hirsutus	Negligible likelihood of introduction	
Pezothrips kellyanus	Negligible likelihood of introduction	
Sphaceloma fawcettii var. *scabiosa*	Negligible likelihood of introduction	
Tegolophus australis	Negligible likelihood of introduction	

[a]The uncertainty statement, if included, identifies the most important source(s) of uncertainty.

Table 5. Summary for pests selected for further evaluation and determined to be candidates for risk management. All of these pests meet the threshold for unacceptable consequences of introduction.

Pest	**Likelihood of Introduction overall rating**	**Uncertainty statement (optional)[a]**
Bactrocera neohumeralis	Medium	
Bactrocera tryoni	Medium	
Ceratitis capitata	Medium	

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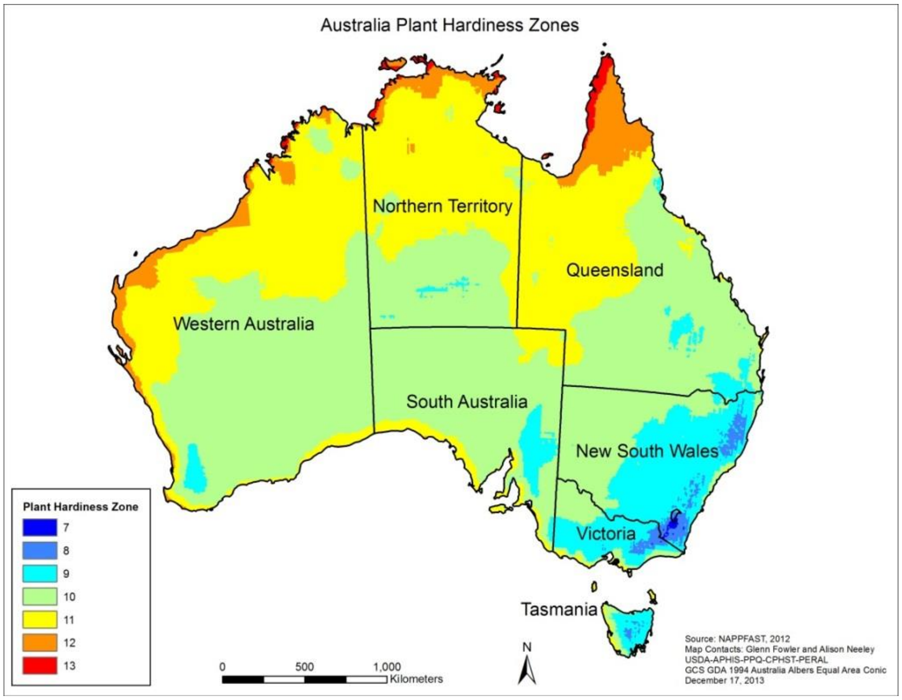
Appendices

Appendix 1. Plant Hardiness Zones in Australia.



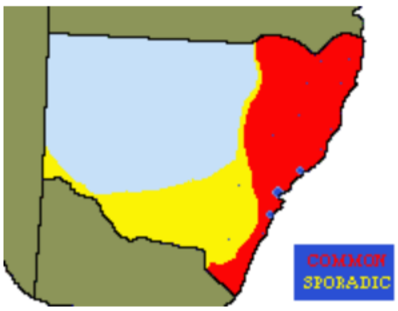
Appendix 2. Distribution of *Bactrocera tryoni* and *B. neohumeralis*.

Bactrocera tryoni*:* Alice Springs in Northern Territory, Torres Strait islands, inland Queensland as far west as Mount Isa and eastern Australia as far south as East Gippsland, Victoria. Occasional records (since eradicated) from Perth, Western Australia and Adelaide, South Australia. (Other Northern Territory records appear to refer to the suspected hybrid *B. tryoni* x *B. aquilonis*) (Hancock et al., 2000). Widely distributed in Eastern Australia from Cape York to Victoria (Walker, 2005b).

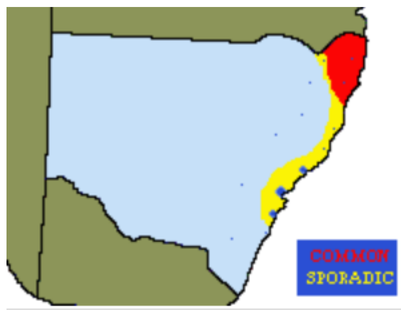
Bactrocera neohumeralis**:** Torres Strait islands and eastern Australia, south to Coff's Harbour, northern New South Wales. Also recorded at inland localities of Emerald and Clermont in Queensland (Hancock et al., 2000).

The maps below depict distribution only in NSW (NSWG I&I. n.d):

B. tryoni[20]

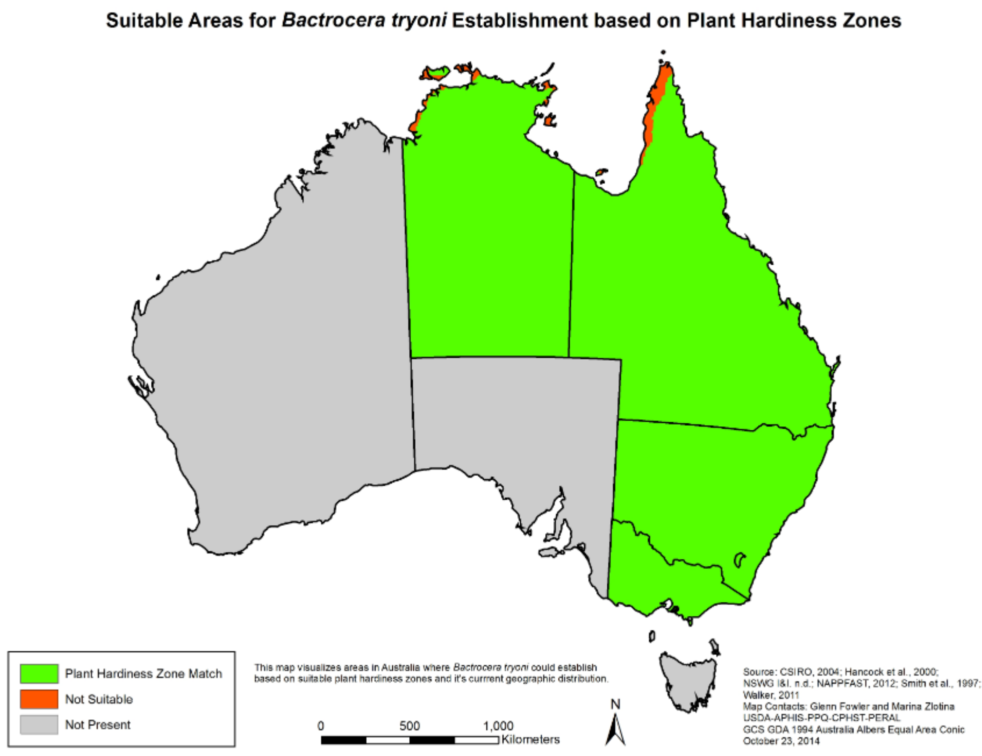


B. neohumeralis[21]



Legend:
Red – areas where the pest is common;
Yellow - areas where the pest occurs sporadically.

[20] Source: http://www1.dpi.nsw.gov.au/keys/fruitfly/tryoni.htm
[21] Source: http://www1.dpi.nsw.gov.au/keys/fruitfly/neohumer.htm


Suitable Areas for *Bactrocera tryoni* Establishment based on Plant Hardiness Zones
Plant Hardiness Zone Match
Not Suitable
Not Present
This map visualizes areas in Australia where *Bactrocera tryoni* could establish based on suitable plant hardiness zones and it's current geographic distribution.
0
500
1,000
Kilometers
N
Source: CSIRO, 2004; Hancock et al., 2000; NSWG I&I. n.d.; NAPPFAST, 2012; Smith et al., 1997; Walker, 2011
Map Contacts: Glenn Fowler and Marina Zlotina
USDA-APHIS-PPQ-CPHST-PERAL
GCS GDA 1994 Australia Albers Equal Area Conic
October 23, 2014