Biosecurity Plan
for the Avocado Industry

A shared responsibility between government and industry

Version 3.0 February 2020

Plant Health AUSTRALIA

Hort Innovation
Strategic levy investment

AVOCADO FUND

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In referencing this document, the preferred citation is:

Plant Health Australia Ltd (2020) Biosecurity Plan for the Avocado Industry (Version 3.0 – 2020) Plant Health Australia, Canberra, ACT.

This project has been funded by Hort Innovation, using the avocado research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not for profit research and development corporation for Australian horticulture.

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Acknowledgements

The *Biosecurity Plan for the Avocado Industry* project was coordinated by Plant Health Australia and developed through a partnership approach with government and industry.

The following organisations and agencies were involved in the development and finalisation of the plan:

Endorsement

The *Biosecurity Plan for the Avocado Industry (Version 3.0)* was formally endorsed by the avocado industry (through Avocados Australia) in October,2019, and all state and territory governments (through the Plant Health Committee) in January 2020.

The Australian Government endorses the document without prejudice for the purposes of industry's planning needs and meeting the Department's obligations under Clause 13 of the EPPRD. In providing this endorsement the Department notes page 42 of the Plan which states: "This Document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling). This is a broader view of potential risk than the Biosecurity Import Risk Assessment (BIRA) conducted by the Department of Agriculture which focus only on specific regulated import pathways."

Reporting suspect pests

Any unusual plant pest should be reported immediately to the relevant state/territory agriculture department through the Exotic Plant Pest Hotline (1800 084 881). Early reporting enhances the chance of effective control and eradication.

IF YOU SEE ANYTHING UNUSUAL,
CALL THE EXOTIC PLANT PEST HOTLINE
1800 084 881

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LIST OF ACRONYMS

ACPPO	Australian Chief Plant Protection Office
APVMA	Australian Pesticides and Veterinary Medicines Authority
AS/NZS	Australian Standard/New Zealand Standard
BICON	Australian Biosecurity Import Conditions Database
BIG	Biosecurity Implementation Group
BIRA	Biosecurity Import Risk Analysis
BOLT	Biosecurity On-Line Training
BP	Biosecurity Plan
BRP	Biosecurity Reference Panel
CABI	Centre for Agriculture and Bioscience International
CCEPP	Consultative Committee on Emergency Plant Pests
CPHM	State Chief Plant Health Manager
DA	Department of Agriculture
DAF QLD	Department of Agriculture and Fisheries, Queensland
DJPR	Department of Jobs, Precincts and Regions, Victoria
DPI NSW	Department of Primary Industries, New South Wales
DPIPWE	Department of Primary Industries, Parks, Water and Environment, Tasmania
DPIR NT	Department of Primary Industry and Resources, Northern Territory
DPIRD	Department of Primary Industries and Regional Development, WA
EPP	Emergency Plant Pest
EPPO	European and Mediterranean Plant Protection Organization
EPPRD	Emergency Plant Pest Response Deed
FAO	Food and Agriculture Organization of the United Nations
HACCP	Hazard Analysis Critical Control Point
HPP	High Priority Pest
ICA	Interstate Certification Assurance
IGAB	Intergovernmental Agreement on Biosecurity
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MICoR	Manual of Importing Country Requirements
NAQS	Northern Australian Quarantine Strategy
NDP	National Diagnostic Protocol
NMG	National Management Group
NPBDN	National Plant Biosecurity Diagnostic Network
NPBRDES IC	National Plant Biosecurity Research, Development and Extension Strategy. Implementation Committee
NPBS	National Plant Biosecurity Strategy
NSW	New South Wales
NT	Northern Territory

ORC	Owner Reimbursement Costs
PaDIL	Pest and Disease Image Library
PHA	Plant Health Australia
PHC	Plant Health Committee
PIC	Property Identification Code
PIRSA	Primary Industries and Regions South Australia
QA	Quality Assurance
QLD	Queensland
RDC	Research and Development Corporation
RD&E	Research, Development and Extension
SA	South Australia
SARDI	South Australian Research and Development Institute
SDQMA	Sub-Committee for Domestic Quarantine and Market Access
SNPHS	Sub-Committee for Plant Health Surveillance
SPHD	Sub-Committee on Plant Health Diagnostic
SPS	Sanitary and Phytosanitary
TEG	Technical Expert Group
TST	Threat Summary Table
Vic	Victoria
WA	Western Australia
WTO	World Trade Organization

DEFINITIONS

The definition of a plant pest used in this document includes insects, mites, snails, nematodes or pathogens (diseases) that have the potential to adversely affect food, fibre, ornamental crops, bees and stored products, as well as environmental flora and fauna. Exotic pests are those not currently present in Australia. Endemic pests are those established within Australia.

Emergency Plant Pest (EPP) – for a pest to be classified as an emergency plant pest (EPP), it must either be listed in Schedule 13 of the EPPRD, or be determined by the Categorisation Group or National Management Group (NMG) to be of potential national significance and meet at least one of the criteria below:

- a known exotic pest
- a variant form of an established plant pest
- a previously unknown pest
- a confined or contained pest.

High Priority Pest (HPP) – an exotic plant pest identified as one of the greatest pest threats to one or more plant production industries. A HPP must have a High or Extreme overall rating through the Biosecurity Planning process. For more information on risk ratings please refer to page 41.

EXECUTIVE SUMMARY

To ensure its future viability and sustainability, it is important that the Australian avocado industry, represented by Avocados Australia as the peak industry body, minimises the risks posed by exotic pests and responds effectively to plant pest threats. This plan is a framework to coordinate biosecurity activities and investment for Australia's avocado industry. It provides a mechanism for industry, governments and stakeholders to better prepare for and respond to, incursions of pests that could have significant impacts on the avocado industry. It identifies and prioritises exotic plant pests (not currently present in Australia) and established pests of biosecurity concern and focus on future biosecurity challenges.

The Biosecurity Plan for the Avocado Industry was developed in consultation with the Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG), which consisted of plant health and biosecurity experts and industry representatives. These groups were coordinated by Plant Health Australia (PHA) and included representatives from Avocados Australia, relevant state and territory agriculture agencies and PHA.

The development of Threat Summary Tables (TST), constituting a list of over 170 exotic plant pests and the potential biosecurity threat that they represent to the Australian avocado industry, was key to the industry biosecurity planning process. Each pest on the list was given an overall risk rating based on four criteria; entry, establishment, spread potential, and economic impact. In this biosecurity plan, established pests of biosecurity significance for the avocado industry were also identified (Table 2) as good biosecurity practice is beneficial for the ongoing management and surveillance for these pests.

The Biosecurity Plan for the Avocado Industry also details current mitigation and surveillance activities being undertaken and identifies contingency plans, fact sheets and diagnostic protocols that have been developed for pests relevant to the avocado industry (Table 4). This enables identification of gaps and prioritises specific actions, as listed in the Biosecurity Implementation Table (Table 3). The development of this table will increase the avocado industry's biosecurity preparedness and response capability by outlining specific areas of action which could be undertaken through a government and industry partnership.

This biosecurity plan is principally designed for decision makers. It provides the avocado industry and government with a mechanism to identify exotic plant pests as well as to address the strengths and weaknesses in relation to the avocado industry's current biosecurity position. It is envisaged that annual reviews of this Biosecurity Plan (BP) will be undertaken to assess progress against agreed activities, with another formal review conducted in 5 years.

The biosecurity plan is a document outlining the commitment to the partnership between the avocado industry and government to improve biosecurity for the avocado industry.

SIGNIFICANT BIOSECURITY THREATS

Document overview

Biosecurity for the Australian avocado industry focuses on five key areas to identify the components to be implemented through the life of the biosecurity plan 2019-2024. These five areas are outlined in the sections below.

High priority exotic pests and established pests of biosecurity significance

A key outcome of this biosecurity plan is the identification of the exotic high priority pests, and established pests of biosecurity significance for the Australian avocado industry (Page 4). This section includes:

- the High Priority Pests (HPPs), which are the most significant exotic threats affecting the avocado industry as identified through a prioritisation process.
- the established pests of biosecurity significance, which have been identified in consultation with industry.

The exotic HPP list and established pests of biosecurity significance will allow industry and government to better prioritise preparedness activities and will assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers, development of surveillance programs, diagnostic protocols as well as development of pest-specific mitigation activity.

Established weeds of biosecurity significance were considered during the development of this plan. No weeds of biosecurity significance were identified for the avocado industry through consultation with government and industry.

Implementing biosecurity for the Australian Avocado Industry 2019-2024

This section (Page 18) includes the biosecurity implementation plan and a gap analysis of the current level of preparedness for HPPs of the avocado industry. The Biosecurity Implementation Group (BIG), comprised of both industry and government representatives, developed the implementation plan that sets out shared biosecurity goals and objectives over the next five years. It is intended that the biosecurity implementation plan is revisited by the Biosecurity Reference Panel (BRP) regularly over the next five years to maintain its relevance.

Threat identification and pest risk assessments

Guidelines are provided for the identification and ranking of biosecurity threats through a process of qualitative risk assessment. The primary goal is to coordinate identification of exotic pest threats that could impact productivity, or marketability. This plan strengthens risk assessment work already being done both interstate and overseas. All exotic avocado biosecurity threats considered in the biosecurity plan are detailed in threat summary tables (Appendix 2: Threat Summary Tables). From the prioritisation process undertaken in the TST, pests with an overall high rating were identified as a HPP (Table 1). Established pests of biosecurity significance are also listed.

Risk mitigation and preparedness

This section provides a summary of activities to mitigate the impact of pest threats on the Australian avocado industry, along with a set of guidelines for managing risk at all operational levels. Many pre-emptive practices can be adopted by plant industries and government agencies to reduce risks. The major themes covered include:

- Barrier quarantine
- Surveillance
- Training
- Awareness
- Farm biosecurity
- Reporting of suspect pests

A summary of pest-specific information and preparedness documents, such as fact sheets, contingency plans and diagnostic protocols are also described to outline activities industry has undertaken to prepare for an exotic pest incursion. Information for industry on how to align preparedness activities with R,D&E, such as researching IPM strategies, and chemical control is also provided.

Response management

This section provides a summary of the processes in place to respond to emergency plant pest (EPP)[1] incursions that would affect the Australian avocado industry. Areas covered in this section include the Emergency Plant Pest Response Deed (EPPRD), PLANTPLAN (outlines the generic approach to response management under the EPPRD), categorisation of pests under the EPPRD and industry specific response procedures and industry communication.

PESTS OF BIOSECURITY SIGNIFICANCE OVERVIEW

A key component of this biosecurity plan is to identify the exotic and established pests of biosecurity significance to the Australian avocado industry. This section provides information on the High Priority Pest list, and the established pests of biosecurity significance for the avocado industry. These pest lists, provide the Australian avocado industry, governments and other stakeholders with the information needed to prioritise resources for biosecurity risk management.

Established weeds of biosecurity significance were considered during the development of this plan. No weeds of biosecurity significance were identified for the avocado industry through consultation with government and industry.

[1] Refer to the PHA website for details http://www.planthealthaustralia.com.au/biosecurity/emergency-plant-pests/

Avocado industry high priority exotic pests

Table 1 provides an overview of the top ranked threats to the avocado industry for invertebrates, pathogens and nematodes respectively. Further details on each pest along with the basis for the likelihood ratings are provided in the threat summary tables (Appendix 2: threat summary tables). Assessments may change given more detailed research, and the priority list will be formally reviewed along with the Biosecurity Plan on an annual basis through the Biosecurity Reference Panel. An explanation of the method used for calculating the overall risk can be found on the PHA website[2].

Table 1. Avocado industry high priority pest threat list.

COMMON NAME (SCIENTIFIC NAME)	HOST(S)	AFFECTED PLANT PART	DISPERSAL	ENTRY POTENTIAL	EST.[3] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Invertebrates								
Acari (Mites)								
Persea mite (*Oligonychus perseae)*	Avocado, citrus, apricot, peach, nectarine, plum, persimmon, grapevine, sumac and liquidambar trees, roses and acacia	Leaves	Adults capable of dispersal by wind, infested plant material	MEDIUM	HIGH[4]	HIGH[5]	HIGH	**HIGH**
Coleoptera (Beetles and weevils)								
Small avocado seed weevil (*Conotrachelus aguacatae*)	Avocado, guava	Fruit	Infested plant material	HIGH	HIGH	HIGH	HIGH	**HIGH**
Small seed weevil (*Conotrachelus perseae*)	Avocado, guava	Fruit	Infested plant material	HIGH	HIGH	HIGH	HIGH	**HIGH**

[2] Available from www.planthealthaustralia.com.au/biosecurity/risk-mitigation

[3] Establishment potential

[4] Spreads rapidly since its webbing protects it and its eggs from the predacious mite *Amblyseius hibisci*, a common biological control agent in California. In severe infestations, mite population can reach 1000 mites per leaf. Its numbers peak with dry summer heat and decline rapidly in the fall, but enough winter survival occurs (eggs overwinter) to repeat the cycle, allowing buildup of adult populations in spring. Gwen is a favorite host, then Hass, Reed, and other varieties.

[5] A predacious mite native to California, *Galendromus annectens* and *Galendromus helveolus* help with control. Individual homeowner trees can be helped by water-jet washing, which is more effective if insecticidal soap is added. To minimize initial infection, avoid drought and other stress.

COMMON NAME (SCIENTIFIC NAME)	HOST(S)	AFFECTED PLANT PART	DISPERSAL	ENTRY POTENTIAL	EST.[3] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Large seed weevil, Avocado seed weevil (*Heilipus lauri*)	Avocado	Fruit	Infested plant material	HIGH	HIGH	HIGH	HIGH	**HIGH**
Hemiptera (Stink bugs, aphids, mealybugs, scale, whiteflies & hoppers)								
Papaya mealybug (*Paracoccus marginatus)*	Wide host range including *Citrus* spp., papaya, avocado, mango, cherry, pineapple, pomegranate, hibiscus, cotton, tomato, eggplant, capsicum, bean, pea, sweet potato, wattles, coffee	Whole plant above ground	Infested soil and plant material. First instar crawlers capable of short distance dispersal by walking.	HIGH	HIGH	HIGH	HIGH	**HIGH**
Diptera (Flies and midges)								
Mexican fruit fly (*Anastrepha ludens*)	Wide host range including cashew, pawpaw, citrus spp. (lime, sour orange, sweet lemon tree, pummelo, mandarin, tangelo, navel orange, grapfruit), arabica coffee, persimmon, apple, mango, passionfruit, avocado, peach, pomegranate, European pear	Fruit	Adults capable of flight over long distances[6]. Transmitted via infested plant material (fruit and puparia in soil or packaging with plants that have already fruited)	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Carambola fruit fly (*Bactrocera carambolae)*	Cashew nut, breadfruit, jackfruit, tomato, capsicum, pawpaw, avocado, *Citrus* spp. (lime, lemon, mandarin, navel orange, grapefruit), mangosteen, mango, guava, sapodilla, pomegranate, Singapore almond	Fruit	Transmitted by infested plant material (fruit).	HIGH	HIGH	HIGH	HIGH	**HIGH**

[6] Adults can fly as far as 135 km.

COMMON NAME (SCIENTIFIC NAME)	HOST(S)	AFFECTED PLANT PART	DISPERSAL	ENTRY POTENTIAL	EST.[3] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Oriental fruit fly (*Bactrocera dorsalis (syn. B. invadens, B. papayae, B. philippinensis*[7]))	Wide host range of over 300 species including cashew nut, black currant tree, jackfruit, capsicum, chilli, pawpaw, watermelon, *Citrus* spp. (lime, sour orange, Mauritius bitter orange, Tahitian lime, lemon, pumelo, mandarin, navel orange, grapefruit), arabica coffee, robusta coffee, melon, cucumber, persimmon, loquat, mangosteen, apple, mango, sapodilla, bitter gourd, black mulberry, banana, plantain, rambutan, passionfruit, avocado, bean, apricot, sweet cherry, plum, peach, guava, pomegranate, European pear, Oriental pear tree, mangrove, tomato, eggplant, Singapore almond, cocoa	Fruit	Transmitted by infested plant material (fruit), hitchhiker.	HIGH	HIGH	HIGH	HIGH	**HIGH**
Tongan fruit fly (*Bactrocera facialis*)	Wide host range including cashew nut, breadfruit, capsicum, chilli, lemon, guava, pumelo, mandarin, navel orange, peach, grapefruit, mango, avocado, tomato	Fruit	Adults capable of flight.	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Sri Lankan fruit fly *(Bactrocera kandiensis)*	Wide host range including cashew nut, pawpaw, pumelo, mango, avocado, guava, pomegranate, clove	Fruit	Adults capable of flight.	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Fijian fruit fly (*Bactrocera kirki*)	Wide host range including pineapple, capsicum, chilli, lime, mandarin, navel orange, mango, passionfruit, peach, guava, avocado, tomato, eggplant, cashew nut	Fruit	Adults capable of flight.	HIGH	HIGH	HIGH	HIGH	**HIGH**
Cook Islands fruit fly (*Bactrocera melanotus)*	Wide host range including mango, pawpaw, avocado, breadfruit, jackfruit, guava, citrus, tomato	Fruit	Adults capable of flight	MEDIUM	HIGH	HIGH	HIGH	**HIGH**

[7] *Bactrocera dorsalis*, *B. invadens*, *B. papayae* and *B. philippinensis* have been condensed into one species B. dorsalis (Schutze et al., 2014).

COMMON NAME (SCIENTIFIC NAME)	HOST(S)	AFFECTED PLANT PART	DISPERSAL	ENTRY POTENTIAL	EST.[3] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Fijian fruit fly *(Bactrocera passiflorae)*	Cashew nut, pawpaw, lime, mandarin, passionfruit, mango, avocado, guava, eggplant, cocoa	Fruit	Adults capable of flight	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Pacific fruit fly *(Bactrocera xanthodes)*	Breadfruit, pawpaw, mandarin, guava, tomato, mango, apple, avocado	Fruit	Adults capable of flight	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Melon fruit fly (*Zeugodacus cucurbitae)*	Wide host range including jackfruit, pawpaw, watermelon, pumelo, navel orange, gherkin, melon, cucumber, melon, pumpkin, marrow, cucurbits, quince, common fig, loofah, mango, sapodilla, passionfruit, avocado, common bean, peach, guava, tomato, cowpea	Fruit	Transmitted by infested plant material (fruit)	HIGH	HIGH	HIGH	HIGH	**HIGH**
Lepidoptera (Moths and butterflies)								
Brown-headed leafroller (*Ctenopseustis herana)*[8]	Wide host range including avocado, pome fruit, stone fruit, apples, eucalyptus, oak, acacia, pine	Leaves, fruit	Adults capable of flight	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Brown-headed leafroller (*Ctenopseustis obliquana)*	Apple, Radiata pine, eucalypt, oak, grape, apricot, peach, avocado, blackberry, macadamia, dock, clover, willow, kiwi	Leaves, fruit	Adults capable of flight	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Stenomid (avocado) moth, Avocado fruit borer, Avocado seed moth (*Stenoma catenifer)*	Avocado	Whole plant above ground	Adults capable of flight	HIGH	HIGH	HIGH	HIGH	**HIGH**

[8] The two brown-headed leafrollers C. herana and C. obliquana are identical at all stages - adult moths, eggs, larvae or pupae.

COMMON NAME (SCIENTIFIC NAME)	HOST(S)	AFFECTED PLANT PART	DISPERSAL	ENTRY POTENTIAL	EST.[3] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Thysanoptera (Thrips)								
Avocado thrips (*Scirtothrips perseae)*	Avocado	Fruit, leaves	Hitchhiker on infected plant material[9].	HIGH	HIGH	HIGH	HIGH	**HIGH**
Pathogens								
Bacteria (including phytoplasmas)								
Bacterial canker complex (syn. Avocado blast complex) (*Pseudomonas syringae pv. Syringae, Pantoea agglomerans, Xanthomonas campestris[10])*	Wide host range including onion, leek, capsicum, chrysanthemum, citrus, cucumber, pumpkin, garden dahlia, hibiscus, walnut, lettuce, magnolia, mango, lucerne, rice, passionfruit, avocado, bean, poplar, stone fruit, azalea, roses, tomato, willows, clover, blueberries, grapevine and maize	Whole plant	Transmitted by infested plant material	HIGH	HIGH	HIGH	HIGH	**HIGH**
Fungi (including Oomycetes)								
Avocado scab (*Elsinoe perseae (syn. Sphaceloma perseae))*	Avocado	Whole plant above ground	Wind, rain, insects and infected material	HIGH	HIGH	HIGH	HIGH	**HIGH**
Bark canker *(Phytophthora mengei)*	Avocado	Lower trunk and limbs	Soilborne pathogen. Spread in surface water, infested soil and infected nursery plants, and through mechanical and insect wounds.	HIGH	HIGH	HIGH	HIGH	**HIGH**

[9] Not likely to be spread on mature fruit.
[10] Although P. syringae and X. campestris are found throughout Australia, the SA and Cal organisms are considered to be new 'pathovars'. Attacks plants from the seedling stage through to maturity.

COMMON NAME (SCIENTIFIC NAME)	HOST(S)	AFFECTED PLANT PART	DISPERSAL	ENTRY POTENTIAL	EST.[3] POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Sudden oak death (syn. Ramorum leaf blight) *(Phytophthora ramorum)*	Wide host range including oak tree, Douglas-fir tree, blueberry, avocado	Above ground plant parts	Plant material, water, soilborne.	HIGH	HIGH	HIGH	HIGH	**HIGH**
Laurel wilt *(Raffaelea lauricola)*	*Lauraceae* including avocado	Whole plant	Vectors[11]	HIGH	HIGH	HIGH	HIGH	**HIGH**

[11] Vectored by *Xyleborus glabratus*. According to preliminary studies, avocado fruit is not a pathway. New Ambrosia species were discovered (*Euwallacea sp. aff. fornicatus* and *Microperus* sp.) in Queensland and were found to be carriers of the fungal symbiont under experimental conditions (Geering, 2013).

Pollination pests

Although there are a variety of mechanisms for pollination, the European honey bee (*Apis mellifera*) is the most important insect pollinator of cultivated agricultural and horticultural crops. Pollination services of the European honey bee is provided by beekeepers to growers of pollinator-reliant crops.

As honey bees forage for nectar and pollen their activities pollinate plants, resulting in increased seed or fruit set, improved fruit shape and more even maturation of some crops.

Both established and exotic pests of honey bees (bee pests) and bee species that compete with honey bees (pest bees) can have a major impact on crop pollination services. Bee pests and pest bees can also impact unmanaged colonies which provide "free" pollination.

Avocados are regarded as a pollination-reliant industry and honey bee pests and pest bees can impact the avocado industry, through reduced pollination and therefore yield. A list of the high priority bee pests and pest bees which could impact the avocado industry can be located on the PHA website planthealthaustralia.com.au/industries/honey-bees/ and the BeeAware website beeaware.org.au/pests/

Established pests of biosecurity significance

Introduction

This section identifies established pests of biosecurity significance for the avocado industry in Australia. By identifying pests which avocado producers already have to manage, mechanisms can be put in place to better align industry and government resources and provide a stronger base for biosecurity risk management for the avocado industry.

Identification of established pests of biosecurity significance will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers, surveillance coordinators, diagnosticians and development of pest-specific mitigation activities.

Threat identification

Information on established pests of the avocado industry described in this document came from a combination of:

- past records
- various pest targets under the Avocado Nursery Voluntary Accreditation Scheme (ANVAS)
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment.

In order to be considered as a pest of biosecurity significance, the pests included in Table 2 should be economically important to the avocado industry and at least one of the following:

- restricted to regions within Australia
- notifiable by law
- have market access implications
- able to be prevented from entering a farm through good biosecurity practices.

These pests were considered in an effort to prioritise investment but did not undergo a formal pest risk assessment.

Table 2. Established pests of biosecurity significance

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS	FACTSHEETS	COMMENTS
Invertebrates						
Acari (mites)						
Avocado brown mite (*Oligonychus punicae*)	Avocado, mango	Leaves	Northern Territory[12]	No formal movement restrictions	Not developed	A sporadic pest. Severe infestations tend to occur in border row trees along dirt roads, where road dust is detrimental to mite predators. Ash deposited on leaves from bushfires reportedly also causes brown mite outbreaks.
Coleoptera (beetles and weevils)						
Tea shot-hole borer (*Euwallacea fornicatus*)	Papaya, Carolina poplar, sapodilla, avocado, tea, pomegranate, macadamia[13]	Branches	Queensland[14]	WA	Not developed	Wide spread in north Queensland.
Red shouldered leaf beetle (*Monolepta australis)*	Avocado, carambola, cotton, corn, Eucalyptus, grasses, legumes, lychee, macadamia, mango	Leaves, roots	Australian Capital Territory, New South Wales, Queensland	No formal movement restrictions	https://www.daf.qld.gov.au/business-priorities/agriculture/plants/fruit-vegetable/insect-pests/red-shouldered-leaf-beetle	Form swarms which invade orchards and can cause serious damage within 2-3 hours. However it is only the swarming beetles which cause damage; individuals or small groups are not likely to cause damage.

[12] https://appd.ala.org.au/appd-hub/occurrences/search?taxa=Oligonychus+punicae
[13] https://www.sciencedirect.com/science/article/pii/S1226861518307507?via%3Dihub
[14] http://era.daf.qld.gov.au/id/eprint/2676/1/AV10004-Biosecurity-Capacity-Building-Laurel-Wilt.pdf

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS	FACTSHEETS	COMMENTS
Oribius weevil (*Oribius destructor*)	Capsicum, citrus, strawberry, apple, avocado	Whole plant above ground plant parts	North Queensland	WA	Not developed	Major pest of horticulture in the Papua New Guinea Highlands. Damage is caused by adult feeding which causes leaf shot-holing, stem and fruit scarring, and branch die-back.
Oribius weevil (*Oribius inimicus*)	Wide host range including apple, avocado, capsicum, citrus, coffee, lettuce, orange, peanuts, strawberry, French bean	Whole plant above ground plant parts	North Queensland	WA	Not developed	Major pest of horticulture in the Papua New Guinea Highlands. Damage is caused by adult feeding which causes leaf shot-holing, stem and fruit scarring, and branch die-back.
Swarming leaf beetles (*Rhyparida spp.* including *R. Alcyone, R. amplicollis, R. apicalis, R. australis, R. basipennis, R. brevilineata, R. caeruleipennis, R. clypeata, R. commutabilis, R. copei, R. didyma, R. dimidiate, R. discopunctulata, R. humeralis, R. limbatipennis, R. nitida)*	Wide host range including avocado, lychee, rambutan, durian, mangosteen, maize, sugarcane, ornamentals, native trees (especially *Eucalyptus torelliana* and *Eucalyptus citriodora*), and pasture species	Terminal bud	Found in all districts but more common in north Queensland.	No formal movement controls	https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/pests-field-crops/leaf-beetles https://www.daf.qld.gov.au/business-priorities/agriculture/plants/fruit-vegetable/insect-pests/swarming-leaf-beetles	Major and sporadic. A serious pest in some localities, particularly where orchards are adjacent to pastures or sugarcane or in wet tropical coastal areas.

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS	FACTSHEETS	COMMENTS
Island pinhole borer (*Xyleborus perforans* (syn. *Xyleborus immaturus*))	Avocado	Whole plant above ground plant parts	Queensland, New South Wales[15]	WA	Not developed	No additional comments.
Asian ambrosia beetle (*Xylosandrus crassiusculus*)	Avocado, plum, peach, persimmon, pear, oak, eucalyptus, magnolia, acacia, casuarina, macadamia	Whole plant above ground plant parts	Queensland, New South Wales	WA	biosecurity.govt.nz/dmsdocument/33451/send	Recently detected (February 2019) during routine surveillance in New Zealand. Biosecurity New Zealand is currently undertaking delimiting surveys. Found in traps in NSW and southern Queensland with no associated host data. Associated with the fungus *Ambrosiella roeperi*.
Brown twig beetle (*Xylosandrus morigerus*)	Avocado	Whole plant above ground plant parts	Queensland	No formal movement restrictions	Not developed	No additional comments.

[15] https://appd.ala.org.au/appd-hub/occurrences/search?taxa=Xyleborus+perforans
https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:302b159c-9fd0-4362-a33b-2524c38c80f7

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS	FACTSHEETS	COMMENTS
Hemiptera (Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)						
Banana spotting bug *Amblypelta lutescens*	Papaya, coconut, macadamia nut, mango, cassava, avocado, beans	Fruit	Northern Territory, Queensland, Western Australia	No formal movement restrictions		Avocado orchards are usually sprayed every 2-3 weeks for up to six months from fruit set to control the bugs. They are concentrated in restricted parts of the orchard, along the edge closest to natural breeding areas, in 'hotspot' areas. They do not fly large distances.
Fruit spotting bug *Amblypelta nitida*	Eucalypt[16], macadamia nut, mango, lychee, pecan nuts, avocado	Fruit	Queensland, New South Wales[17]	No formal movement restrictions	https://www.daf.qld.gov.au/business-priorities/agriculture/plants/fruit-vegetable/insect-pests/fruit-spotting-bug	No additional comments.
Trilobite scale *Pseudaonidia trilobitiformis*	Cashew nut, citrus, coconut, coffee, mango, avocado, cocoa, ginger	Leaves	Queensland, Northern Territory[18]	WA	Not developed	No additional comments.
Lepidoptera (Butterflies and moths)						
Avocado leaf roller (*Homona spargotis*)	Avocado, coffee, custard apple, tea	Leaves	Queensland[19]	No formal movement restrictions	https://www.daf.qld.gov.au/business-priorities/agriculture/plants/fruit-vegetable/insect-pests/avocado-leaf-roller	The caterpillars of this moth roll and web leaves together. Severe leaf damage may be caused. Trees in flush are more susceptible

[16] Eucalypt-dominated wet sclerophyll forest and rainforest in the wetter parts of coastal Queensland and northern New South Wales
[17] It seems to occur only along the east coast of Australia. The general limit of its range is the Great Dividing Range.
[18] appd.ala.org.au/appd-hub/occurrences/search?taxa=Pseudaonidia+trilobitiformis#listView
agriculture.gov.au/SiteCollectionDocuments/ba/memos/2006/animal/2006-14a.pdf
[19] https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:d8d32985-c738-47ef-9818-e9a33a70cbc6

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS	FACTSHEETS	COMMENTS
Thysanoptera (Thrips)						
Red-banded thrips *Selenothrips rubrocinctus*	Cashew nut, coffee, persimmon, mangosteen, cotton, mango, avocado, guava, blackberry, raspberry, cocoa, grape	Leaves	Northern Territory, Queensland	No formal movement restrictions		Highly polyphagous, feeding and breeding mostly on tree leaves.
Pathogen						
Fungi (including Oomycetes)						
Seed rot (*Botrytis sp.*)	Avocado	Seed	Widespread	No formal movement restrictions	Not developed	No additional comments.
Black root rot (*Calonectria ilicicola*)	Avocado, papaya, eucalyptus sp., peanut, custard apple.	Whole plant	Queensland	No formal movement restrictions	ngia.com.au/Attachment?Action=Download&Attachment_id=2122	Damaging to the root system of nursery trees and young trees in the field. Not known as a pathogen of mature trees.
Stem dieback or graft rot (*Colletotrichum spp.*)	Avocado	Stems	Widespread	No formal movement restrictions	ngia.com.au/Attachment?Action=Download&Attachment_id=2122	In particular *Colletotrichum gloesporiodes* var. *minus* is a major postharvest disease of avocado in wetter growing areas.
Black root rot (*Dactylonectria spp*).	Avocado, grapevine, kiwifruit, olive	Whole plant	Widespread	No formal movement restrictions	static1.squarespace.com/static/57a92741d1758eb27ea55171/t/5c861031c830254860d71352/1552289843987/APPS+Pathogen+of+the+Month+April+2018.pdf	Severe disease of avocado nursery trees and young orchard transplants. Not known as a pathogen of mature trees.

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS	FACTSHEETS	COMMENTS
Stem dieback or graft rot (Fungi from the family Botryosphaeriaceae, including ***Dothiorella aromatica*** (*Macrophoma aromatica*)	Avocado	Stems	Widespread	No formal movement restrictions	www.ngia.com.au/Attachment?Action=Download&Attachment_id=2122	With changing climatic conditions, particularly higher temperatures, changes in rainfall patterns and more catastrophic environmental events (drought, flooding) this disease is likely to increase in importance to the avocado industry.
Seed rot (Fungi from the family Botryosphaeriaceae)	Avocado	Seed	Widespread	No formal movement restrictions	ngia.com.au/Attachment?Action=Download&Attachment_id=2122	This pathogen is likely seedborne. Therefore use of seed infected with these fungi may increase risk of graft incompatibility and/or branch dieback of the seedling after planting in the orchard.
Diplodia pod rot of cocoa (*Lasiodiplodia theobromae)*	Avocado, citrus, mango, grapefruit, guava, coconut, grapevine, papaya	Whole plant	Northern Territory, New South Wales, Queensland, South Australia, Western Australia	No formal movement restrictions		A major postharvest disease in avocado.
Root rot (*Phellinus noxius*)	Fig, poinciana, leopard tree, avocado, hoop pine	Whole plant	East coast from Cape York to northern New South Wales	No formal movement restrictions	daf.qld.gov.au/__data/assets/pdf_file/0010/51211/phellinus_noxius_web.pdf	Planting in infested sites without removal of the infection source may result in rapid death of new plantings. Root barriers around the infected site may reduce the rate of spread.

COMMON NAME (SCIENTIFIC NAME)	HOSTS	AFFECTED PLANT PART	DISTRIBUTION IN AUSTRALIA	STATE MOVEMENT CONTROLS	FACTSHEETS	COMMENTS
Leaf spot, Cercospora spot (*Pseudocercospora purpurea*)	Avocado	Leaf, fruit	Queensland, Northern Territory	No formal movement restrictions	ngia.com.au/Attachment?Action=Download&Attachment_id=2122	This pathogen is unlikely to cause the death of avocado nursery or field trees, but it may impact on market access.
Phytophthora (including *Phytophthora cinnamomic, Phytophthora cryptogea, Phytophthora cactorum*)	Pineapple, chestnut, cyprus, species in the family Ericaceae including *Rhododendron* spp., *Eucalyptus* spp. especially jarrah (*Eucalyptus marginata*), walnut, pine, almond, cherry, peach, and plum, oak, avocado, cranberry	Whole plant	Widespread	No formal movement restrictions	pestnet.org/fact_sheets/avocado_dieback_120.htm ngia.com.au/Attachment?Action=Download&Attachment_id=2122	Any activity that moves soil, water or plant material can spread Phytophthora. Can remain dormant for long periods making it impossible in most situations to eradicate from infested areas
Viruses and Viroids						
Avocado sunblotch (*Avocado sunblotch viroid*)[20]	Avocado	Whole plant above ground	Sporadic	No formal movement restrictions	planthealthaustralia.com.au/wp-content/uploads/2013/01/Avocado-sunblotch-FS.pdf ngia.com.au/Attachment?Action=Download&Attachment_id=2122	National survey under way.

[20] A sporadic pest in Australia that can be eradicated.

Implementing biosecurity for the Australian Avocado Industry 2019-2024

Following the prioritisation and gap analysis through the Biosecurity Implementation Group (BIG) biosecurity planning process, both industry and government have developed an implementation plan that sets out shared biosecurity goals and objectives. This section contains a Biosecurity Implementation Table which should act as a guide for biosecurity activities for the avocado industry and the government for 2019-2024. It is intended that the plan is monitored using annual review by the Biosecurity Reference Panel.

Biosecurity Implementation Table

The Biosecurity Implementation Table aims to build upon the themes outlined in the Intergovernmental Agreement on Biosecurity (IGAB)[21] and the National Plant Biosecurity Strategy (NPBS)[22] by providing a clear line of sight between the development of this Biosecurity Plan and broader plant health policy and legislation.

This table aims to provide the focus and strategic direction for plant biosecurity activities relating to the avocado industry over the next five years (i.e. the life of this Biosecurity Plan). The table provides specific recommendations on potential biosecurity activities identified by both industry and government to improve biosecurity preparedness for pest threats.

This table has been developed in recognition that biosecurity is a shared responsibility between the avocado industry and governments, and for this reason, the Biosecurity Implementation Table has been produced to help coordinate actions and resources in the biosecurity system, with the view of creating an effective and productive biosecurity partnership. Activities may require additional funding to be sourced prior to commencement. By implementing the specific actions listed in the Biosecurity Implementation Table, it will not only strengthen the avocado biosecurity system, but also the broader plant biosecurity system. Future versions of this table will contain information on the progress made by governments and industry on the Biosecurity Implementation Table (Table 3).

[21] For more information visit agriculture.gov.au/animal-plant-health/pihc/intergovernmental-agreement-on-biosecurity
[22] For more information visit planthealthaustralia.com.au/national-programs/national-plant-biosecurity-strategy/

Table 3. The Biosecurity Implementation Table for the Australian Avocado Industry 2019-2024.

Strategy: Capacity and Capability

Aligns with Strategy 4 of NPBS, Schedule 6 of IGAB

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
A. Establish a biosecurity reference panel to help coordinate industry's future biosecurity activities, develop key biosecurity messages/materials and to review the implementation plan annually.	Avocados Australia, State Government, PHA	Annually	
B. Ensure that reference panel priorities feed through to the relevant funding body (e.g. Hort Innovation) or committee (e.g. national fruit fly council, AGSOC, SPHD, SNPHS).	Avocados Australia, Hort Innovation, PHA, Reference Panel	Annually	
C. Undertake deed training by PHA for Avocados Australia board members and relevant staff.	Avocados Australia, PHA	2020	

Strategy: Plant Biosecurity Education and Awareness

Aligns with Strategy 7 of NPBS, Schedule 6 of IGAB

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
A. Establish a Biosecurity Reference Panel (BRP) to help coordinate future biosecurity activities, develop key biosecurity messages/materials, and review the implementation plan.	PHA (Industry, State Governments)	First year of BP and then annually	
B. Ensure that biosecurity priorities requiring funding, action or notification are tabled with the relevant funding body or committee • BRP to identify potential biosecurity R&D priorities to submit to Hort Innovation • BRP to identify potential cross sectoral R&D priorities to submit to Plant Biosecurity Research Initiative (PBRI) • PHA to establish mechanisms to notify PHC, SNPHS and SPHD of biosecurity priorities	PHA or BRP	Annually at Biosecurity Reference Panel (BRP) meeting	
C. Promote, disseminate and demonstrate biosecurity to industry through industry forums, newsletters, road shows, field days, networks and/or workshops (hardcopy and online): - On-farm biosecurity planning - Reporting anything unusual - Certification of healthy propagation material - Best biosecurity practice such as hygiene principles - Promote bee code of practice with pollination contractors - On-farm biosecurity website: farmbiosecurity.com.au - EPPRD and owner reimbursement cost (ORC) frameworks - Economic case for good biosecurity practice (e.g. what would the cost of a specific incursion be)	Avocados Australia, PHA	Ongoing	Avocado Nursery Voluntary Accreditation Scheme (ANVAS), Avocados Australia Industry Development Manager, Avocados Australia Communications Manager
D. Develop awareness materials (e.g. on farm biosecurity planner, fact sheets (practice or pest specific), pest guides, shed poster etc), case studies and scenarios to encourage industry engagement on biosecurity issues.	Avocados Australia, State Government, PHA	2020	Avocados Australia and Queensland Department of Agriculture and Fisheries are updating a shed poster for HPPs.

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
E. Review the orchard biosecurity manual for the avocado industry and distribute to growers through awareness activities in growing regions.	Avocados Australia, Hort Innovation, PHA	2020	Version 1.0, published 2011, is currently in use by the avocado industry.
F. Review and develop detailed fact sheets on the following pests and publish them on the Avocados Australia Best Practice Resource <u>Pathogens</u> • Bark canker (*Phytophthora mengei*) • Bacterial canker complex (*Pseudomonas syringae pv. syringae, Pantoea agglomerans, Xanthomonas campestris*) <u>Invertebrates</u> • Small avocado seed weevil (*Conotrachelus aguacatae*) • Small seed weevil (*Conotrachelus perseae*) • Large seed weevil, Avocado seed weevil (*Heilipus lauri*)	Avocados Australia, Hort Innovation, PHA	Annually	
G. Identify industry biosecurity training and extension needs, recommend priorities.	Reference Panel, PHA	Annually	
H. Monitor the Fruit Fly Council newsletter for issues relevant to the avocado industry.	Avocados Australia	Ongoing	
I. Raise awareness of the BeeAware website: beeaware.org.au and subscribe to the BeeAware newsletter.	Avocados Australia, PHA	Ongoing	

Strategy: Preparedness and Response

Aligns with Strategy 3 of NPBS, Schedule 7 of IGAB

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
A. Engage in developing a laurel wilt (*Raffaelea lauricola*) industry preparedness project containing: - an industry specific business continuity plan - a pathway analysis review - categorisation in the Emergency Plant Pest Response Deed - awareness material such as factsheets - finalise the National Diagnostic Protocol for laurel wilt.	Avocados Australia, Hort Innovation, PHA	Annually	Currently SPHD have developed a draft National Diagnostic Protocol for Laurel wilt.
B. Develop/Update a cross sectoral contingency plan for - Brown-headed leafroller (*Ctenopseustis obliquana* and *Ctenopseustis herana*) - Bacterial canker complex (*Pseudomonas syringae pv. syrinage*)	Avocados Australia, Relevant Industries, PBRI, Commonwealth, PHA	Annually	
C. To investigate the development of a shelf/emergency permits with the APVMA for *Scirtothrips perseae* and Lepidoptera for the Australian avocado industry. If required identify trial work required to acquire a permit.	Avocados Australia, Hort Innovation, APVMA, PHA	2020	Generation of data for pesticide applications in horticulture crops R&D project in progress.
D. Promote clean planting material through Avocado Nursery Voluntary Accreditation Scheme (ANVAS).	Avocados Australia, State Government, Commonwealth, PHA	Ongoing	The outcomes of the current R&D project investigating tree mortality during early field establishment and project implementation of recommendations from the avocado industry nursery voluntary accreditation scheme review will improve this program into the future.

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
E. Consider a simulation exercise for a HPP incursion; particularly to test the ability to reach out/communicate to all parts of the avocado supply chain.	Avocados Australia, Hort Innovation and other relevant RDCs, State Government, Commonwealth, PHA	2021	
F. Engage with cross sectoral initiatives to improve preparedness for and response to *Xylella fastidiosa*.	Avocados Australia, Relevant industries, Hort Innovation, State Government, Commonwealth, PHA	Ongoing	Avocados Australia engaged with the Xylella coordinator.
G. Engage with preparedness and response activities developed for bee pests such as Varroa e.g. simulation activities and National Bee Pest Surveillance and remain up to date with the latest RD&E about optimal pollination and alternative pollinators.	Relevant Industries, Hort Innovation, State Government, Commonwealth, PHA	Ongoing	
H. Update the industry member database to facilitate critical information in the event of an emergency response.	Avocados Australia, PHA	Ongoing	The Australian Tree Crop Rapid Response Map is available online and can help inform management during disease outbreaks.
I. Maintain a positive PHA and an EPPR levy set at zero as a mechanism to fund industry biosecurity measures.	Avocados Australia, Commonwealth, PHA	Ongoing	
J. Consider categorisation of these industry specific High Priority Pests in the Emergency Plant Pest Response Deed: • Small avocado seed weevil (*Conotrachelus aguacatae*) • Small seed weevil (*Conotrachelus perseae*) • Large seed weevil, avocado seed weevil (*Heilipus lauri*) • Persea mite (*Oligonychus perseae*) • Stenomid (avocado) moth, Avocado fruit borer, Seed moth (*Stenoma catenifer*) • Avocado thrips (*Scirtothrips perseae*) • Avocado scab (*Elsinoe perseae)*	Avocados Australia, State Government, Commonwealth, PHA	Annually	

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
• Bark canker (*Phytophthora mengei*)			
K. Develop an owner reimbursement cost framework	Avocados Australia, PHA	2021	

Strategy: Surveillance

Aligns with Strategy 2 of NPBS, Schedule 4 of IGAB

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
A. Raising industry awareness of HPPs and exotic pests to ensure better monitoring across the industry regardless of whether a pest is found or not.	Avocados Australia	Ongoing	Industry promote the Avocado Problem Solver Field Guide which contains information on exotic pests and best practice. The avocado industry biosecurity capacity building R&D project will deliver articles on some exotic pests.
B. Establish and maintain linkages with the International Plant Sentinel Network to remain informed about plant pests affecting avocado crops overseas.	Avocados Australia, PHA	Ongoing	Avocados Australia kept informed through PHA updates
C. Establish and maintain linkages with the National Forest Biosecurity Coordinator, Director of plant surveillance (NAQS) and Northern Australia Surveillance Manager to remain informed about surveillance activities underway in other industries.	Avocados Australia, Commonwealth (NAQS), PHA	Ongoing	Avocados Australia kept informed through PHA updates.
D. Understand what surveillance is taking place for HPPs (exotic and established) and consider a surveillance strategy (in a workshop) which recommends surveillance for industry HPPs, linking industry and government efforts.	Avocados Australia, Hort Innovation, State Governments, Commonwealth (SNPHS), PHA, Reference Panel	Annually	
E. Avocados Australia will continue to support funding of the National Bee Pest Surveillance Program, which is designed to detect new incursions of exotic bee pests and pest bees.	Avocados Australia, Hort Innovation, State Governments, Commonwealth, PHA	Year 2019-2024	The avocado R&D levy is currently contributing funding towards the National Bee Pest Surveillance Program.

Strategy: Diagnostics

Aligns with Strategy 5 of NPBS, Schedule 4 of IGAB

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
A. To raise diagnostic priorities with SPHD on an annual basis where priorities change.	Avocados Australia, Commonwealth (SPHD), PHA, Reference Panel	Annually	Avocados Australia have noted the need to get the diagnostic protocol for laurel wilt updated from draft to final as the top priority for industry.
B. Ensure awareness of diagnostic capacity for industry HPPs both laboratory capabilities and which pests have protocols available for diagnostics.	Avocados Australia, State Government, Commonwealth (SPHD), Reference Panel	Annually	
C. Keep informed of activities with SPHD and SNPHS through the diagnostic and surveillance network coordinator.	Avocados Australia, Commonwealth (SPHD), PHA, Reference Panel	Annually	PHA has recently appointed a diagnostic and surveillance network coordinator.
D. Maintain and develop diagnostic protocols for exotic and quarantinable pests and pathogens.	Commonwealth (SPHD), Horticulture Innovation, Reference Panel	Annually	Avocado industry biosecurity capacity building R&D project is supporting this action.
E. Consider the suitability for the *avocado sunblotch viroid* diagnostic protocol to get national endorsement.	Commonwealth (SPHD), Reference Panel	2020	

Strategy: Established Pests

Aligns with Strategy 6 of NPBS, Schedule 5 of IGAB

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
A. Raise industry awareness of pests of biosecurity significance and demonstrate how best biosecurity practice has direct relevance to day to day operations for pests already within Australia as well as exotic pests (e.g. western flower thrips).	Avocados Australia, Hort Innovation, State Government, PHA	Ongoing	Current projects in place supporting industry communication, extension and industry development.
B. Maintain Avocados Australia's on-line Best Practice Resource with current best practice information.	Avocados Australia, Hort Innovation	Ongoing	Best Practice Resource established with high level of use.
C. Continue cross sectoral research communication to manage *Phytophthora cinnamomi* in tree crops more generally.	Relevant Industries, Hort Innovation and other relevant RDCs	Ongoing	

Strategy: Biosecurity Research, Development and Extension (RD&E)

Aligns with Strategy 8 of NPBS, Schedule 8 of IGAB

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
A. Prioritise biosecurity RD&E annually to feed into Hort Innovation plant biosecurity RD&E implementation priorities.	Avocados Australia, Reference Panel	Annually	
B. Consider collaborative opportunities to maximise R&D investment in biosecurity.	Avocados Australia, Hort Innovation and other relevant RDCs, NPBRDES IC, National Fruit Fly Council, PBRI, Commonwealth, PHA	Ongoing	
C. Support and monitor fruit fly RD&E initiatives that will provide more flexible export trade relevant to the Avocado industry.	Avocados Australia, Hort Innovation, Fruit Fly Fund	Ongoing	
D. Continue investing in alternate pollinator/optimal pollination R&D as a preparedness initiative for bee pests.	Avocados Australia, Relevant Industries, Relevant R&D Providers, Hort Innovation Pollination Fund, PHA	Year 2019-2020	
E. Continue investing in R&D for workable market access protocols	Avocados Australia, Hort Innovation	Ongoing as required	MT14052 – Market access data packages

Strategy: Legislative and Regulatory Issues of Importance

Aligns with Strategy 1 of NPBS

ACTION	RESPONSIBLE PARTY	DUE DATE	CURRENT ACTIVITIES
A. Raise awareness that all states have a responsibility to practice good biosecurity under the Biosecurity Act, 2015. Some states may have quite specific legislative approaches whilst others have a more general approach, e.g. The General Biosecurity Obligation (in QLD), General Biosecurity Duty (NSW).	Avocados Australia, State Governments, Commonwealth, PHA	Ongoing	
B. States to inform industry and in turn industry to raise awareness with growers on each state legislative requirements in relation to pest reporting and management of neglected orchards. • Avocados Australia to provide the Qld and NSW General Biosecurity Obligation factsheets on their website.	Avocados Australia, State Governments, PHA	2019	

Australian Avocado industry - biosecurity preparedness

The following table (Table 4) has been populated with the high priority pests of the avocado industry. The aim of this table is to document the current preparedness documents and activities which are available and are currently being undertaken. This will allow industry, governments and RD&E agencies to better prepare for these high priority pests and align future activities as listed in the Biosecurity Implementation Table (Table 3).

Table 4. Documents and activities currently available for high priority pests of the avocado industry[23]

COMMON NAME (SCIENTIFIC NAME)	NATIONAL DIAGNOSTIC PROTOCOL[24]	SURVEILLANCE PROGRAMS	FACT SHEETS[25]	CONTINGENCY PLAN	EPPRD CATEGORY	NATIONAL PRIORITY PEST	COLLABORATORS[26]
Invertebrates							
Coleoptera (Beetles and weevils)							
Small avocado seed weevil (*Conotrachelus aguacatae*)	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	-
Small seed weevil (*Conotrachelus perseae*)	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	-
Large seed weevil, avocado seed weevil (*Heilipus lauri*)	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	-
Hemiptera (stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)							
Papaya mealybug (*Paracoccus marginatus*)	Not developed	Yes- NAQS	Yes-Papaya industry	Yes-Papaya Industry[27]	Not categorised	Not listed	Papaya and Coffee
Acari (Mites)							
Persea mite (*Oligonychus perseae*)	Not developed	Not covered by a pest specific surveillance program	Yes-Avocado industry	Not developed	Not categorised	Not listed	-

[23] Information presented has been taken from the National Plant Biosecurity Status Report 2018 and confirmed or updated through either Plant Health Committee, the Subcommittee on Plant Health Diagnostic Standards, the Subcommittee on National Plant Health Surveillance or other stakeholders
[24] Copies of these documents are available from planthealthaustralia.com.au/pidd
[25] Copies of these documents are available from planthealthaustralia.com.au/pidd
[26] Industries listed in this column identify these pests within their biosecurity plans.
[27] The threat specific contingency plan for Papaya mealy bug can be found on **planthealthaustralia.com.au/pests/papaya-mealy-bug/**

COMMON NAME (SCIENTIFIC NAME)	NATIONAL DIAGNOSTIC PROTOCOL[24]	SURVEILLANCE PROGRAMS	FACT SHEETS[25]	CONTINGENCY PLAN	EPPRD CATEGORY	NATIONAL PRIORITY PEST	COLLABORATORS[26]
Diptera (Flies and midges)							
Mexican fruit (*Anastrepha ludens*)	Not developed[28]	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	-
Carambola fruit fly (*Bactrocera carambolae*)	Not developed[28]	Yes – Northern Australia (NAQS), NSW, QLD, SA, TAS, VIC, WA	Yes- Avocado, Mango, Papaya and Summerfruit industries	Not developed	Not categorised	Yes- 3	Banana, Citrus, Papaya, Passionfruit, Tomato, Tropicals, Vegetable
Oriental fruit fly (*Bactrocera dorsalis* (syn. *B. invadens, B. papayae, B. philippinensis*))	Not developed[28][29]	Yes –, Northern Australia (NAQS), NSW, NT, QLD, SA, TAS, VIC, WA	Yes – Apple and Pear, Citrus, Avocado, Mango, Papaya, Cherry and Summerfruit industries	Not developed	2	Yes- 3	Apple & Pear, Banana, Cherry, Citrus, Lychee, Melon, Papaya, Passionfruit, Summerfruit, Tomato, Vegetable, Viticulture (Dried, Table and Wine Grapes)
Tongan fruit fly (*Bactrocera facialis*)	Not developed[28]	Yes-NSW, NT, QLD, SA, TAS, VIC, WA	Not developed	Not developed	Not categorised	Yes- 3	Passionfruit, Tomato, Tropicals
Sri Lankan fruit fly (*Bactrocera kandiensis*)	Not developed[28]	Yes- NT, QLD, SA, TAS, VIC, WA	Not developed	Not developed	Not categorised	Yes- 3	Citrus, Passionfruit
Fijian fruit fly (*Bactrocera kirki*)	Not developed[28]	Yes – Northern Australia (NAQS), NSW, NT, QLD, SA, TAS, VIC, WA	Not developed	Not developed	Not categorised	Yes- 3	Passionfruit
Cook Islands fruit fly (*Bactrocera melanotus*)	Not developed[28]	Yes- NSW, NT, QLD, SA, TAS, VIC, WA	Not developed	Not developed	Not categorised	Yes- 3	Passionfruit

[28] The Australian handbook for the identification of fruit flies provides diagnostic information on this species. Available at: fruitflyidentification.org.au/lookup-species/

[29] An International Plant Protection Convention protocol exists. Note this diagnostic protocol may has not been tested for use in Australia. Available at: ippc.int/en/news/bactrocera-dorsalis-new-ippc-diagnostic-protocol-adopted/

COMMON NAME (SCIENTIFIC NAME)	NATIONAL DIAGNOSTIC PROTOCOL[24]	SURVEILLANCE PROGRAMS	FACT SHEETS[25]	CONTINGENCY PLAN	EPPRD CATEGORY	NATIONAL PRIORITY PEST	COLLABORATORS[26]
Fijian fruit fly (*Bactrocera passiflorae*)	Not developed[28]	Yes – Northern Australia (NAQS), NSW, NT, QLD, SA, TAS, VIC, WA	Yes- Papaya industry	Not developed	Not categorised	Yes- 3	Papaya, Passionfruit, Tropicals, Vegetables
Pacific fruit fly (*Bactrocera xanthodes*)	Not developed[28]	Yes – Northern Australia (NAQS), NSW, NT, QLD, SA, TAS, VIC, WA	Not developed	Not developed	Not categorised	Yes- 3	Passionfruit
Melon fruit fly (*Zeugodacus cucurbitae*)	Not developed[28]	Yes- NSW, QLD	Not developed	Not developed	Not categorised	Yes- 3	Tomato
Lepidoptera (Butterflies and moths)							
Brown-headed leafroller *(Ctenopseustis herana)*	Not developed[30]	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	Apple and Pear
Brown-headed leafroller *(Ctenopseustis obliquana)*	Not developed	Not covered by a pest specific surveillance program	Yes-Cherry industry	Not developed	Not categorised	Not listed	Apple and Pear, Blueberry, Cherry, Summerfruit, Viticulture
Stenomid (avocado) moth, avocado fruit borer, avocado seed moth *(Stenoma catenifer)*	Not developed	Not covered by a pest specific surveillance program	Yes-Avocado industry	Not developed	Not categorised	Not listed	-

[30] The two brown-headed leafrollers C. herana and C. obliquana are identical at all stages - adult moths, eggs, larvae or pupae.

COMMON NAME (SCIENTIFIC NAME)	NATIONAL DIAGNOSTIC PROTOCOL[24]	SURVEILLANCE PROGRAMS	FACT SHEETS[25]	CONTINGENCY PLAN	EPPRD CATEGORY	NATIONAL PRIORITY PEST	COLLABORATORS[26]
Thysanoptera (Thrips)							
Avocado thrips *(Scirtothrips perseae)*	NDP 3	Not covered by a pest specific surveillance program	Yes- Avocado industry	Not developed	Not categorised	Not listed	-
Pathogens							
Bacteria							
Bacterial canker complex (syn. Avocado blast complex) *(Pseudomonas syringae pv. syringae, Pantoea agglomerans, Xanthomonas campestris)*	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	Nursery and Garden
Fungi (including Oomycetes)							
Avocado scab (*Elsinoe perseae (syn. Sphaceloma perseae*))	In development	Not covered by a pest specific surveillance program	Yes- Avocado industry	Not developed	Not categorised	Not listed	-
Bark canker *(Phytophthora mengei)*	Not developed	Surveillance- Qld[9]	Not developed	Not developed	Not categorised	Not listed	-
Sudden oak death (syn. Ramorum leaf blight) (*Phytophthora ramorum*)	NDP 5	Surveillance- Qld[31]	Yes-Nursery and Garden, Tea Tree and Plantation Forestry Industries	Yes- Sudden Oak death CP	1	Yes-16	Truffle, Cutflower, Blueberry, Nursery and Garden, Nut, Tea Tree and Plantation forest.

[31] Surveillance program is applicable for all *Phytophthora* spp.

COMMON NAME (SCIENTIFIC NAME)	NATIONAL DIAGNOSTIC PROTOCOL[24]	SURVEILLANCE PROGRAMS	FACT SHEETS[25]	CONTINGENCY PLAN	EPPRD CATEGORY	NATIONAL PRIORITY PEST	COLLABORATORS[26]
Laurel wilt (*Raffaelea lauricola*)	Draft	Not covered by a pest specific surveillance program	Yes- Avocado industry	Not developed	Not categorised	Not listed	-

Avocado industry biosecurity statement

All EPPRD Parties are required under Clause 13 of the EPPRD to produce a Biosecurity statement, the purpose of which is to provide acknowledgement of and commitment to risk mitigation measures and preparedness activities related to plant biosecurity. The Biosecurity statement will inform all Parties of activities being undertaken by the Industry Party to meet this commitment. Parties are required to report to PHA each year any material changes to the content of, or the Party's commitment to, the Party's Biosecurity statement. Biosecurity statements are included in Schedule 15 of the EPPRD, which can be found on the PHA website at planthealthaustralia.com.au/biosecurity/emergency-plant-pest-response-deed/

NATIONAL BIOSECURITY SYSTEM

What is biosecurity and why is it important?

Plant biosecurity is a set of measures which protect the economy, environment and community from the negative impacts of plant pests. A fully functional and effective biosecurity system is a vital part of the future profitability, productivity and sustainability of Australia's plant production industries and is necessary to preserve the Australian environment and way of life.

Plant pests are insects, mites, snails, nematodes or pathogens (diseases) that have the potential to adversely affect food, fibre, ornamental crops, bees and stored products, as well as environmental flora and fauna. For agricultural systems, if exotic pests enter Australia they can reduce crop yields, affect trade and market access, significantly increase costs to production and in the worst-case scenario, bring about the complete failure of a production system. Historical examples present us with an important reminder of the serious impact that exotic plant pests can have on agricultural production.

Australia's geographic isolation and lack of shared land borders have, in the past, provided a degree of natural protection from exotic plant pest threats. Australia's national quarantine system also helps to prevent the introduction of harmful exotic threats to plant industries. However, there will always be some risk of an exotic pest entering Australia, whether through natural dispersal (such as wind) or assisted dispersal as a result of increases in international tourism, imports and exports, mail and changes to transport procedures (e.g. refrigeration and containerisation of produce).

The plant biosecurity system in Australia

Australia has a unique and internationally recognised biosecurity system to protect our plant production industries and the natural environment against new pests. The system is underpinned by a cooperative partnership between plant industries and all levels of government.

The framework for managing the cooperative partnership for delivering an effective plant biosecurity system is built on a range of strategies, policies and legislation, such as the Intergovernmental Agreement on Biosecurity (IGAB) and the National Plant Biosecurity Strategy (NPBS). These not only provide details about the current structure but provide a vision of how the future plant biosecurity system should operate.

Australia's biosecurity system has been subject to several reviews in recent times, with the recommendations recognising that a future-focused approach is vital for maintaining a strong and resilient biosecurity system that will protect Australia from new challenges. As a result, there is a continuous improvement from industry and governments to Australia's plant biosecurity system, with the key themes including:

- Targeting what matters most, including risk-based decision making and managing biosecurity risks across the biosecurity continuum (pre-border, border and post-border)
- Good regulation, including reducing regulatory burden and having effective legislation in place
- Better processes, including service delivery modernisation with electronic, streamlined systems
- Sharing the responsibility, including maintaining productive relationships with all levels of government, primary industries and the wider Australian public

- Maintaining a capable workforce.

Through these themes, a focus on the biosecurity continuum better supports consistent service delivery offshore, at the border, and onshore, and provides an effective biosecurity risk management underpinned by sound evidence and technical justification.

The benefits of the modern biosecurity system are realised by industry, government and the community, with positive flow on effects to the economy more generally. This occurs through streamlined business processes, productivity improvements and reduced regulatory burden in a seamless and lower cost business environment, by emphasising risk-based decision making and robust partnerships.

Avocado peak industry body

Avocados Australia is the peak industry body for the avocado industry. They are a signatory to the EPPRD and are the key industry contact point if a suspect emergency plant pest affecting the avocado industry is detected. For further information about Avocados Australia in relation to response procedures following the identification of a suspect exotic pest refer to page 68. For a background on the avocado industry, refer to page 73.

Plant Health Australia

Plant Health Australia (PHA) is the national coordinator of the government-industry partnership for plant biosecurity in Australia.

PHA is a not-for-profit, subscription-funded public company based in Canberra. PHA's main activities are funded from annual subscriptions paid by members. The Australian Government, state and territory governments and 39 plant industry organisations are all members of PHA and each meet one third of the total annual membership subscription. This tripartisan funding model ensures the independence of the company.

The company was formed to address priority plant health issues, and to work with all its members to develop an internationally outstanding plant health management system that enhances Australia's plant health status and the sustainability and profitability of plant industries. Through PHA, current and future needs of the plant biosecurity system can be mutually agreed, issues identified, and solutions to problems found. PHA's independence and impartiality allow the company to put the interests of the plant biosecurity system first and support a longer-term perspective.

For more information about PHA visit planthealthaustralia.com.au

The Biosecurity Plan

The Biosecurity Plan for the Avocado Industry was developed in consultation with the Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG), which consisted of plant health and biosecurity experts and industry representatives. These groups were coordinated by Plant Health Australia (PHA) and included representatives from Avocados Australia, relevant state and territory agriculture agencies and PHA.

The biosecurity plan not only details exotic pest threats of the Australian avocado industry but also contains information on the current mitigation and surveillance activities being undertaken and identifies contingency plans, fact sheets and diagnostic protocols that have been developed for pests relevant to the industry.

This plan is a framework to coordinate biosecurity activities and investment for Australia's avocado industry and to address the strengths and weaknesses in relation to industry's current biosecurity position. It provides a mechanism for industry, governments and stakeholders to better prepare for and respond to, incursions of pests that could have significant impacts on the avocado industry.

Biosecurity planning

Biosecurity planning provides a mechanism for the avocado industry, government and other relevant stakeholders to actively determine pests of highest priority, analyse the risks they pose and put in place practices and procedures that would rapidly detect an incursion, minimise the impact if a pest incursion occurs and/or reduce the chance of pests becoming established. Effective industry biosecurity planning relies on all stakeholders, including government agencies, industry, and the public (Figure 1).

Ensuring the avocado industry has the capacity to minimise the risks posed by pests, and to respond effectively to any pest threats is a vital step for the future sustainability and viability of the industry. Through this pre-emptive planning process, the industry will be better placed to maintain domestic and international trade and reduce the social and economic costs of pest incursions on both growers and the wider community. The information gathered during these processes provides additional assurance that the Australian avocado industry is free from specific pests and has systems in place to control and manage biosecurity risks, which assists the negotiation of access to new overseas markets.

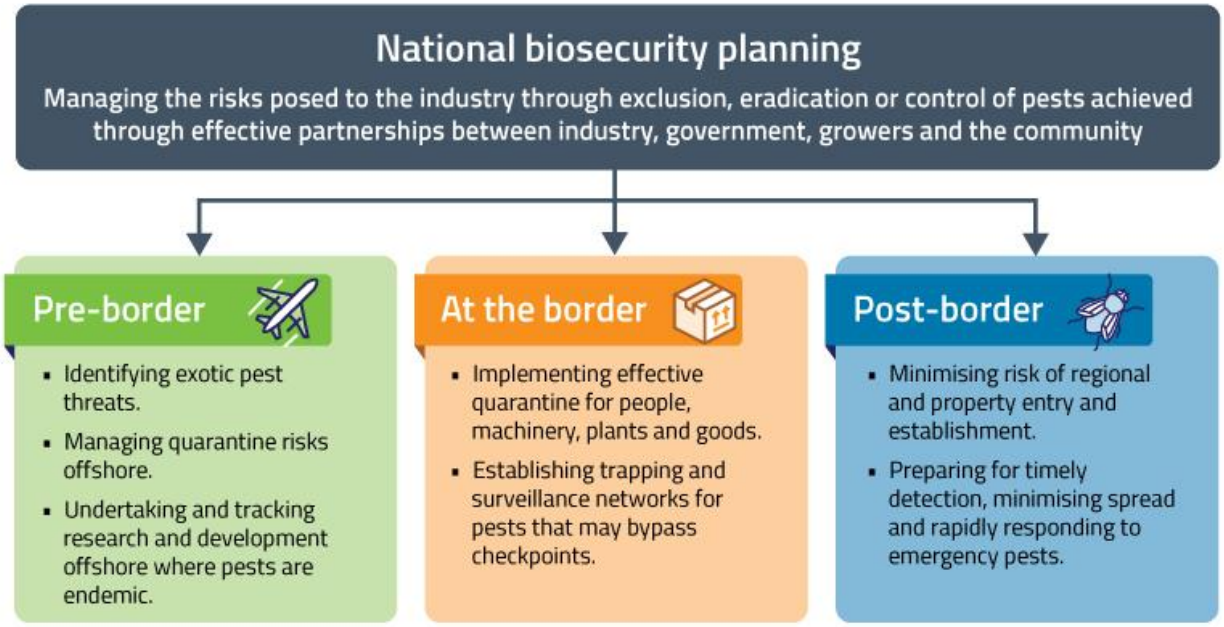

Figure 1. Industry biosecurity: a shared responsibility.

Biosecurity Plan development

With the assistance of Avocados Australia, a Technical Expert Group (TEG) and a Biosecurity Implementation Group (BIG) were formed to work on the review of the Biosecurity Plan for the Avocado Industry (BP). These groups were coordinated by Plant Health Australia (PHA) and included representatives from Avocados Australia, relevant state and territory agriculture agencies and PHA (

Table 5 and Table 6).

Key roles of the Technical Expert Group for the BP included:

- identifying and documenting key threats to the avocado industry
- confirming an agreed high priority pest (HPP) list.

Key roles of the Biosecurity Implementation Group for the BP included:

- documenting pest-specific fact sheets, contingency plans, diagnostic protocols and surveillance programs for HPPs
- documenting the roles and responsibilities of stakeholder groups
- developing a biosecurity implementation table for future biosecurity related work to be conducted over the life of this biosecurity plan.

Table 5. Members of the Technical Expert Group (TEG) and/or the Biosecurity Implementation Group (BIG)

NAME	ORGANISATION	AREA OF EXPERTISE	MEMBER OF TEG	MEMBER OF BIG
Amanda Kobelt	Ag Vic	Entomology	✓	
Elizabeth Minchinton	Ag Vic	Pathology	✓	
Dudley Mitchell	Avocados Australia	Industry	✓	✓
Tom Silver	Avocados Australia	Industry	✓	✓
John Tyas	Avocados Australia	Industry	✓	✓
Corrine Jasper	Hort Innovation	Industry		✓
Penny Measham	Hort Innovation	Industry	✓	
Pip Cotter	NSW DPI	Industry Extension		✓
Rebekah Pierce	NSW DPI	Industry Extension		✓
Jo Lee	PHA	Biosecurity	✓	✓
Rodney Turner	PHA	Biosecurity	✓	✓
Bridie Carr	QDAF	Industry Extension	✓	
Lindy Coates	QDAF	Pathology	✓	
Christine Horlock	QDAF	Pathology	✓	✓
Simon Newett	QDAF	Industry Extension	✓	
Ian Newton	QDAF	Entomology	✓	
Elizabeth Dann	University of Queensland	Pathology	✓	✓
Andrew Geering	University of Queensland	Virology	✓	
Louisa Parkinson	University of Queensland	Pathology	✓	
Alison Mackie	WA DPIRD	Industry	✓	
Declan McCauley	WA DPIRD	Industry	✓	

Table 6. Scientists and others who contributed information for the review of the biosecurity plan[32]

NAME	ORGANISATION	AREA OF EXPERTISE
Brad Siebert	New Zealand Avocado	Industry / Biosecurity
Leandra Fernandes	PHA	Biosecurity
Emily Lamberton	PHA	Biosecurity
Victoria Ludowici	PHA	Biosecurity
Jenny Shanks	PHA	Biosecurity

[32] These people did not attend the technical expert group or biosecurity implementation group meetings but were approached for assistance during the biosecurity plan review process.

Review processes

With the support of the relevant industry bodies and PHA this plan should be reviewed on a 5-year basis. The review process will ensure:

- Threat Summary Tables are updated to reflect current knowledge
- pest risk assessments are current
- changes to biosecurity processes and legislation is documented
- contact details and the reference to available resources is accurate

In addition to the formal review process above, the document should be reviewed/revisited annually by a Biosecurity Reference Panel comprised of industry, government and PHA to ensure currency and relevance and to monitor progress with implementation. As an example, the industry biosecurity priorities identified within the plan could feed directly into industry R&D priority setting activities on an annual basis.

Opportunities to make out-of-session changes to the biosecurity plan, including the addition/subtraction of high priority pests or changes to legislation are currently being investigated. Such changes would need to include consultation and agreement of industry and government. This flexibility will facilitate the plan's currency and relevance.

THREAT IDENTIFICATION AND PEST RISK ASSESSMENTS

Introduction

This section identifies high risk exotic pest threats to the avocado industry, and presents a framework for assessing the potential economic, social and environmental impacts associated with each threat. This part of the biosecurity plan uses a nationally consistent and coordinated approach to threat identification and risk assessment to provide a strong base for future risk management in the avocado industry.

By identifying key threats, a pre-emptive approach may be taken to risk management. Under this approach, mechanisms can be put into place to increase our response effectiveness if pest incursions occur. One such mechanism is the EPPRD that has been negotiated between PHA's government and industry members. The EPPRD ensures reliable and agreed funding arrangements are in place in advance of EPP incursions, and assists in the response to EPP incursions, particularly those identified as key threats.

Identification of high risk exotic pests will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers and diagnosticians, and development of pest-specific incursion response plans.

Established pests of biosecurity significance have also been considered in this plan. It is well understood that good biosecurity practice is beneficial for the ongoing management of established pests, as well as for surveillance and early detection of exotic pests. Established pests cause ongoing hardships for growers and these pests have been listed with the support of industry and government in recognition that they need a strategic, consistent, scientific and risk-based approach to better manage these pests for the avocado industry.

Exotic pests of the avocado industry

Threat identification

Information on exotic pest threats to the avocado industry described in this document came from a combination of:

- past records
- industry practice and experience

- relevant published literature
- local industry and overseas research
- specialist and expert judgment

At this time, only invertebrate pests (insects, mites, molluscs and nematodes) and pathogens (disease causing organisms) have been identified, for risk assessment as these are what are responded to under national agreed arrangements, under the EPPRD. If exotic weeds were to be included in the EPPRD then this would be revisited through future reviews of the plan.

Pest risk assessments

The assessment process used in this BP was developed in accordance with the International Standards for Phytosanitary Measures (ISPM) No. 2 and 11 [Food and Agriculture Organization of the United Nations (FAO), 2004; 2007]. A summary of the pest risk analysis protocol followed in this BP is shown in Table 7, and the complete protocol used for pest risk analysis in this BP can be found on the PHA website.

While there are similarities in the ranking system used in this document and the Biosecurity Import Risk Analysis (BIRA) process followed by the Department of Agriculture (DA), there are differences in the underlying methodology and scope of consideration that may result in different outcomes between the two assessment systems. This includes different guidance to assignment of qualitative probabilities when compared with DA's BIRA process.

Modifications of the DA (Department of Agriculture Fisheries and Forestry, 2011) protocol have been made to suit the analysis required in the BP development process, including, but not limited to:

- Entry potential: The determination of entry potential in this BP takes into account multiple possible pathways for the legal importation of plant material as well as illegal pathways, contamination and the possibility of introduction through natural means such as wind. Therefore, the scope is wider than that used by the DA in their BIRA process, which only considers legal importation of plants or plant commodities.
- Potential economic impact of pest establishment in this document only takes into account the impacts on the avocado industry. The DA BIRA process has a wider scope, including the effects to all of Australia's plant industries, trade, the environment and public health.
- Risk potentials and impacts: The number of categories used in this BP for describing the entry, establishment, spread, and potential economic impact (see 'Description of terms used in pest risk tables', page 58) differs in comparison to that used in the DA BIRA process.

Table 7. Summary of pest risk assessment process used in BPs.

Step 1	Clearly identify the pest	• Generally, pest defined to species level • Alternatively, a group (e.g. family, genus level) can be used • Sub-species level (e.g. race, pathovar, etc.) may be required
Step 2	Assess entry establishment and spread likelihoods	• Assessment based on current system and factors • Negligible, low, medium, high or unknown ratings
Step 3	Assess the likely consequences	• Primarily based on likely economic impact to industry based on current factors • Negligible, low, medium, high, extreme or unknown ratings
Step 4	Derive overall risks	• Entry, establishment and spread likelihoods are combined to generate a likelihood score • Likelihood score combined with the likely economic impact to generate an overall risk score
Step 5	Review the risks	• Risk ratings should be reviewed with the BP

The objective of risk assessment is to clearly identify and classify biosecurity risks and to provide data to assist in the evaluation and treatment of these risks. Risk assessment involves consideration of the sources of risk, their consequences, and the likelihood that those consequences may occur. Factors that affect the consequences and likelihood may be identified and addressed via risk mitigation strategies.

Risk assessment may be undertaken to various degrees of refinement, depending on the risk information and data available. Assessment may be qualitative, semi-quantitative, quantitative, or a combination of these. The complexity and cost of assessment increase with the production of more quantitative data. It is often more practical to first obtain a general indication of the level of risk through qualitative risk assessment, and if necessary, undertake more specific quantitative assessment later [Australian Standard/New Zealand Standard (AS/NZS) ISO 31000, 2009].

Ranking pest threats

Key questions required for ranking the importance of pests include the following:

- What are the probabilities of entry into Australia, establishment and spread, for each pest?
- What are the likely impacts of the pest on cost of production, overall productivity and market access?
- How difficult is each pest to identify and control and/or eradicate?

The TSTs (Appendix 2: Threat Summary Tables) present a list of potential plant pest threats to the avocado industry and provide summarised information on entry, establishment and spread potential, the economic consequences of establishment and eradication potential (where available). The most serious threats from the TSTs were identified through a process of qualitative risk assessment and are listed in the HPP list (Table 1).

> This document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling). This is a broader view of potential risk than the BIRA conducted by the Department of Agriculture which focus only on specific regulated import pathways.

When a pest that threatens multiple industries is assessed, the entry, establishment and spread potentials take into account all known factors across all host industries. This accurately reflects the ability of a pest to enter, establish and spread across Australia and ultimately results in different industries, and their BPs, sharing similar pest ratings. However, the economic impact of a pest is considered at an industry specific level (i.e. for the avocado industry only in this BP), and therefore this rating may differ between BPs.

Description of terms used in pest risk tables

The descriptions below relate to terms in Table 1 and elsewhere in the document.

Entry potential

Negligible	The probability of entry is extremely low given the combination of all known factors including the geographic distribution of the pest, quarantine practices applied, probability of pest survival in transit and pathways for pest entry and distribution to a suitable host.
Low	The probability of entry is low, but clearly possible given the expected combination of factors described above.
Medium	Pest entry is likely given the combination of factors described above.
High	Pest entry is very likely and potentially frequent given the combination of factors described above.
Unknown	The pest entry potential is unknown or very little of value is known.

Establishment potential

Negligible	The probability of entry is extremely low given the combination of all known factors including the geographic distribution of the pest, quarantine practices applied, probability of pest survival in transit and pathways for pest entry and distribution to a suitable host.
Low	The probability of entry is low, but clearly possible given the expected combination of factors described above.
Medium	Pest entry is likely given the combination of factors described above.
High	Pest entry is very likely and potentially frequent given the combination of factors described above.
Unknown	The pest entry potential is unknown or very little of value is known.

Spread potential

Negligible	The pest has very limited potential for spread in Australia given the combination of dispersal mechanisms, availability of hosts, vector presence, industry practices and geographic and climatic barriers.
Low	The pest has the potential for natural or assisted spread to susceptible hosts within Australia yet is hindered by a number of the above factors
Medium	The pest has an increased likelihood of spread due to the above factors
High	The natural spread of the pest to most production areas is largely unhindered and assisted spread within Australia is also difficult to manage
Unknown	The spread potential is unknown or very little of value is known.

Economic impact

Negligible	There are very minor, often undetectable, impacts on production with insignificant changes to host longevity, crop quality, production costs or storage ability. There are no restrictions to market access.
Very low	There are minor, yet measurable, impacts on production including either host longevity, crop quality, production costs or storage ability. There are no restrictions to market access.
Low	There are measurable impacts to production including either host mortality, reduction in yield, production costs, crop quality, storage losses, and/or minimal impacts on market access.
Medium	There are significant impacts on production with either host mortality, reduction in yield, production costs, crop quality, storage losses, and/or moderate impacts on market access.
High	There are severe impacts on production including host mortality and significant impacts on either crop quality or storage losses, and/or severe impacts on market access.
Extreme	There is extreme impact on standing crop at all stages of maturity, with high host mortality or unmanageable impacts to crop production and quality, and /or extreme, long term, impacts on market access.
Unknown	The economic potential of the pest is unknown or very little of value is known.

References

AS/NZS ISO 31000:2009 Risk management - Principles and guidelines. Standards Australia, Sydney, and Standards New Zealand, Wellington.

Australian Government Department of Agriculture and Water Resources 2017, *Final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports*, Department of Agriculture and Water Resources, Canberra, available at http://www.agriculture.gov.au/biosecurity/risk-analysis/group-pest-risk-analyses/group-pra-thrips-orthotospoviruses/final-report

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Department of Agriculture and Water Resources 2019a, *Draft report for the review of biosecurity import requirements for fresh avocados from Chile*, Department of Agriculture and Water Resources, Canberra, Australia, available at http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/risk-analysis/plant-reviews/draft-report-avocados-chile.pdf.

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FAO (2004) Pest risk analysis for quarantine pests including analysis of environmental risks and living modified organisms. International Standards for Phytosanitary Measures No. 11. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

FAO (2007) Framework for pest risk analysis. International Standards for Phytosanitary Measures No. 2. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

RISK MITIGATION AND PREPAREDNESS

Introduction

There are a number of strategies that can be adopted to help protect and minimise the risks of Emergency Plant Pests under International Plant Protection Convention (IPPC) standards (ippc.int/standards) and Commonwealth and State/Territory legislation.

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the avocado industry (Figure 2). Such risk mitigation and preparedness practises are the responsibility of governments, industry and the community.

A number of key risk mitigation areas are outlined in this guide, along with summaries of the roles and responsibilities of the Australian Government, state/territory governments, and avocado industry members. This section is to be used as a guide outlining possible activities that may be adopted by industry and growers to mitigate the risk and prepare for an incursion response. Each grower will need to evaluate the efficacy of each activity for their situation.

Figure 2. Examples of biosecurity risk mitigation activities.

Barrier quarantine

Barrier quarantine refers to the biosecurity measures implemented at all levels of the avocado industry including national, state, regional and farm levels.

National level – importation restrictions

The Department of Agriculture (DA) is the Australian Government department responsible for maintaining and improving international trade and market access opportunities for agriculture, fisheries, forestry and food industries. DA achieves this through:

- establishment of scientifically-based quarantine policies
- provision of effective technical advice and export certification services
- negotiations with key trading partners
- participation in multilateral forums and international sanitary and phytosanitary (SPS) standard-setting organisations
- collaboration with portfolio industries and exporters.

DA is responsible for developing biosecurity (SPS) risk management policy and reviewing existing quarantine measures for the importation of live animals and plants, and animal and plant products. In particular, DA undertakes import risk analyses to determine which products may enter Australia, and under what quarantine conditions. DA also consults with industry and the community, conducting research and developing policy and procedures to protect Australia's animal and plant health status and natural environment. In addition, DA assists Australia's export market program by negotiating other countries' import requirements for Australian animals and plants. Further information can be found at agriculture.gov.au.

The administrative authority for national quarantine is vested in DA under the Biosecurity Act 2015. Quarantine policies are developed on the basis of a BIRA process. This process is outlined in the BIRA Handbook 2011 (Department of Agriculture, Fisheries and Forestry, 2011). DA maintains barrier quarantine services at all international ports and in the Torres Strait region. The management of quarantine policy, as it relates to the introduction into Australia of fruit, seed, or other plant material, is the responsibility of DA.

BICON contains the current Australian import conditions for more than 20,000 foreign plants, animal, mineral and human products and is the first point of access to information about Australian import requirements for a range of commodities. It can be used to determine if a commodity intended for import to Australia requires a quarantine import permit and/or treatment or if there are any other quarantine prerequisites. The cases listed on BICON for avocados are included below (Table 8). For export conditions see the Manual of Importing Country Requirements (MICoR) database at agriculture.gov.au/micor/plants.

The Australian Government is responsible for the inspection of machinery and equipment being imported into Australia. Any machinery or equipment being imported into Australia must meet quarantine requirements. If there is any uncertainty, contact DA on (02) 6272 3933 or 1800 020 504, or visit the website at agriculture.gov.au/biosecurity/import.

The World Trade Organization (WTO) SPS Agreement facilitates international trade while providing a framework to protect the human, animal and plant health of WTO members. SPS measures put in place must minimise negative effects on trade while meeting an importing country's appropriate level of protection. For plant products, these measures are delivered through the IPPC standard setting organisations and collaboration with portfolio industries and exporters. For more information on the IPPC visit ippc.int.

Table 8. Product types for which import conditions are listed in BICON (as at June 2019)[33]

CROP	PRODUCT TYPE
Avocado	Fresh avocado for human consumption
	Persea americana seed for sowing
	Persea spp. for use as nursery stock
	Dried herbs for human consumption
	Dried herb products not for human consumption

State and regional level – movement restrictions

The ability to control movement of materials that can carry and spread avocado pests is of high importance. Each state/territory has quarantine legislation in place to control the importation of avocado material interstate and intrastate, and to manage agreed pests if an incursion occurs (Table 9). Further regulations have been put in place in response to specific pest threats and these are regularly reviewed and updated by state/territory authorities and the Sub-Committee for Domestic Quarantine and Market Access (SDQMA).

Moving plant material between states/territories generally requires permits from the appropriate authority, depending on the plant species and which territory/state the material is being transferred to/from. Moving plant material intrastate may also require a permit from the appropriate authority. Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of cherries can be obtained by contacting your local state or territory agriculture department directly (Table 9), or through the SDQMA website www.domesticquarantine.org.au which lists relevant contacts in each state/territory as well as Interstate Certification Assurance (ICA) documents relating to each state/territory.

The movement of farm vehicles and equipment between states is also restricted because of the high risk of inadvertently spreading pests. Each state/territory has quarantine legislation in place governing the movement of machinery, equipment and other potential sources of pest contamination. Further information can be obtained by contacting your local state/territory Department of Agriculture (Table 9).

[33] Please note, this is a summary only. Conditions change overtime and BICON (www.agriculture.gov.au/import/bicon), or the Department of Agriculture will need to be consulted to confirm the specific conditions that apply to a given situation.

Table 9. Interstate and interregional movement of plant products – legislation, quarantine manuals and contact numbers.

STATE	ADMINISTERING AUTHORITY	LEGISLATION	LINKS TO QUARANTINE MANUAL	PHONE
ACT	Environment ACT environment.act.gov.au	*Plant Disease Act 2002* *Pest Plants and Animals Act 2005*	See NSW conditions	13 22 81
NSW	Department of Primary Industries dpi.nsw.gov.au	*Biosecurity Act 2015* *Biosecurity Regulation 2017* *Biosecurity Order (Permitted Activities) 2017* and other supporting legislation such as Control Orders	dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases	(02) 6391 3384
NT	Department of Primary Industry and Fisheries dpir.nt.gov.au/	*Plant Health Act 2008* *Plant Health Regulations 2011*	nt.gov.au/industry/agriculture/food-crops-plants-and-quarantine/plants-and-quarantine	(08) 8999 2118
QLD	Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland daf.qld.gov.au/biosecurity	Biosecurity Act 2014 Biosecurity Regulation 2016	daf.qld.gov.au/plants/moving-plants-and-plant-products	132 523[34] (07) 3404 6999[35]
SA	Primary Industries and Regions SA pir.sa.gov.au	Plant Health Act 2009 Plant Health Regulations 2009	pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia	(08) 8207 7820
TAS	Department of Primary Industries, Parks, Water and Environment dpipwe.tas.gov.au	Plant Quarantine Act 1997 Weed Management Act 1999	dpipwe.tas.gov.au/biosecurity-tasmania/plant-biosecurity/plant-biosecurity-manual	1300 368 550
VIC	Department of Jobs, Precincts and Regions djpr.vic.gov.au	Plant Biosecurity Act 2010 Plant Biosecurity Regulations 2016	agriculture.vic.gov.au/psb	136 186
WA	Department of Primary Industries and Regional Development agric.wa.gov.au/	Biosecurity and Agricultural Management Act 2007		(08) 9334 1800

[34] Within QLD
[35] Interstate

New South Wales

Information on pre-importation inspection, certification and treatment requirements may be obtained from NSW DPI Regulatory Services by phone 02 6391 3384 or by visiting the NSW Department of Primary Industries website dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases.

Northern Territory

Administrative authority for regional quarantine in the Northern Territory (NT) is vested in the Department of Primary Industry and Resources (DPIR) under the Plant Health Act 2008 and Plant Health Regulations 2011. The Act enables notifiable pests to be gazetted, quarantine areas to be declared and inspectors appointed to carry out wide ranging control and/or eradication measures. Plant import requirements for particular pests, plants or plant related materials are identified in the Regulations. Further information on NT import requirements and treatments can be obtained by contacting NT Quarantine on (08) 8999 5511 or email quarantine@nt.gov.au.

For more information refer to the NT DPIR website dpir.nt.gov.au/.

Queensland

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Queensland, as well as maps of pest quarantine areas, may be obtained from the Biosecurity Queensland part of the DAF Queensland website (daf.qld.gov.au/plants/moving-plants-and-plant-products).

Further details can be obtained from the DAF Queensland Customer Service Centre (13 25 23 within Queensland, or phone 07 3404 6999 or fax 07 3404 6900 interstate).

South Australia

Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of fruit or plant material in South Australia (SA) may be obtained from Biosecurity SA - Plant Health by phone (08) 8207 7820 or fax (08) 8207 7844. Further information can be found at pir.sa.gov.au/biosecurity/plant_health.

Primary Industries and Regions South Australia (PIRSA) have strict regulations and requirements regarding the entry of plant material (fruit, vegetables, flowers, plants, soil and seeds) into the State.

For further information on import conditions consult the Plant Quarantine Standard (pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia).

Tasmania

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Tasmania may be obtained from the Department of Primary Industries, Parks, Water and Environment (DPIPWE) Biosecurity website (www.dpipwe.tas.gov.au/biosecurity) or by phoning 1300 368 550.

General and specific import conditions apply to the importation of plant material into Tasmania to prevent the introduction of pests and diseases into the State. Plants and plant products must not be imported into Tasmania unless State import requirements are met and a Notice of Intention to import has been provided to a Biosecurity Tasmania inspector not less than 24 hours prior to the importation.

For further information on import conditions consult the Plant Quarantine Manual (dpipwe.tas.gov.au/biosecurity-tasmania/plant-biosecurity/plant-biosecurity-manualhttp://dpipwe.tas.gov.au/biosecurity/plant-biosecurity/plant-biosecurity-manual).

Victoria

The movement into Victoria of plants and plant products may be subject to a prohibition, or to one or more conditions which may include chemical treatments. These prohibitions and conditions are described on the Department of Jobs, Precincts and Regions (DJPR) website (see link in Table 9). Some items may need to be presented to a DJPR inspector or an accredited business, for checking of details such as correct certification, labelling or treatment.

Further information on pre-importation inspection, certification and treatments and/or certification requirements for movement of fruit or plant material into or within Victoria may be obtained from DJPR on the web at agriculture.vic.gov.au/psb or by phone 136 186.

Western Australia

The lead agency for agricultural biosecurity in Western Australia is the Department of Primary Industries and Regional Development (DPIRD). Western Australia is naturally free from a large number of pests and diseases that are present in many other parts of the world. WA's geographical isolation in conjunction with a robust plant biosecurity system including border and intrastate regulations, industry and public awareness campaigns and surveillance programs maintains this status.

There are general and specific legislative requirements which underpin Western Australian plant biosecurity. Amongst other things the legislation regulates movement of potential carriers (such as plant material, honey, machinery, seeds etc.) into and within the state.

General conditions include (but are not limited to the following):

- The requirement for all potential carriers to be presented to an inspector for inspection upon arrival in WA
- Soil is prohibited entry and imported goods, including containers, must be free from soil
- Freedom from pests and diseases of quarantine concern to WA

In addition to the general requirements, specific requirements are also in place for movement into and within the state.

For further information on requirements contact Quarantine WA on (08) 9334 1800 or fax (08) 9334 1880.

Farm level – exclusion activities

A significant risk of spreading pests onto farms arises when propagation material, people, machinery and equipment move from property to property and from region to region. It is the responsibility of the industry and the owner/manager of each property to ensure these risks are minimised.

It is in the interests of industry to encourage and monitor the management of risk at the farm level, as this will reduce the probability of an incursion and increase the probability of early detection. This should in turn reduce the likelihood of a costly incident response, thereby reducing costs to industry, government and the community.

One major way this can be achieved is through management of industry biosecurity at the farm level using exclusion practices. Further detail on potential strategies is included in the Farm Biosecurity section (page 79). The avocado industry is already a strong supporter of farm biosecurity; but should continue to further extend this message of promoting good farm hygiene in a wide range of ways.

Surveillance

Surveys enhance prospects for early detection, minimise costs of eradication and are necessary to meet the treaty obligations of the WTO SPS Agreement with respect to the area freedom status of Australia's states, territories and regions.

The SPS Agreement gives WTO members the right to impose SPS measures to protect human, animal and plant life health provided such measures do not serve as technical barriers to trade. In other words, for countries (such as Australia) that have signed the SPS Agreement, imports of food, including fresh fruit and cherries, can only be restricted on proper, science-based quarantine grounds. Where quarantine conditions are imposed, these will be the least trade restrictive measures available that meet Australia's appropriate level of quarantine protection. The Agreement also stipulates that claims of area freedom must be supported by appropriate information, including evidence from surveillance and monitoring activities. This is termed "evidence of absence" data and is used to provide support that we have actively looked-for pests and not found them.

ISPM 6 (ippc.int/sites/default/files/documents/20140528/spec_61_revispm6_2014-05-28_201405281352--150.18%20KB.pdf) provides international guidelines for structured pest surveys. Structured pest survey

planning and implementation depends on the risk involved, the resources available, and the requirements of trading partners (particularly when Australia wishes to access overseas markets). The intensity and timing of surveys also depend on the spread characteristics of the pest and the costs of eradication.

Early detection of an exotic pest incursion can significantly increase the likelihood of a successful eradication campaign and reduce the associated costs. Effective surveillance plays a critical role in working toward this goal. Surveillance can be either targeted toward specific pests, or general in nature. General non-targeted surveillance is based on recognising normal versus suspect plant material. Targeted surveillance is important for establishing whether particular pests are present in each state or region, and if so, where these occur.

Industry personnel can provide very effective early detection of new or unusual symptoms through their normal management practices (i.e. 'passive surveillance'), provided individuals are aware of what to look for and of reporting procedures. Consultants and crop scouts can provide valuable information as they are regularly in the field, and hence can observe any unusual pest activity or symptoms on plants.

National surveillance programs

The Department of Agriculture (DA) maintains barrier quarantine services at all international ports and in the Torres Strait region. DA also surveys the northern coast of Australia, offshore islands and neighbouring countries for exotic pests that may have reached the country through other channels (e.g. illegal vessel landings in remote areas, bird migrations, wind currents) as part of the Northern Australia Quarantine Strategy (NAQS). NAQS surveillance programs relevant to the avocado industry are listed in Table 10.

State surveillance programs

State level surveillance depends on the participation of all stakeholder groups, particularly state/territory agriculture departments, industry representative groups, agri-business and growers.

The state/territory agriculture department can provide:

- planning and auditing of surveillance systems
- coordination of surveillance activities between industry and interstate groups
- diagnostic services
- field diagnosticians for special field surveillance
- surveillance on non-commercial sites
- liaison services with industry members
- communication, training and extension strategies with industry
- biosecurity training
- reporting services to all interested parties (Department of Agriculture, national bodies, trading partners and industry).

Various pest surveillance programs are managed by the Department of Agriculture and the state/territory agriculture departments. Many state/territory departments run general surveillance programs whereby suspect samples can be forwarded and diagnosed for the presence of exotic pests free of charge. Official surveillance programs that target pests of the avocado industry (exotic or those under official control in a region or state/territory) are shown in Table 10.

Table 10. Official surveillance programs that target pests of the avocado industry (as at January 2018)[36]

SURVEILLANCE PROGRAM	PESTS TARGETED	HOSTS TARGETED
Australian Government		
Northern Australia Quarantine Survey exotic fruit fly trapping	Exotic fruit flies (*Bactrocera* spp.)	Horticulture
New South Wales		
Asian market access for citrus and cherries	Queensland fruit fly (*Bactrocera tryoni*), lesser Queensland fruit fly (*Bactrocera neohumeralis*), various cue lure attracted exotic fruit flies	Cherry and citrus production
Exotic fruit flies – Riverina	Mediterranean fruit fly (*Ceratitis capitata*), other tri lure responsive exotic fruit flies	Various horticultural crops (citrus, stone fruit)
Brown marmorated stink bug	Brown marmorated stink bug *(Halyomorpha halys)*	Multiple hosts
Greater Sydney Local Land Services periurban surveillance program	Various, including tomato potato psyllid *(Bactericera cockerelli)*, brown marmorated stink bug *(Halyomorpha halys*), Asian citrus psyllid (*Diaphorina citri*), African citrus psyllid (*Trioza erytreae*) and glassy winged sharpshooter (*Homalodisca vitripennis*)	Multiple plant hosts in periurban landscape, including community gardens
National plant health surveillance program – multi pest surveillance	Multiple, including glassy winged sharpshooter (*Homalodisca vitripennis), Xylella fastidiosa*, fire blight (*Erwinia amylovora*), brown marmorated stink bug (*Halyomorpha halys*), exotic mites (including *Brevipalpus spp., Aceria granati*), Asian citrus psyllid *(Diaphorina citri*), African citrus psyllid (*Trioza erytreae*), huanglongbing (*Candidatus Liberibacter asiaticus*), citrus canker (*Xanthomonas axonopodis* subsp. *citri*), and invasive ants (*Solenopsis spp., Wasmannia auropunctata, Anoplolepis gracilipes*)	Multiple plant hosts around ports of Sydney, Newcastle and Wollongong
Northern Territory		
Area freedom surveillance program	Queensland fruit fly (*Bactrocera tryoni*)	Horticultural crops
National plant health surveillance program – port of entry program	Exotic fruit flies *(Bactrocera spp.* and *Ceratitis spp.)*	Horticultural crops
Regional fruit fly monitoring and surveillance	Exotic fruit flies *(Bactrocera spp.* and *Ceratitis spp.)*	Horticultural crops
National plant health surveillance program	Glassy winged sharpshooter (*Homalodisca vitripennis*)	Multiple
National plant health surveillance program	Pierce's disease (*Xylella fastidiosa*)	Multiple
Queensland		
Exotic fruit fly in the Torres Strait program	Exotic fruit fly including *Bactrocera* and *Zeugodacus spp*.	Multiple
National plant health surveillance program	A range of exotic timber and forest pests, including sugarcane longhorn beetle (*Dorysthenes buqueti*), Asian and citrus longhorn beetle (*Anoplophora spp*.), lychee longicorn beetle	Multiple

[36] Information presented has been taken from the National Plant Biosecurity Status Report 2018 and confirmed or updated in December 2018 by the Sub-committee on National Plant Health Surveillance (sub-committee of the Plant Health Committee)

SURVEILLANCE PROGRAM	PESTS TARGETED	HOSTS TARGETED
	(*Aristobia testudo*), lateral-banded mango longhorn beetle (*Batocera rubus*), sawyer beetles (*Monochamus spp.*), drywood longicorn beetle (*Stromatium barbatum*), ambrosia beetles, bark beetles (*Ips spp.*), pine beetles bark beetles (*Dendroctonus spp.*), wood wasps (Siricid wasps e.g. *Uroceris gigas*). Exotic fruit flies (*Bactrocera, Zeugodacus* and *Ceratitis spp.*), gypsy moths (*Lymantria spp.*), Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*)	
Conifer auger beetle	Conifer auger beetle *(Sinoxylon conigerum)*	Conifer trees
Endemic and exotic diseases of cotton	Exotic strains of bacterial blight *(Xanthomonas campestris),* blue disease *(suspected Luteovirus), cotton leaf curl virus (Begomovirus),* Texas root rot *(Phymatotrichum omnivorum),* exotic strains Verticillium wilt *(Verticillium dahliae),* exotic strains Fusarium wilt *(Fusarium oxysporum f. sp. vasinfectum).* Endemic cotton diseases, including *Fusarium spp.* and *Verticillium spp.*	Cotton
Grow help Australia diagnostic service project	All pests and pathogens that can affect horticultural crops, national parks, gardens, hobby growers and home gardeners. Commonly encountered pathogens include *Phytophthora spp., Fusarium spp., Colletotrichum spp., Alternaria spp., Rhizoctonia spp., Pythium spp., Ralstonia spp., Erwinia spp.* and viruses	Fruit, vegetable and ornamental hosts
South Australia		
Queensland fruit fly	Queensland fruit fly *(Bactrocera tryoni)*	Horticultural crops
Brown marmorated stink bug	Brown marmorated stink bug *(Halyomorpha halys)*	Multiple
National plant health surveillance program	Glassy winged sharpshooters (*Homalodisca vitripennis* and *Homalodisca coagulate*)	*Vitus vinifera*
Ports of entry trapping program	Multiple – *Bactrocera tau, B. carambolae, B. dorsalis, B. albistrigata, B. umbrosa, B. trivialis, B. facialis, B. kirki, B. melanotus, B. xanthodes, B. psidii, B. zonata, Ceratitis capitata, Zeugodacus cucurbitae*	Various fruit fly hosts
Tasmania		
Fruit fly trapping surveillance	*Bactrocera tryoni, Ceratitis capitata, B. dorsalis* and other exotic fruit flies	Host fruit trees, fruit and vegetables
National plant health surveillance program – brown marmorated stink bug	Brown marmorated stink bug *(Halyomorpha halys)*	Various hosts near cargo, freight, ports and in parks and gardens
National plant health surveillance program – glassy winged sharpshooter	Glassy winged sharpshooter (*Homalodisca vitripennis*)	Various hosts near cargo, freight, ports and in parks and gardens
National plant health surveillance program – Pierce's disease	Pierce's disease (*Xylella fastidiosa*)	Various hosts at nurseries and on urban pathways

SURVEILLANCE PROGRAM	PESTS TARGETED	HOSTS TARGETED
Victoria		
National plant health surveillance program	Fruit flies *(Bactrocera spp., Ceratitis captitata)*	Fruit and vegetable crops
National plant health surveillance program	Exotic fruit flies, various *Bactrocera* and *Ceratitis spp.*	Plants and weed hosts around Victorian ports
National plant health surveillance program	Japanese sawyer beetle (*Monocamus alternatus*), wood wasp (*Urocerus fantoma*), black spruce longhorn beetle (*Tetropium castaneum*), brown spruce longhorn beetle (*Tetropium fuscum*), Asian gypsy moth (*Lymantria dispar* and other *Lymantria spp.*), pine wilt nematode (*Bursaphelenchus spp.*), brown marmorated stink bug (*Halyomorpha halys*)	Plants and weed hosts around Melbourne ports
National plant health surveillance program	Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*)	Grapes
Western Australia		
Medfly area freedom (ORIA)	Mediterranean fruit fly *(Ceratitis capitata)*	Many horticultural hosts
Port of entry – fruit fly trapping	Various *Bactrocera* and *Ceratitis spp.*	Horticultural hosts
Queensland fruit fly surveillance	Queensland fruit fly *(Bactrocera tryoni)*	Many horticultural hosts
Brown marmorated stink bug	Brown marmorated stink bug *(Halyomorpha halys)*	General surveillance, all hosts, urban areas
National plant health surveillance program	Fire blight (*Erwinia amylovora*), huanglongbing (Candidatus *Liberibacter asiaticus*), citrus canker (*Xanthomonas axonopodis pv. citri*), citrus longicorn beetle (*Anoplophora chinensis*), red imported fire ants (*Solenopsis invicta*), Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis)*	Pome and citrus crops

Farm level pest monitoring

Farm level monitoring involves the participation and interaction of growers, agribusiness and industry representative groups. Examples of the surveillance activities that can be carried out by each of these groups are outlined in Figure 3. Conducting regular surveys of farms and nurseries provides the best chance of spotting new pests early and implementing eradication or management responses.

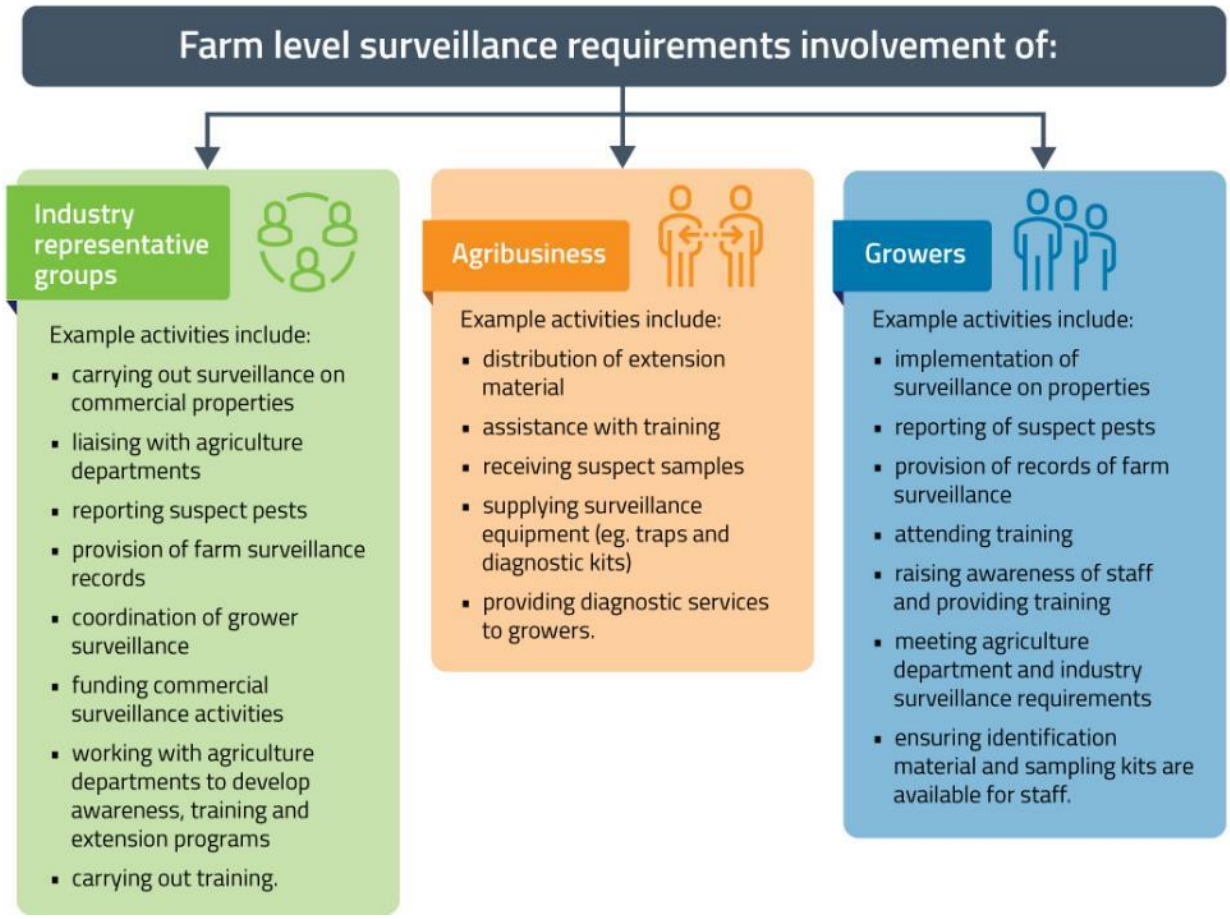

Figure 3. Examples of farm level surveillance activities.

Training

A key component of biosecurity preparedness is ensuring personnel engaged are suitable and effectively trained for their designated roles in a response. Biosecurity preparedness training is the responsibility of all governments and industries, involved in the biosecurity system.

National EPP Training Program

PHA supports members in training personnel through the delivery of the National EPP Training Program. This program is focussed on ensuring personnel from the governments and peak industry bodies who will be involved in responses to EPPs have the skills and knowledge to effectively fulfil the roles and responsibilities of their parties, as signatories to the EPPRD. This covers a range of areas, from representatives on the national decision-making committees (i.e. the Consultative Committee on Emergency Plant Pests and the National Management Group) through to industry liaison personnel in the State Coordination or Local Control Centres.

In addition to face to face training delivered to members and the provision of simulation exercises, PHA also offers biosecurity training through the Biosecurity OnLine Training (BOLT) platform which houses a variety of eLearning courses relevant to plant biosecurity. Access to BOLT is free and open to any stakeholder interested in biosecurity and is available through planthealthaustralia.com.au/bolt.

For more information on the National EPP Training program, refer to planthealthaustralia.com.au/training.

Awareness

Early reporting enhances the chance of effective control and eradication. Awareness activities raise the profile of biosecurity and exotic pest threats to the avocado industry, which increases the chance of early detection and reporting of suspect pests. Responsibility for awareness material lies with industry and government, with assistance from PHA as appropriate. Any unusual plant pest should be reported immediately to the relevant state/territory agriculture department through the Exotic Plant Pest Hotline (1800 084 881).

High priority plant pest threat-related documents

Pests listed in Table 1 have been identified as high priority threats to the avocado industry by members of the TEG. They have been assessed as having high entry, establishment and spread potentials and/or a high economic impact. This list should provide the basis for the development of awareness material for the industry.

Further information on high priority pests

The websites listed below (Table 11) contain information on pests across most plant industries, including the avocado industry.

Table 11. Sources of information on high priority pest threats for the avocado industry.

SOURCE	WEBSITE
CABI – Crop Protection Compendium	cabi.org/cpc/
DAF Queensland A-Z list of significant plant pests and diseases	daf.qld.gov.au/plants/health-pests-diseases/a-z-significant
Department of Agriculture	agriculture.gov.au
European and Mediterranean Plant Protection Organization (EPPO)	eppo.int/DATABASES/pqr/pqr.htm
Plant Health Australia (PHA)	planthealthaustralia.com.au/
Pest and Disease Image Library (PaDIL)	padil.gov.au/
University of California Statewide Integrated Pest Management (IPM) Program	ipm.ucdavis.edu/EXOTIC/exoticpestsmenu.html

Further information/relevant websites

A range of government and grower organisation details and websites for persons seeking further information on avocado industry biosecurity (Table 12).

Table 12. Interstate and interregional movement of plant products – legislation, quarantine manuals and contact numbers.

AGENCY	WEBSITE/EMAIL	PHONE	ADDRESS
National			
Avocados Australia	avocado.org.au	(07) 3846 6566 1300 303 971	PO Box 134 Brisbane Markets, QLD, 4106
Department of Agriculture	agriculture.gov.au	(02) 6272 3933 1800 020 504	GPO Box 858 Canberra, ACT 2601
Plant Health Australia	planthealthaustralia.com.au biosecurity@phau.com.au	(02) 6215 7700	Level 1, 1 Phipps Cl Deakin, ACT 2600
New South Wales			
Department of Primary Industries	dpi.nsw.gov.au/biosecurity/plant	(02) 6391 3535	Locked Bag 21 Orange, NSW 2800
Queensland			
Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland	daf.qld.gov.au	13 25 23[37] (07) 3404 6999[38]	80 Ann Street Brisbane, QLD 4000
Northern Territory			
Department of Primary Industry and Resources	dpir.nt.gov.au/about	(08) 8999 5511	Berrimah Farm, Makagon Road Berrimah, NT 0828

[37] Within QLD
[38] Interstate

AGENCY	WEBSITE/EMAIL	PHONE	ADDRESS
South Australia			
Primary Industries and Regions SA	pir.sa.gov.au	(08) 8207 7820	GPO Box 1671 Adelaide, SA 5001
Biosecurity SA-Plant Health	pir.sa.gov.au/biosecuritysa/planthealth PIRSA.planthealth@sa.gov.au	(08) 8207 7820	33 Flemington Street Glenside, SA 5065
Biosecurity SA-Plant Health Market access and Interstate Certification Assurance	IRSA.planthealthmarketaccess@sa.gov.au	(08) 8207 7814	
Biosecurity SA-Plant Health Transport manifest lodgement	pirsa.planthealthmanifest@sa.gov.au	Fax: (08) 8124 1467	
South Australian Research and Development Institute	sardi@sa.gov.au	(08) 8303 9400	2b Hartley Grove Urrbrae, SA 5064
Tasmania			
Department of Primary Industries, Parks, Water and Environment	dpipwe.tas.gov.au BPI.Enquiries@dpipwe.tas.gov.au	1300 368 550	GPO Box 44, Hobart, TAS 7001
Victoria			
Department of Jobs, Precincts and Regions	economicdevelopment.vic.gov.au/	136 186	CPHO Group, Division of Market Access and Regulation, Biosecurity Branch Department of Jobs, Precincts and Regions 475 Mickleham Road, Attwood, Victoria 3047
Western Australia			
Department of Primary Industries and Regional Development	agric.wa.gov.au/	(08) 9368 3333	WA DPIRD, PO Box 1143 West Perth WA 6872

Farm biosecurity

Introduction

Plant pests can have a major impact on production if not managed effectively. This includes pests already present in Australia and a number of serious pests of avocado that Australia does not have.

Farm biosecurity measures can be used to minimise the spread of such pests before their presence is known or after they are identified, and therefore can greatly increase the likelihood that they could be eradicated. This section of the document outlines farm biosecurity and hygiene measures to help reduce the impact of pests on the industry.

The biosecurity and hygiene measures outlined here can be considered as options for each farm's risk management. Many of these measures can be adopted in a way that suits a given farm so that each can have an appropriate level of biosecurity.

Farm biosecurity reporting procedures and hygiene strategies to reduce threats covered in this document are:

- selection and preparation of appropriate plant material
- chemical control measures
- control of vectors
- control of alternative hosts
- neglected farms and volunteer plants
- post-harvest handling and produce transport procedures
- use of warning and information signs
- managing the movement of vehicles and farm equipment
- movement of people
- visiting overseas farms/orchards – what to watch out for when you return
- including farm biosecurity in Industry best management practice and quality assurance schemes
- farm biosecurity checklist.

Development of an on-farm biosecurity plan tailored to the needs of an individual operation is a good way to integrate best practice biosecurity with day to day operations (farmbiosecurity.com.au/planner/). Further information on farm biosecurity can be found at farmbiosecurity.com.au or by contacting Avocados Australia.

Reporting suspect emergency plant pests

Rapid reporting of exotic plant pests is critical as early detection gives Australia the best chance to effectively control and eradicate pests. If you find something you believe could be an exotic plant pest, call the Exotic Plant Pest Hotline immediately to report it to your local state or territory government.

The one phone number – 1800 084 881 – will connect to an automated system that allows the caller to choose the state or territory that the report relates to. The caller will then be connected to the relevant authority for that jurisdiction. Most lines are only monitored during business hours. Messages can be left outside of those hours and calls will be returned as soon as an officer is available. A summary of the opening hours for each state and territory is provided in Table 13. Each jurisdiction also has an alternative contact to ensure no report is missed. It does not matter which of these methods is used to report a suspect exotic plant pest. The important thing is to report it.

Calls to the Exotic Plant Pest Hotline will be answered by an experienced person, who will ask some questions to help understand the situation, such as:

- What was seen (describe the pest or send a photo)
- Where it was found
- What it was found on
- How many pests are present/how infected is the crop
- How widely distributed it is
- When it was first noticed

It is important not to touch or move the suspect material as this may spread the exotic pest or render samples unsuitable for diagnostic purposes. A biosecurity officer may attend the location to inspect and collect a sample. In some cases, the biosecurity officer will explain how to send a sample for testing. In this circumstance they will explain how to do this without risk of spreading the pest and ensuring it arrives at the laboratory in a suitable condition for identification.

Every report will be taken seriously, will be followed up and treated with confidentiality.

Table 13. Exotic Plant Pest Hotline hours of operation and Alternate contact information for reporting per jurisdiction.

STATE/TERRITORY	HOTLINE HOURS	ALTERNATIVE CONTACT
NSW	Operates 08:30 – 16:30 Monday to Friday. After hours answering machine service with messages followed up the next business day.	biosecurity@dpi.nsw.gov.au
NT	Operates 08:00 – 16:30 Monday to Friday. After hours answering machine service with messages followed up the next business day.	quarantine.NT@nt.gov.au
QLD	Operates 08:00-17:00 Monday to Friday (09:00-17:00 Thursday). Calls outside these hours answered by a third party who will take the message and depending on the urgency of the report, organise a response from a biosecurity officer as soon as possible.	Biosecurity Queensland on 13 25 23
SA	Operates 24 hrs/ 7 days	Online plant pest report form
TAS	Operates 24 hrs/ 7 days	Biosecurity Tasmania on (03) 6165 3777
VIC	Operates 08:00 – 18:00 Monday to Friday. After hours answering machine service with messages followed up the next business day. Option also to forward to the 24 hr Emergency Animal Disease Watch Hotline.	plant.protection@ecodev.vic.gov.au
WA	Operates 08:30 – 16:30 Monday to Friday. After hours answering machine service with messages followed up the next business day.	info@agric.wa.gov.au

Recent changes to legislation in some states includes timeframes for reporting and have implications for those who do not report. It is important that individuals know the obligations for their jurisdiction.

Some avocado pests are notifiable under each state or territory's quarantine legislation. Each state or territory's list of notifiable pests are subject to change over time so contacting your local state/territory agricultural agency (Table 12) will ensure information is up to date. Landowners and consultants have a legal

obligation to notify the relevant state/territory agriculture agency of the presence of those pests within a defined timeframe (Table 14).

Preparedness

Pest-specific preparedness and response information documents

To help prepare for an incursion response a list of pest-specific preparedness and response information documents are provided in Table 4 that may support a response. Over time, as more resources are produced for pests of the avocado industry they will be included in this document and made available through the PHA website. Resources include the development of pest-specific information and emergency response documents, such as fact sheets, contingency plans, diagnostic protocols and a summary of surveillance programs currently in operation for these high priority pests (see www.planthealthaustralia.com.au/pidd). These documents and programs should be developed over time for all medium to high risk pests listed in the TSTs (Appendix 2: threat summary tables).

Fact sheets

Fact sheets or information sheets are a key activity of biosecurity extension and education with growers. Fact sheets provide summary information about the pest, its biology, what it looks like and what symptoms it may cause. They also contain detailed images. Refer to Table 14 for a list of current fact sheets available for avocado producers.

Contingency Plans

Contingency Plans provide background information on the pest biology and available control measures to assist with preparedness for incursions of a specific pest into Australia (Table 14). A contingency plan provides guidelines for steps to be undertaken and considered when developing a response plan for the eradication of that pest. Any response plan developed using information in whole or in part from a contingency plan must follow procedures as set out in PLANTPLAN and be endorsed by the National Management Group prior to implementation.

For a list of current contingency plans see planthealthaustralia.com.au/pidd.

National Diagnostic Protocols

Diagnostic protocols are documents that contain information about a specific plant pest, or related group of pests, relevant to its diagnosis. National Diagnostic Protocols (NDPs) are diagnostic protocols for the unambiguous taxonomic identification of a pest in a manner consistent with ISPM No. 27 – Diagnostic Protocols for Regulated Pests. NDPs include diagnostic procedures and data on the pest, its hosts, taxonomic information, detection and identification.

Australia has a coherent and effective system for the development of NDPs for plant pests managed by the Sub-Committee on Plant Health Diagnostics (SPHD). NDPs are peer reviewed and verified before being endorsed by Plant Health Committee (PHC).

Endorsed NDPs are available on the National Plant Biosecurity Diagnostic Network (NPBDN) website (plantbiosecuritydiagnostics.net.au), together with additional information regarding their development and endorsement.

Diagnostic information for some avocado pests (Table 14) is available through the PHA website planthealthaustralia.com.au/pidd. For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies, available from the PHA website.

*Table 14. Pest-specific information and documents for the avocado industry, complied from the avocado industry TST. *Indicates a HPP for the avocado industry*[39]

SCIENTIFIC NAME	COMMON NAME	FACT SHEET	CONTINGENCY PLAN	DIAGNOSTIC PROTOCOL
Invertebrates				
Acari (mites)				
**Oligonychus perseae*	Persea mite	Yes – avocado	Not developed	Not developed
Diptera (flies & midges)				
Anastrepha fraterculus	South American fruit fly	Not developed	Not developed	Not developed[40]
Anastrepha ludens	Mexican fruit fly	Yes – citrus	Not developed	Not developed[40]
Anastrepha obliqua	West Indian fruit fly	Not developed	Not developed	Not developed[40]
Anastrepha serpentina	Sapodilla fruit fly	Not developed	Not developed	Not developed[40]
Anastrepha striata	Guava fruit fly	Not developed	Not developed	Not developed[40]
Anastrepha suspensa	Caribbean fruit fly	Yes – citrus	Not developed	Not developed[40]
**Bactrocera carambolae*	Carambola fruit fly	Yes- avocado, mango, papaya, summerfruit	Not developed	Not developed[40]
**Bactrocera dorsalis (syn. B. invadens, B. papayae, B. philippinensis)*	Oriental fruit fly	Yes – apple and pear, citrus, avocado, mango, papaya, and summerfruit industries	Not developed	Not developed[40]
**Bactrocera facialis*	Tongan fruit fly	Not developed	Not developed	Not developed[40]
**Bactrocera kandiensis*	Sri Lankan fruit fly	Not developed	Not developed	Not developed[40]
**Bactrocera kirki*	Fijian fruit fly	Not developed	Not developed	Not developed[40]
**Bactrocera melanotus*	Cook Islands fruit fly	Not developed	Not developed	Not developed[40]
**Bactrocera passiflorae*	Fijian fruit fly	Yes- avocados, papaya, passionfruit	Not developed	Not developed[40]
**Bactrocera xanthodes*	Pacific fruit fly	Not developed	Not developed	Not developed[40]
Ceratitis rosa	Natal fruit fly	Not developed	Not developed	Not developed[40]

[39] Copies of these documents are available from www.planthealthaustralia.com.au/pidd or by contacting the relevant state/territory agriculture agency.

[40] The Australian handbook for the identification of fruit flies provides some diagnostic information on this species. Available at: fruitflyidentification.org.au/lookup-species/

SCIENTIFIC NAME	COMMON NAME	FACT SHEET	CONTINGENCY PLAN	DIAGNOSTIC PROTOCOL
**Zeugodacus cucurbitae (syn. Bactrocera cucurbitae)*	Melon fruit fly	Yes – melon, citrus, papaya	Not developed	Not developed[40]
Hemiptera (stink bugs, aphids, mealybugs, scale, whiteflies & hoppers)				
Aleurocanthus woglumi	Citrus blackfly	Yes - mango	Not developed	Not developed
Dysmicoccus neobrevipes	Grey pineapple mealybug	Yes - pineapple	Not developed	Not developed
Halyomorpha halys	Brown marmorated stink bug	Yes – tree nuts, cherries	Yes	Not developed
Homalodisca vitripennis	Glassy-winged sharpshooter	Yes – blueberries, almond, citrus, nursery & garden, viticulture, cherries	Yes – nursery & garden	NDP 23
Leptoglossus zonatus	Western leaf footed bug	Yes – tree nuts	Not developed	Not developed
**Paracoccus marginatus*	Papaya mealy bug	Yes - papaya	Yes – nursery & garden	Not developed
Planococcus ficus	Grape mealybug	Yes - viticulture	Not developed	Draft NDP
Lepidoptera (butterflies & moths)				
Argyrotaenia citrana	Orange tortrix	Yes – viticulture	Not developed	Not developed
**Ctenopseustis obliquana*	Brown-headed leafroller	Yes – cherries	Not developed	Not developed
Platynota stultana	Omnivorous leafroller	Yes – viticulture	Not developed	Not developed
**Stenoma catenifer*	Stenomid (avocado) moth	Yes – avocado	Not developed	Not developed
Thaumatotibia leucotreta	False codling moth	Yes - summerfruit	Yes – grains	Not developed
Thysanoptera (thrips)				
Frankliniella bispinosa	Florida flower thrips	Yes - citrus	Not developed	Not developed
**Scirtothrips perseae*	Avocado thrips	Yes – avocado	Not developed	NDP 3

SCIENTIFIC NAME	COMMON NAME	FACT SHEET	CONTINGENCY PLAN	DIAGNOSTIC PROTOCOL
Pathogens				
Bacteria				
Xylella fastidiosa	Avocado leaf scorch	Yes – blueberries, cherries, citrus, almonds, avocados, viticulture	Yes – nursery & garden	NDP 6
Fungi (including Oomycetes)				
**Elsinoë perseae*	Avocado scab	Yes – avocado	Not developed	Not developed
**Phytophthora ramorum*	Sudden oak death	Yes – nursery & garden, plantation forestry, tea tree,	Yes – nursery & garden	NDP 5
**Raffaelea lauricola*	Laurel wilt	Yes - avocado	Not developed	Draft NDP
Viruses and viroids				
Avocado Sunblotch Viroid	Avocado Sunblotch	Yes – avocado	Not developed	Not developed

Research Development and Extension

Research, Development and Extension – Linking Biosecurity Outcomes to Priorities

Through the biosecurity planning process, gaps in knowledge or extension of knowledge will have been identified and need to be documented in the implementation table. Some of these gaps will require further research and development (e.g. understanding risk pathways, developing surveillance programs or diagnostic protocols, developing tools to facilitate preparedness and response, developing IPM or resistance breeding strategies), other gaps will require communication or extension of that knowledge to various target audiences (developing awareness raising materials, undertaking training exercises, running workshops, consideration of broader target audiences).

It is important that the RD&E gaps identified through this plan feed directly into the normal annual RD&E priority setting and strategic planning activities that an industry undertakes. This is fundamental if an industry is to progress biosecurity preparedness and response throughout the life of the biosecurity plan.

Market access

As an active trading nation, Australia has entered into a number of multilateral and bilateral trade agreements that influence its plant biosecurity system. On a multilateral level, Australia's rights and obligations in relation to plant biosecurity are set out under World Trade Organization (WTO) agreements, particularly the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), although others may apply in certain circumstances.

The SPS Agreement provides WTO member countries with the right to use sanitary and phytosanitary measures to protect human, animal and plant life or health. Under this agreement countries are allowed to specify consistent, science-based conditions aimed at providing sanitary and phytosanitary protection but not unnecessarily restricting trade. The establishment of exotic pests in Australia may result in conditions on Australian exports that previously did not apply and in some cases, may result in the short or long-term loss of overseas markets, depending on the significance of the pest to the trading partner and the availability of options to reduce the risk to acceptable levels. These options could include measures such as pest free areas

or place of production or treatments e.g. cold or fumigation. The time taken to regain access will depend on the availability and acceptance of measures to reduce risk and the receiving markets risk appetite.

Market access for the avocado industry

Export is a focus for the avocado industry. The Australian avocado industry have identified Japan, Thailand, China, India and New Zealand as important export markets. The development of these markets may be hampered by the establishment of exotic pests. To this end, the likelihood of entry restrictions being imposed by these markets if a high priority pest (Table 1) is detected in Australia has been summarised below (Table 15).

Table 15. Likelihood of entry restrictions being imposed for existing markets if an exotic high priority pest established in Australia[41]. A pest is unlikely to cause market access issues if it is already present in a country, but it is possible if the pest is not known to occur in that country or has restricted distributions. This table only includes existing export markets for the avocado industry

SCIENTIFIC NAME	COMMON NAME	JAPAN	THAILAND	CHINA	INDIA	NEW ZEALAND
COLEOPTERA (Beetles and weevils)						
Conotrachelus aguacatae	Small avocado seed weevil	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
Conotrachelus perseae	Small avocado seed weevil	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
Heilipus lauri	Large seed weevil, avocado seed weevil	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
DIPTERA (Flies & Midges)						
Anastrepha ludens	Mexican fruit fly	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
Bactrocera carambolae	Carambola fruit fly	Not known to be present	Present	Not known to be present	Not known to be present	Not known to be present
Bactrocera dorsalis	Oriental fruit fly	Not known to be present	Present	Present	Present	Not known to be present
Bactrocera facialis	Tropical fruit fly	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
Bactrocera kandiensis	Fruit fly	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
Bactrocera kirki	Fruit fly	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
Bactrocera melanotus	Fruit fly	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
Bactrocera passiflorae	Fijian fruit fly	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present

[41] Pest presence or absence was determined using the CABI Crop Protection Compendium (cabi.org/cpc/)

SCIENTIFIC NAME	COMMON NAME	JAPAN	THAILAND	CHINA	INDIA	NEW ZEALAND
Bactrocera xanthodes	Pacific fruit fly	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
***Zeugodacus cucurbitae* (syn. *Bactrocera cucurbitae*)**	Melon fruit fly	Not known to be present	Present	Present	Present	Not known to be present
HEMIPTERA (Stink bugs, aphids, mealybugs, scale, whiteflies & hoppers)						
Paracoccus marginatus	Papaya mealy bug	Not known to be present	Present	Present	Present	Not known to be present
LEPIDOPTERA (Butterflies & moths)						
Ctenopseustis herana	Brown-headed leafroller	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Present
Ctenopseustis obliquana	Brown-headed leafroller	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Present
Stenoma catenifer	Stenomid (avocado) moth	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
ACARI (Mites)						
Oligonychus perseae	Persea mite	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
THYSANOPTERA (Thrips)						
***Scirtothrips perseae;* (syn. *S. aguacata, S. kupande*)**	Avocado thrips	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present

SCIENTIFIC NAME	COMMON NAME	JAPAN	THAILAND	CHINA	INDIA	NEW ZEALAND
BACTERIA						
***Pseudomonas syringae pv. syringae*[42],**	Bacterial canker complex, avocado blast complex	Present	Present	Present	Present	Present
***Pantoea agglomerans;* syn. *Erwinia herbicola*,**		Not known to be present	Not known to be present	Present	Not known to be present	Present
***Xanthomonas campestris* (avocado pathovars)**		Present (*Xanthomonas campestris pv. nigromaculans & Xanthomonas campestris pv. armoraciae)*	Not known to be present	Present (*Xanthomonas campestris pv. armoraciae)*	Present (*Xanthomonas campestris pv. armoraciae & Xanthomonas campestris pv. esculenti)*	Not known to be present
FUNGI (INCLUDING OOMYCETES)						
***Elsinoë perseae* (syn. *Sphaceloma perseae*)**	Avocado scab	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
Phytophthora mengei	Bark canker	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present
Phytophthora ramorum	Sudden oak death	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present

[42] All 3 bacteria (*P. syringae pv. syringae, Pantoea agglomerans* and *Xanthomonas campestris*) are required to be present to form the bacterial canker complex in avocado.

Implementation actions

To help maintain or facilitate market access, in the event of an incursion, the avocado industry in partnership with the Department of Agriculture and the relevant state and territory governments should develop the following, for the HPP pests (Table 15):

- Surveillance plan including a method for collecting and storing surveillance data
- Diagnostic protocols that have been assessed in the Australian environment
- Biosecurity treatment measures (e.g. irradiation or fumigation)

Implementation of these actions is recommended for pests with market access implications as this data will also be crucial for maintaining interstate trade should an incursion occur within Australia, resulting in a restricted distribution or quarantine zone. The implemented system should also take into account the likelihood of having entry restrictions imposed by overseas trade partners for those pests identified as possible in Table 15. A single system will facilitate market access discussions for both domestic and international trade and will minimise the potential disruption to the industry.

References

Department of Agriculture, Fisheries and Forestry (2011) Import Risk Analysis Handbook 2011. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

CABI (2019) CABI Crop Protection Compendium. Available at: cabi.org/cpc/

RESPONSE MANAGEMENT

Introduction

No matter how many preparedness activities are undertaken or how much surveillance is done at the border, a small number of plant pests will inevitably make their way into Australia. This section outlines the national agreements and processes in place to effectively respond to such incursions.

Gathering information, developing procedures, and defining roles and responsibilities during an emergency can be extremely difficult. To address this area, PHA coordinated the development of PLANTPLAN, a national set of incursion response guidelines for the plant sector, detailing the procedures required and the roles and responsibilities of all Emergency Plant Pest Response Deed (EPPRD) signatories affected by an Emergency Plant Pest (EPP).

The following section includes key contact details and communication procedures that should be used in the event of an incursion in the avocado industry. Additionally, a listing of pest-specific emergency response and information documents are provided that may support a response. Over time, as more of these documents are produced for pests of the avocado industry they will be included in this document and made available through the PHA website.

The Emergency Plant Pest Response Deed

A fundamental component of the Australian plant biosecurity system is the EPPRD, which is an agreement between the Australian government, the state/territory governments, 38 plant industries (including Avocados Australia) and PHA (collectively known as the signatories), that allows the rapid and efficient response to EPPs. The EPPRD is a legally binding document that outlines the basic operating principles and guidelines for eradication responses of EPPs.

The EPPRD provides:

- A national response management structure that enables all governments and plant industry signatories affected by the EPP to contribute to the decisions made about the response.

- An agreed structure for the sharing of costs to deliver eradication responses to EPPs detected in Australia. Costs are divided between signatories affected by the EPP in an equitable manner based on the relative potential impact of the EPP.
- A mechanism to encourage reporting of EPP detections and the implementation of risk mitigation activities.
- A mechanism to reimburse growers whose crops or property are directly damaged or destroyed as a result of implementing a Response Plan
- Early detection and response
- Rapid responses to EPPs (excluding weeds)
- Decisions to eradicate are based on appropriate criteria (e.g. eradication must be technically feasible and cost beneficial)
- An industry commitment to biosecurity and risk mitigation and a government commitment to best management practice
- Cost Sharing of eligible costs
- An Agreed Limit for Cost Sharing
- An effective industry/government decision-making process.

For further information on the EPPRD, including copies of the EPPRD, fact sheets or Frequently Asked Questions, visit planthealthaustralia.com.au/epprd and planthealthaustralia.com.au/epprd-qa.

PLANTPLAN

PLANTPLAN outlines the generic approach to response management under the EPPRD and introduces the key roles and positions held by industry and government during a response. The document is supported by a number of operating guidelines, job cards and standard operating procedures that provide further detail on specific topics. PLANTPLAN underpins the EPPRD and is endorsed by all EPPRD signatories.

The current version of PLANTPLAN and supporting documents are available on the PHA website (planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/).

For more information about PLANTPLAN and the supporting document visit planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/

Funding a response under the EPPRD

The following section outlines how eradication responses are nationally cost shared between affected industries and governments.

A copy of the EPPRD can be downloaded from the PHA website planthealthaustralia.com.au/epprd.

Cost sharing a response

Affected industries and governments invest in the eradication of EPPs and share the costs of an agreed response plan, this is referred to as 'cost sharing'. Not all activities in a response are eligible to be cost shared, with some activities considered as normal commitments for signatories.

The cost shared costs of a response are divided between affected industries and governments in an equitable manner directly related to the benefit obtained from eradicating the EPP. These relative benefits are represented by the category of the pest, with the overall view that 'the higher the benefit, the greater the investment'.

There are four categories for EPPs (Table 16). The category indicates how the funding will be split between government and industries; with the government funding the share of public benefit and industry funding the share of private benefit. It does not indicate its likelihood of eradication or its overall importance i.e. an EPP listed as Category 1 is not deemed to be any more or less important than an EPP listed as Category 4.

Table 16. Response funding allocation between Government and Industry for an EPP.

CATEGORISING OF EPP	GOVERNMENT FUNDING	INDUSTRY FUNDING
Category 1	100%	0%
Category 2	80%	20%
Category 3	50%	50%
Category 4	20%	80%

Pest categorisation

The list of categorised EPPs can be found in Schedule 13 of the EPPRD. In the event that a response plan is endorsed for an uncategorised EPP, cost sharing will commence using the default category (Category 3) and may be revised later.

Any signatory to the EPPRD can request for additional pests to be categorised and added to Schedule 13 of the EPPRD. Contact EPPRD@phau.com.au for more information and guidance on this process.

Once a substantiated request has been received by PHA a group of independent scientific technical experts (known as the categorisation group) will be convened to assess all known information about the EPP to identify the public and private benefits. Full details can be found in *Clauses 7 and 9 of the EPPRD*.

Avocado EPPs categorised to date

EPPs relevant to the avocado industry that are categorised and listed within Schedule 13 of the EPPRD are listed in Table 17.

Table 17. Formal categories for pests of the avocado industry listed in Schedule 13 of the EPPRD (as at June 2019).

FORMAL CATEGORY	SCIENTIFIC NAME	COMMON NAME
1	*Phytophthora ramorum*	Sudden oak death (syn. Ramorum leaf blight)
2	*Bactrocera dorsalis* (syn. *B. invadens, B. papayae, B. philippiensis*)	Oriental fruit fly
2	*Xylella fastidiosa*	Pierces disease
4	*Peridroma saucia*	Variegated cutworm

How to respond to a suspect EPP

Following the detection of a suspect EPP, the relevant state agency will be notified either directly or through the Exotic Plant Pest Hotline. Within 24 hours of the state agency having a reasonable suspicion that they are dealing with an EPP, the Chief Plant Health Manager (CPHM) of the state or territory will inform the Australian Chief Plant Protection Officer (ACPPO). All signatories affected by the EPP (both government and industry) are then notified immediately, and a Consultative Committee on Emergency Plant Pests (CCEPP) meeting is convened (this process is outlined in Figure 4). Only the industry signatories affected by the EPP are engaged in the response process. These are determined based on the known hosts of the EPP. All positive detections of EPPs or suspect EPPs must undergo secondary identification from an independent laboratory. Confirmation of the identification should not delay the reporting of the EPP to the ACPPO or the CCEPP.

Figure 4. Reporting of suspect EPPs and notification process.

Once a pest is notified to the CCEPP, all signatories that are affected by the EPP play a part in the national management of EPP response. This is primarily through the two national decision-making committees, both of which Avocados Australia have a representative on:

- The Consultative Committee on Emergency Plant Pests (CCEPP) which provide technical expertise on the response
- The National Management Group (NMG) which acts on recommendations from the CCEPP and make the final decisions about EPP responses and funding.

Technical and economic considerations are reviewed, and a decision made on whether to eradicate using the cost sharing mechanisms under the EPP (i.e. develop a response plan) or take another course of action (potentially to contain or do nothing which will mean long term management of the pest).

The relevant state/territory agriculture department is responsible for the on-ground response to EPPs and will adopt precautionary emergency containment measures if appropriate. Depending on the nature of the EPP, measures could include:

- restriction of operations in the area
- disinfection and withdrawal of people, vehicles and machinery from the area
- restricted access to the area
- control or containment measures.

Each response to an EPP is applied differently due to the nature of the incursion, however, each follows the defined phases of a response as outlined at planthealthaustralia.com.au/biosecurity/incursion-management/phases-of-an-emergency-plant-pest-response/.

Owner reimbursement costs

Owner Reimbursement Costs (ORCs) are included in the shared costs of a response and are available to eligible growers to alleviate the financial impacts of crops or property that are directed to be destroyed under an agreed response plan.

ORCs were developed to encourage early reporting and increase the chance of successful eradication. ORCs are paid to the owner and cover direct costs associated with implementing a response plan, including:

- Value of crops destroyed,
- Replacement of lost capital items and
- Fallow periods

ORCs are only available when there is an approved response plan under the EPPRD, and only to industries that are signatories to the EPPRD, such as the avocado industry.

The value of ORCs is directed by the ORC Evidence Frameworks and is based on an agreed valuation approach developed for each industry.

Further information about ORCs is available from planthealthaustralia.com.au/biosecurity/incursion-management/owner-reimbursement-costs/

Industry specific response procedures

Industry communication

Avocados Australia are the peak industry body for the avocado industry, i.e. signatory to the EPPRD, and will be the key industry contact point if a plant pest affecting the avocado industry is detected and responded to using the arrangements in the EPPRD. Avocados Australia will have responsibility for relevant industry communication and media relations (see PLANTPLAN for information on approved communications during an incursion). The contacts nominated for the CCEPP and the NMG by Avocados Australia will be contacted (Table 18) regarding any meetings of the CCEPP or NMG. It is important that all Parties to the EPPRD ensure their contacts for these committees are nominated to PHA and updated swiftly when personnel change.

Close cooperation is required between relevant government and industry bodies to ensure the effective development and implementation of a response to an emergency plant pest, and the management of media/communication and trade issues. Readers should refer to PLANTPLAN or undertake the relevant BOLT courses for further information.

Table 18. Contact details for Avocados Australia

Website	avocado.org.au/
Postal address	PO Box 134 Brisbane Markets, QLD, 4106, Australia
Email	admin@avocado.org.au
Phone	(61) 07 3846 6566 or toll free 1300 303 971
Fax	(61) 07 3846 6577 or toll free 1300 303 972

References

PLANTPLAN (2018) PLANTPLAN Australian Emergency Plant Pest Response Plan. Version 3.2. (planthealthaustralia.com.au/plantplan).

APPENDIX 1: PROFILE OF THE AUSTRALIAN AVOCADO INDUSTRY

To develop any biosecurity plan it is critical to understand the profile and context of the industry.

Avocados Australia

Avocados Australia is the main industrial body representing the Australian Avocado industry along with its growers, industry people, associated businesses and its members. It was formed in 2003 and replaced the Australian Avocados Growers Federation (AAGF) to foster the growth of the industry and to meet the need of the growers.

All commercial avocado growers in Australia pay statutory national levies which are used for research and development (R&D), marketing and biosecurity. These levies are collected by the Australian Government. Avocados Australia works closely with Hort Innovation through the Avocado Strategic Industry Advisory Panel (SIAP) to ensure that the R&D and marketing levies are well directed to the needs of the industry (Avocados Australia, 2018). The Avocado Strategic Investment Plan 2017-2021 provides guidance in the investment of avocado marketing and R&D levies. The biosecurity levy is managed through Plant Health Australia. The Emergency Plant Pest Response (EPPR) levy which is zero provides a way for the avocado industry to meet its obligations in terms of funding eradication of plant pests as and when required.

Table 19. Current levies and their rates (Avocados Australia, 2018)

LEVIES	CENTS PER KILOGRAM
Research and Development	2.9
Marketing	4.5
Plant Health Australia	0.1
Emergency Plant Pest Response (EPPR)	0
Total	**7.5**

Industry profile

Avocados, a favoured food for Australians, belongs to the genus *Persea americana* which is one of 50 genera belonging to the family Lauraceae. Other species that fall under this family include cinnamon, California bay, camphor, ancient laurel and Sassafras, to name a few (Menge & Ploetz, 2003).

Avocado trees are believed to be native to Southern Mexico with a geographic area stretching from Mexico through to the highlands of Guatemala all the way to the sub-tropical areas of Latin America presenting a diverse set of environments (Ploetz, et al., 1994). The first Europeans to eat avocados were the Spanish explorers in the 16th century and were responsible for bringing avocados to Europe and exporting them to other countries. In the 1800's, avocados were first planted in the United States from Mexico and Central America (Ploetz, et al., 1994). This was followed by the importation of a green skinned superior quality of the Mexican-Guatemalan hybrid called Fuerte into California by nurseryman F. O Popenoe in 1911 (Vock, 2001). This cultivar was responsible for marking the beginning of a worldwide commerce in avocado as it quickly spread around the world.

Avocados are currently grown in 59 countries with Mexico being the highest producer followed by the United States, Indonesia, South Arica, Chile, Brazil, Dominican Republic, China, Columbia and Peru respectively (Schaffer et al., 2013). More than half of the countries producing avocados are in the Americas, while 77 per cent of the production on a worldwide basis occurs in 24 countries in South, Central and North America (Schaffer et al., 2013).

The Australian avocado industry is mostly based on rootstocks that are propagated from seed, although, clonal rootstocks are also used (Department of Agriculture and Fisheries Queensland, 2014 and Schaffer et

al., 2013). Production of avocados in Australia occurs in various regions with diverse climates from subtropical to Mediterranean. The most common varieties of avocado produced in Australia are Hass and Shepard. Hass accounts for 78 per cent of fresh production, Shepard 20 per cent and other varieties 3 per cent (Hort Innovation, 2019).

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APPENDIX 2: THREAT SUMMARY TABLES

Avocado industry threat summary tables

The information provided in the threat summary tables is an overview of exotic plant pest threats to the avocado industry. More than 170 exotic plant pests were identified. Summarised information on entry, establishment and spread potentials and economic consequences of establishment are provided where available. Pests under official control[43] or eradication may be included in these tables where appropriate. However, avocado pests that are established but regionalised within Australia are not covered by TSTs but may be assessed in state biosecurity plans. Assessments may change given more detailed research and will be reviewed with the biosecurity plan. Full descriptions of the risk rating terms can be found on page 42. An explanation of the method used for calculating the overall risk can be found on the PHA website[44]. Additional information on a number of the pests listed in the TSTs can be found in pest-specific information document (Table 4).

Invertebrates

Table 20. Avocado invertebrate threat summary table.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Acari (mites)										
Oligonychus perseae	Persea mite	Avocado, citrus, apricot, peach, nectarine, plum, persimmon, grapes, sumac, liquidambar trees, rose, Acacia	Leaves	Adults capable of dispersal by wind. Infested plant material	Israel, Canary Islands, Mexico, USA, Costa Rica, Portugal, Spain	MEDIUM	HIGH	HIGH[45]	HIGH[46]	**HIGH**

[43] Official control defined in ISPM No. 5 as the active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests

[44] Available from planthealthaustralia.com.au/biosecurity/risk-mitigation

[45] It spreads rapidly since its webbing protects it and its eggs from the predacious mite *Amblyseius hibisci*, a common biological control agent in California. In severe infestations, mite population can reach 1000 mites per leaf. Its numbers peak with dry summer heat and decline rapidly in the fall, but enough winter survival occurs (eggs overwinter) to repeat the cycle, allowing build-up of adult populations in spring. Gwen is a favourite host, then Hass, Reed, and other varieties.

[46] A predacious mite native to California, *Galendromus annectens* and *Galendromus helveolus* help with control. Individual homeowner trees can be helped by water-jet washing, which is more effective if insecticidal soap is added. To minimize initial infection, avoid drought and other stress.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Oligonychus peruvianus		Arabica coffee, carrot, cotton, cassava, avocado, grape, citrus	Whole plant	Adults capable of long distance flight by wind. Short distance dispersal by walking	Mexico, Guatemala, Trinidad and Tobago, Brazil, Colombia, Ecuador, Peru, Venezuela	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Oligonychus yothersi	Avocado red mite	Avocado, eucalyptus	Leaves	Adults capable of dispersal by wind, infested plant material	Iran, Costa Rica, Cuba, Brazil	LOW-MEDIUM	MEDIUM	LOW-MEDIUM	MEDIUM	**VERY LOW-LOW**
Coleoptera (beetles and weevils)										
Adoretus versutus	Rose beetle	Wide host range including wattles, cashew nut, groundnut, camel's foot, pawpaw, lemon, pumelo, navel orange, grapefruit, coffee, taro, yam, fig, sweet potato, lychee, apple, grape, avocado, beans, plum, guava, radish, European pear, roses, sugarcane, eggplant, sorghum, cocoa, Singapore almond, ginger	Leaves, inflorescence	Infested plant material and machinery, adults capable of flight, eggs are soil borne	Asia, Mauritius, Madagascar, Reunion, St Helena, Seychelles, American Samoa, Cook Is, Fiji, Samoa, Tonga, Vanuatu, Wallis & Futuna Is	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Batocera rufomaculata	Mango tree borer	Cashew nut, fig, mango, avocado	Whole plant	Adults capable of long distance flight[47], entry in timber products	Asia, Egypt, Madagascar, Mauritius, Mayotte, US Virgin Is, Reunion, Seychelles, Barbados, British Virgin Is, Puerto Rico, Solomon Is	MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**
Caulophilus oryzae	Broad nosed grain weevil	Chestnuts, chickpea, sweet potato, millet, feather grass, avocado, maize, ginger	Whole plant	Adults capable of flight	Mexico, USA, Guatemala, Jamaica, Cuba, Panama, Puerto Rico, Portugal	MEDIUM	HIGH	HIGH	LOW	**LOW**
Conotrachelus aguacatae	Small avocado seed weevil	Avocado, guava	Fruit	Infested plant material	Mexico, Nicaragua, Florida	HIGH	HIGH	HIGH	HIGH	**HIGH**
Conotrachelus perseae	Small seed weevil	Avocado, guava	Fruit	Infested plant material	Mexico, Central America, Colombia	HIGH	HIGH	HIGH	HIGH	**HIGH**
Copturomimus hustachei	Small seed weevil	Avocado	Stems	Infested plant material[48]	Mexico, Costa Rica	NEGLIGIBLE	LOW	MEDIUM	HIGH	**VERY LOW**
Copturomimus perseae	Small seed weevil	Avocado	Stems	Infested plant material[48]	Colombia	LOW	LOW	MEDIUM	HIGH	**LOW**

[47] Adults are generally nocturnal and may be attracted to light increasing their flight distance.
[48] Information inferred based on common name

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Copturus aguacatae	Avocado seed weevil	Avocado	Branch, stem, peduncle end of fruit	Adults capable of flight by wind. Short distance dispersal by walking. Infested plant material	Mexico	MEDIUM	MEDIUM	MEDIUM	HIGH	**MEDIUM**
Copturus constrictus	Weevil	Avocado	Stem	Adults capable of flight by wind. Short distance dispersal by walking. Infested plant material[49]	Mexico	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Copturus lunatus	Weevil	Avocado	Stem	Adults capable of flight by wind. Short distance dispersal by walking. Infested plant material[49]	Brazil	LOW	LOW	LOW	LOW	**NEGLIGIBLE**

[49] Information inferred based on genus.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Copturus perseae	Weevil	Avocado, mango	Stem	Adults capable of flight by wind. Short distance dispersal by walking. Infested plant material[50]	Columbia, Burma, India	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Diabrotica fucata		Avocado, beans	Whole plant[50]	Adults capable of flight[51]	Dominican Republic, Martinique, St Lucia, Guyana	NEGLIGIBLE	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Diaprepes abbreviatus	Citrus weevil	Wide host range including celery, peanut, capsicum, coffee, loquat, persimmon, cotton, sweet potato, mango, sapodilla, cassava, banana, rumbutan, avocado, bean, date palm, guava, eggplant, potato, sorghum, cocoa, maize	Whole plant	Hitchhiker, transmitted by infested machinery, soilborne	Florida, Mississippi, Central America and Caribbean, French Guiana	NEGLIGIBLE	MEDIUM	MEDIUM	MEDIUM	**NEGLIGIBLE**
Diaprepes splengleri	Golden leaf weevil	Lime, sour orange, mango, avocado, guava, rose, sugarcane	Whole plant	Infested plant material[50]	Cuba, Puerto Rico, Saint Vincent and the Grenadines, Trinidad and Tobago	NEGLIGIBLE	MEDIUM	MEDIUM	MEDIUM	**NEGLIGIBLE**

[50] Information inferred based on genus.
[51] Information inferred from anatomy.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Euwallacea sp.[52]	Polyphagous shot hole borer	Wide host range including avocado, tree species and timber	Branches	Hitchhiker, flight short distance	California, Israel, South Africa, Thailand, Vietnam, China, Taiwan, Japan	HIGH	HIGH	HIGH	LOW	**LOW**
Euwallacea sp.[52]	Kuroshio shot hole borer	Wide host range including avocado	Branches	Hitchhiker, flight short distance	Taiwan, Japan	HIGH	HIGH	HIGH	LOW	**LOW**
Heilipus apiatus	Weevil	Avocado	Root, Stem	Infested plant material[53]	Florida	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	**NEGLIGIBLE**
Heilipus lauri	Large seed weevil, Avocado seed weevil	Avocado	Fruit	Infested plant material[53]	Mexico, Central America	HIGH	HIGH	HIGH	HIGH	**HIGH**
Hypomeces squamosus	Green weevil, Gold-dust weevil	Wide host range including acacia, eucalyptus, cotton, sunflower, sweet potato, mango, rambutan, tobacco, rice, avocado, sugarcane, cocoa, cowpea, maize	Whole plant	Soilborne, infested plant material	Asia	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

[52] *Fusarium ambrosium* and at least 8 undescribed *Fusarium* spp. (AF2 to AF9) are associated with *Euwallacea* sp. beetles in brood galleries. The *Fusarium* spp. in Australia are undescribed.
[53] Information inferred based on common name

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Lagocheirus araneiformis		Cassava, avocado[54], sugarcane	Stem, leaves	Infested plant material, adults capable of flight[55]	Antigua & Barbuda, Barbados, Caribbean, Dominica, St Lucia, Grenada, Guadeloupe, Honduras, Martinique, Montserrat, St Kitts & Nevis, St Vincent & the Grenadines, Hawaii	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Megaplatypus mutatus (syn. *Platypus mutatus*, *P. sulcatus*)	Ambrosia beetle	Wide range of woody trees including hazelnut (*Corylus avellana*), walnut, maple, citrus, Eucalyptus, ash, laurel, Magnolia, apple, plane tree (*Platanus* spp.), poplar, peach, avocado, pear, oak, willow, lime tree (*Tilia* spp.), elm, sour cherry, acacia, chestnuts,	Whole plant	Hitchhiker. Adults capable of flight[56]	South America, Peru, Italy	MEDIUM	LOW-MEDIUM	LOW-MEDIUM	MEDIUM	**VERY LOW-LOW**
Monolepta apicalis[57]	Avocado beetle	Avocado	Leaves, fruit	Adults capable of flight, infested plant material	South Africa	LOW	MEDIUM	LOW	HIGH	**LOW**

[54] Avocado is main host
[55] Information inferred based on common name.
[56] Generally 50-100 m from the emergence hole. Flight beyond 100 m is unlikely creating a slow rate of natural dispersal.
[57] Note Australia has a similar species *Monolepta australis* that infects Avocado (Erichsen and Shoeman, 1993)

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Naupactus xanthographus	South American fruit tree weevil	Wide host range including citrus, loquat, apple, lucerne, European olive, avocado, apricot, sweet cherry, plum, almond, peach, pears, potato, grapevine	Whole plant	Soilborne, infested plant material, hitchiker, transmitted by infested machinery[58]	Argentina, Chile, Uruguay	MEDIUM	HIGH	MEDIUM	HIGH	**MEDIUM**
***Callimetophus alabatus* (syn. *Niphonoclea albata*)**	Twig borer	Avocado, mango	Stem, branches	Infested plant material	Philippines	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
***Callimetophus capito* (syn. *Niphonoclea capitoe*)**	Mango twig borer	Avocado, mango	Stem, branches	Infested plant material	Philippines	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Pagiocerus fiorii	Seed borer	Avocado, corn	Stem, fruit	Infested plant material	Argentina, Ecuador	LOW	MEDIUM	MEDIUM	MEDIUM	**LOW**

[58] Adults are flightless, therefore natural spread is probably limited to short distances.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Rhynchophorus palmarum	South American palm weevil	Pineapple, pawpaw, citrus, coconut, mango, banana, avocado, date palm, guava, sugarcane, cocoa	Whole plant above ground	Adults capable of flight, infested plant material	Mexico, Cuba, Barbados, Belize, Costa Rica, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Honduras, Martinique, Nicaragua, Panama, Puerto Rico, St Lucia, St Vincent & the Grenadines, Trinidad & Tobago, Brazil, Peru	LOW	LOW	MEDIUM	LOW	**NEGLIGIBLE**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Sinoxylon conigerum	Conifer auger beetle	Wide host range including bamboo, cotton, rubber, mango, cassava, avocado	Stems	Infested plant material[59]	China, India, Indonesia, Japan, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam, Africa, USA, Barbados, Belize, Costa Rica, Haiti, Brazil, Venezuela, Italy, Spain, American Samoa, Niue	MEDIUM	HIGH	HIGH	LOW	**LOW**
Suana concolor		Tea, grapefruit, rambutan, avocado, roses, cocoa, Acacia, Eucalyptus	Leaves[60]	Adults capable of flight[60]	Philippines, South East Asia, India, Sri Lanka, Java, Borneo	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Xyleborus glabratus	Redbay ambrosia beetle	Avocado, red bay	Trunk	Infested plant material	Bangladesh, China, India, Japan, Myanmar, Taiwan, USA,	MEDIUM	MEDIUM	MEDIUM	HIGH[61]	**MEDIUM**
Xyleborus neivai		Citrus, avocado	Stems[62]	Infested plant material	Argentina, Brazil	MEDIUM	MEDIUM	MEDIUM	HIGH[63]	**MEDIUM**

[59] Infested wood and wood products including cardboard boxes
[60] Information inferred based on the moth group of insects
[61] A high priority exotic pest for New Zealand. Main pathway wood packaging. India, Taiwan, Florida and California - from Asia. Quite invasive in America. Main pathway seems to be firewood. Laurel wilt (*Raffaelea lauricola*) is vectored by these beetles and is known to occur in avocado.
[62] Information inferred based on genus
[63] An assumed vector of Laurel wilt

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Diptera (Flies & Midges)										
Anastrepha fraterculus	South American fruit fly	Wide host range including guava, citrus, apple, avocado, peach	Fruit	Hitchhiker[64]	Mexico, Central America and Caribbean, South America, Peru	LOW	HIGH	HIGH	HIGH	**MEDIUM**
Anastrepha ludens	Mexican fruit fly	Wide host range including cashew, pawpaw, *Citrus* spp. (lime, sour orange, sweet lemon tree, pomelo, mandarin, tangelo, navel orange, grapefruit), arabica coffee, persimmon, apple, mango, passionfruit, avocado[65], peach, pomegranate, European pear	Fruit	Adults capable of flight over long distances[64] Transmitted via infested plant material (fruit and puparia in soil or packaging with plants that have already fruited)	Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama	MEDIUM	HIGH	HIGH	HIGH	**HIGH**

[64] *Anastraphea* spp. adults can fly as far as 135 km
[65] Avocado is not the preferred host.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Anastrepha obliqua	West Indian fruit fly	Wide host range including cashew nut, citrus (sour orange, sweet lemon tree, navel orange, grapefruit), arabica coffee, loquat, mango, almond, guava, European pear)	Fruit	Adults capable of flight over long distances[64] Transmitted via infested plant material (fruit and puparia in soil or packaging with plants that have already fruited)	Mexico, Antigua & Barbuda, Bahamas, Barbados, Belize, British Virgin Is, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica, Martinique, Montserrat, Netherlands Antilles, Nicaragua, Panama, Puerto Rico, St Kitts & Nevis, St Lucia, St Vincent & the Grenadines, Trinidad & Tobago, US Virgin Is, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Venezuela	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Anastrepha serpentina	Sapodilla fruit fly	Wide host range including citrus (mandarin, pumelo, navel orange, grapefruit), quince, loquat, apple, mango, sapodilla, avocado, peach, guava	Fruit	Adults capable of flight over long distances[64]	Mexico, Belize, Costa Rica, Guatemala, Honduras, Netherlands Antilles, Panama, Trinidad & Tobago, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Anastrepha striata	Guava fruit fly	Wide host range including navel orange, mango, cassava, passionfruit, avocado[66], peach, guava	Fruit	Adults capable of flight over long distances[64]	Mexico, Belize, Costa Rica, Guatemala, Honduras, Netherlands Antilles, Panama, Trinidad and Tobago, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

[66] Avocado is not the preferred host.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Anastrepha suspensa	Caribbean fruit fly	Wide host range including capsicum, pawpaw, citrus (lime, sour orange, sweet lemon tree, mandarin lime, mandarin, tangelo, navel orange, grapefruit), persimmon, loquat, common fig, apple, mango, sapodilla, date-palm, plum, peach, guava, European pear, black plum, avocado	Fruit	Adults capable of flight over long distances[64]	Bahamas, British Virgin Islands, Cuba, Dominican Republic, Haiti, Jamaica, Puerto Rico, French Guiana	LOW	HIGH	HIGH	HIGH	**MEDIUM**
Bactrocera carambolae	Carambola fruit fly	Cashew nut, breadfruit, jackfruit, capsicum, pawpaw, citrus (lime, lemon, mandarin lime, mandarin, navel orange, grapefruit), mangosteen, mango, sapodilla, avocado, guava, pomegranate, tomato, Singapore almond)	Fruit	Transmitted by infested plant material (fruit)	Brunei Darussalam, India, Indonesia, Malaysia, Singapore, Thailand, Brazil, French Guiana, Suriname	HIGH	HIGH	HIGH	HIGH	**HIGH**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Bactrocera dorsalis (syn. *B. invadens, B. papayae, B. philippinensis)*[67]	Oriental fruit fly	Wide host range of over 300 species including cashew nut, black currant tree, jackfruit, capsicum, chilli, pawpaw, watermelon, citrus (lime, sour orange, Mauritius bitter orange, Tahitian lime, lemon, pumelo, mandarin, navel orange, grapefruit), arabica and robusta coffee, melon, cucumber, persimmon, loquat, mangosteen, apple, mango, sapodilla, bitter gourd, black mulberry, banana, plantain, rambutan, passionfruit, avocado, bean, apricot, sweet cherry, plum, peach, guava, pomegranate, European pear, Oriental pear tree, mangrove, tomato, eggplant, Singapore almond, cocoa	Fruit	Transmitted by infested plant material (fruit), hitchhiker	Widespread throughout Asia, Africa the Pacific [68]	HIGH	HIGH	HIGH	HIGH	**HIGH**
Bactrocera facialis	Tropical fruit fly	Wide host range including cashew nut, breadfruit, capsicum, chilli, lemon, pumelo, mandarin, navel orange, grapefruit, mango, avocado, peach, guava, tomato	Fruit	Adults capable of flight	Tonga	MEDIUM	HIGH	HIGH	HIGH	**HIGH**

[67] *Bactrocera dorsalis, B. invadens, B. papayae* and *B. philippinensis* have been condensed into one species *B. dorsalis* (Schutze et al., 2014).

[68] Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Japan, Christmas Is., India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Taiwan, Vietnam, Benin, Angola, Burkina Faso, Botswana, Burundi, Cameroon, Central African Republic, Chad, Comoros, Cape Verde, Congo, DR Congo, Cote d'Ivoire, Equatorial Guinea, Liberia, Rwanda, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Madagascar, Mauritania, Mali, Mayotte, Mozambique, Namibia, Niger, Nigeria, Sudan, Senegal, Sierra Leone, South Africa, Uganda, Swaziland, Tanzania, Togo, Zambia, Zimbabwe, USA (Hawaii), Palau, French Polynesia, PNG

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Bactrocera kandiensis	Fruit Fly	Wide host range including cashew nut, pawpaw, pumelo, mango, avocado, guava, pomegranate, clove	Fruit	Adults capable of flight	Sri Lanka	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Bactrocera kirki	Fruit Fly	Wide host range including pineapple, capsicum, chilli, lime, mandarin, navel orange, mango, passionfruit, peach, guava, avocado, tomato, eggplant, cashew nut	Fruit	Adults capable of flight	American Samoa, Fiji, French Polynesia, Niue, Samoa, Tonga, Wallis and Futuna Islands	HIGH	HIGH	HIGH	HIGH	**HIGH**
Bactrocera melanotus	Fruit Fly	Wide host range including mango, pawpaw, avocado, breadfruit, jackfruit, guava, citrus, tomato	Fruit	Adults capable of flight	Cook Islands	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Bactrocera passiflorae	Fijian fruit fly	Cashew nut, pawpaw, lime, mandarin, passionfruit, mango, avocado, guava, eggplant, cocoa	Fruit	Adults capable of flight	Fiji, Niue, Tonga, Tuvalu, Wallis and Futuna Islands	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Bactrocera xanthodes	Pacific fruit fly	Breadfruit, pawpaw, mandarin, guava, tomato, mango, apple, avocado	Fruit	Adults capable of flight	American Samoa, Cook Islands, Fiji, Niue, Samoa, Tonga, Tuvalu, Vanuatu, Wallis and Futuna Islands, French Polynesia	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Ceratitis anonae	Fruit fly, annona, African fruit fly	Guava, mango, avocado	Fruit	Adults capable of flight	Africa	LOW	HIGH	HIGH	MED	**LOW**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Ceratitis catoirii	Mascarenes fruit fly	Avocado, mango	Fruit	Adults capable of flight	Reunion Island	LOW	HIGH	HIGH	MED	**LOW**
Ceratitis cosyra	Mango fruit fly	Mango, avocado, peach guava	Fruit	Adults capable of flight	Angola, Benin, Botswana, Burkina Faso, Cameroon, Central African Republic, DR Congo, Cote D'Ivoire, Guinea, Kenya, Madagascar, Malawi, Mali, Mozambique, Nigeria, Sudan, Senegal, Sierra Leone, South Africa, Tanzania, Togo, Zambia, Zimbabwe, New Zealand	LOW	HIGH	HIGH	HIGH	**MEDIUM**
Ceratitis fasciventris	African fruit fly	Guava, mango, avocado	Fruit	Adults capable of flight	Africa	LOW	HIGH	HIGH	HIGH	**MEDIUM**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Ceratitis rosa	Natal fruit fly	Wide host range including cashew nut, chilli, pawpaw, sour orange, mandarin, navel orange, grapefruit, coffee, arabica coffee, pumpkin, quince, loquat, persimmon, mangosteen, apple, mango, avocado, apricot, plum, peach, guava, European pear, tomato, tobacco tree, cocoa, grapevine, jujube	Fruit	Adults capable of flight	Ethiopia, Kenya, Lesotho, Malawi, Zambia, Mauritius, Mozambique, Reunion, South Africa, Uganda, Seychelles, Swaziland, Tanzania, Zimbabwe	LOW	HIGH	HIGH	HIGH	**MEDIUM**
Zeugodacus cucurbitae (syn. *Bactrocera cucurbitae)*	Melon fruit fly	Wide host range including jackfruit, pawpaw, watermelon, pumelo, navel orange, gherkin, cucumber, melon, pumpkin, marrow, cucurbits, quince, common fig, loofah, mango, sapodilla, passionfruit, avocado, common bean, peach, guava, tomato, cowpea	Fruit	Transmitted by infested plant material (fruit)	Asia, Africa, USA, Guam, Kiribati, Nauru, Northern Mariana Islands, Papua New Guinea, Solomon Islands	HIGH	HIGH	HIGH	HIGH	**HIGH**
Hemiptera (Stink bugs, aphids, mealybugs, scale, whiteflies & hoppers)										
Aethalion quadratum	Avocado treehopper	Avocado	Shoots	Adults capable of flight[69]	Mexico, Guatemala	LOW	MEDIUM	HIGH	MEDIUM	**LOW**

[69] Information inferred based on common name.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Aleurocanthus woglumi	Citrus blackfly	Wide host range including cashew nut, pawpaw, citrus, coconut, coffee, quince, lychee, mango, banana, passionfruit, avocado, frangipani, poplars, guava, pomegranate, pears, roses, grape, ginger	Leaves	Short distance wind dispersal[70], hitchhiker, infected plant material	Asia, Africa, Bermuda, USA, Mexico, Brazil, Colombia, Ecuador, French Guiana, Guyana, Suriname, Venezuela, PNG	HIGH[71]	HIGH	HIGH	LOW	**LOW**
Aleurodicus cocois	Coconut whitefly	Cashew nut, plants of the palm family (Arecaceae spp.), coconut, rubber, plantain, avocado, black pepper	Leaves	Wind dispersal, short distance dispersal by crawlers[72]	Hawaii, Mexico, USA, Anguilla, Antigua & Barbuda, Brazil, Barbados, Bolivia, Guyana, Colombia, Dominica, Dominican Rep., Ecuador, El Salvador, Costa Rica, Guyana, St Lucia, Grenada, Guadeloupe, Honduras, St Vincent & the Grenadines, Jamaica, Trinidad & Tobago, Martinique, Suriname, Venezuela	MEDIUM	HIGH	MEDIUM	LOW	**VERY LOW**

[70] 187 m in 24 hours
[71] An A1 quarantine pest for EPPO. Mainly presents a risk for citrus. Can be found on crops, like mango, neighbouring citrus orchards for several generations.
[72] Dispersal is often reduced by strong wind and heavy rain.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Aleurodicus dugesii	Giant whitefly	Wide host range including citrus, banana, apricot, apple, pear, cinnamon, guava, coconut, avocado, passionfruit, willow, geranium, ivy, liquidambar, boxwood and many other ornamentals	Leaves	Wind dispersal[73]	Canary Is, Hawaii, USA, Mexico, Costa Rica, Belize, Guatemala, Nicaragua, Venezuela, Indonesia, Pakistan	HIGH	HIGH	HIGH	MEDIUM[74]	**MEDIUM**
Aleurodicus neglectus		Avocado, custard apple, sugar apple, coconut, cacao	Leaves	Wind dispersal[75]	Trinidad & Tobago, Barbados, Brazil, Costa Rica, Colombia, Guyana	LOW	HIGH	HIGH	MEDIUM	**LOW**
Aleurodicus pulvinatus	Coconut whitefly	Coconut[76], robusta coffee, avocado, black pepper, guava, common guava	Leaves	Wind dispersal[75]	Mexico, Central America and Caribbean, Peru, South America	LOW	HIGH	HIGH	MEDIUM	**LOW**
Amblypelta bilineata	Spotting Bug	Avocado	Fruit	Adults capable of flight[77]	New Caledonia	LOW	HIGH	HIGH	HIGH	**MEDIUM**

[73] Giant whiteflies exhibit a strong tendency to feed in groups. After adults emerge, the majority will remain on the same plant to feed and lay eggs.
[74] If the numbers of whiteflies per leaf are great enough, the plant will suffer from lack of water and nutrients, resulting in a weakened plant and loss of leaves but rarely in plant death.
[75] Information inferred based on common name.
[76] Causes serious damage to coconut trees.
[77] Information inferred based on genus.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Anoplocnemis curvipes	Tip wilter or dahlia bug	Cashew nut, mango, sorghum, cowpea, avocado	Shoots	Infested plant material[78]	Iran, Chad, Cote d'Ivoire, Ghana, Kenya, Nigeria, Senegal, South Africa, Tanzania	LOW	HIGH	HIGH	LOW	**VERY LOW**
Bathycoelia distincta (syn. *Bathycoelia natalicola*)	Two-spotted stink bug	Macadamia, avocado, coffee, guava, bluegum (*Eucalyptus* spp.)	Whole plant above ground	Adults capable of flight, infested plant material[78]	South Africa	LOW	HIGH	HIGH	LOW	**VERY LOW**
Ceroplastes cirripediformis	Barnacle scale	Arabica coffee, sweet potato, cassava, citrus, longan, lychee, avocado	Leaf, branch	Infested plant material and machinery[79]	Bermuda, USA, Central America and Caribbean, Bolivia	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Chinavia pallidoconspersa (syn. *Nezara pallidoconspersa)*	Yellow-edge stink bug	Chickpea, soyabean, common bean, sorghum, cowpea, avocado	Fruit, stems	Adults capable of flight[79]	Democratic republic of Congo, Kenya, Sudan, Tanzania, Uganda	LOW	NEGLIGIBLE	LOW-MEDIUM	LOW	**NEGLIGIBLE**
Coenomorpha nervosa	Brown stink bug	Fig, avocado, macadamia	Fruit, new growth	Adults capable of flight[78]	South Africa	LOW	MEDIUM	MEDIUM	HIGH	**MEDIUM**

[78] Information based on common name.
[79] Information based on genus.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Dysmicoccus grassii (syn. *Dysmicoccus alazon)*	Piojo harinoso de la pina	Fig, mango, avocado, oleander, banana, passionfruit, coffee, cocoa, pineapple	Stems, leaves	Infested plant material[80]	Spain, Cuba, Brazil, Bahamas, Belize, Canary Is, Colombia, Ecuador, Costa Rica, Dominican Republic, France, Haiti, Honduras, Italy, Malaysia, Mexico, Nigeria, Panama, Peru, Puerto Rico, Vieques Is, Sicily, Trinidad & Tobago, USA	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**
Dysmicoccus neobrevipes	Grey pineapple mealybug	Wide host range including acacia, red ginger, pineapple, breadfruit, lime, mandarin, navel orange, coconut, coffee, mangosteen, cotton, mango, banana, rambutan, beans, guava, pomegranate, tomato, eggplant, cocoa, avocado	Leaves, roots	Infested plant material and machinery. Wind dispersal for localised spread	Asia, Uganda, Mexico, USA, Central America and Caribbean, Colombia, Brazil, Ecuador, Peru, Suriname, Italy, Lithuania, American Samoa, Cook Is, Fiji, Kiribati, Guam, Marshall Is, Northern Mariana Is, Samoa	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

[80] Information based on common name.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Empoasca stevensii	Stevens leafhopper	Pawpaw, avocado, plumeria	Leaves, stem (secondary vector of bunchy top[81])	Adults capable of flight	Trinidad & Tobago, Hawaii, Kauai, Florida	LOW	MEDIUM	MEDIUM	HIGH	**MEDIUM**
Halyomorpha halys (syn. *Halyomorpha mista)*	Brown marmorated stink bug	Wide host range over 100 reported host plants from the following families Caprifoliaceae, Malvaceae, Aceraceae, Simaroubaceae, Hippocastanaceae, Poaceae, Amaranthaceae, Rosaceae, Scrophulariaceae, Fabaceae, Asteraceae, Brassicaeae, Annonaceae, Basellaceae, Betulaceae, Solanaceae, Juglandaceae, Bignoniaceae, Celastraceae, Ulmaceae, Rubiaceae, Aquifoliaceae, Cercidiphyllaceae, Oleaceae, Chenopodiaceae, Rutaceae, Cornaceae, Ebenaceae, Elaegnaceae, Moraceae, Oleaceae, Ginkgoaceae, Hamamelidaceae, Pinaceae, Asteraceae, Cannabaceae, Cupressaceae, Sapindaceae, Lythraceae, Rhamnaceae, Tillaceae, Ericaeceae[82]	Whole plant, above ground[83]	Adults capable of flight, hitchhiker[84]	Asia, North America, Europe	HIGH	HIGH	HIGH	LOW	**LOW**

[81] Vectors Bunchy top disease

[82] Avocado is not a preferred host

[83] Does not feed on hard avocado fruit hanging on the tree, only ripe, soft fruit.

[84] Most interceptions have been in the adult stage. Egg masses and nymphs could hitchhike on fresh fruit, vegetables, nursery stock. The eggs are sensitive to temperature, so transport could disrupt first-instar nymphs. Ocean going cargo containers or packing crates are the most common introduction pathway (CABI). Long distance dispersal by adults which can fly 2 km in a day (Wiman el at., 2013), short distance dispersal by late instar nymphs which can climb 6-8 m in 15mins, while 3rd and 5th instars can walk (on average) 1.3-2.6m over 30 mins (on grassy surfaces)

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Helopeltis bakeri	Mirid bug	Cacao, avocado	Whole plant above ground	Adults capable of flight[85]	Philippines	NEGLIGIBLE-LOW	NEGLIGIBLE-LOW	NEGLIGIBLE-LOW	LOW	**NEGLIGIBLE**
Helopeltis collaris	Cacao mirid, capsid bug	Cacao, avocado	Whole plant above ground	Adults capable of flight	Philippines	NEGLIGIBLE-LOW	NEGLIGIBLE-LOW	NEGLIGIBLE-LOW	LOW	**NEGLIGIBLE**
Homalodisca vitripennis (syn. *Homalodisca coagulata*)	Glassy winged sharpshooter[86]	Wide host range of over 100 plants including almond, macadamia, pistachio, walnut, avocado, citrus, Eucalypts, grapes, ash, oleander, blackberry, acacia, bottlebrush, bougainvillea, camellia, chrysanthemum and other ornamentals	Whole plant above ground	Adults capable of flight over long distances.[87]	Mexico, USA, Chile, Cook Islands, French Polynesia	MEDIUM	HIGH	HIGH	UNKNOWN	**UNKNOWN**
Kilifia acuminata	Acuminate scale	Wide host range including pineapple, mango, lychee, citrus, carambola, ginger, avocado, guava	Stems, leaves	Infested soil and plant material.	Cuba, Trinidad & Tobago, Fiji	MEDIUM	UNKNOWN	UNKNOWN	LOW	**UNKNOWN**
Leptoglossus zonatus	Western leaf footed bug	Wide host range including pistachio, citrus, guava, avocado, pomegranate, melons, cotton, sorghum, corn, tomato, cucurbits, eggplant, almond, pecan, pumpkin	Fruit, seeds	Adults capable of flight.	Mexico	LOW	MEDIUM	MEDIUM	HIGH	**MEDIUM**

[85] Information inferred based on genus.
[86] Vector of the strain of the bacterium *Xylella fastidiosa* causing leaf scorch
[87] Nymphs are wingless and cannot fly but can distrubte themselves by walking and jumping through the canopy or dropping from plants and walking to new hosts. Most rapid and long distance movement is as viable egg masses in nursery stock of either crop or ornamental plants.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Metcalfiella monogramma	Avocado treehopper	Box elder, maple tree	Stem	Adults capable of flight, infested plant material[88]	Mexico	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Neopinnaspis harperi	Harper scale	Wide host range including *Acacia*, *Acer*, *Camellia*, olives, macadamia, Cotoneaster, fig, Hakea, walnut, avocado, stonefruit, *Rubus*, ash, willow	Branches	Infested plant material	Hawaiian Islands, Japan, Taiwan, USA	LOW	MEDIUM	MEDIUM	UNKNOWN	**UNKNOWN**
Nipaecoccus nipae	Spiked mealybug	Wide host range including breadfruit, pawpaw, coconut, citrus, sweet potato, mango, cassava, banana, rambutan, olive, orchids, avocado, guava, potato, cocoa, grape, ginger	Whole plant above ground	Infested plant material	China, Georgia, India, Indonesia, South Korea, Philippines, Turkey, Algeria, Madagascar, Morocco, South Africa, Europe, Zimbabwe, Mexico, USA, Central America and Caribbean, Argentina, Brazil, Bermuda, Colombia, Ecuador, Guam, Guyana, Samoa, Suriname, Peru, Venezuela, Fiji, Micronesia	LOW-MEDIUM	HIGH	MEDIUM	MEDIUM	**LOW**

[88] Information inferred based on genus.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Parabemesia myricae	Japanese bayberry whitefly	Wide host range including citrus., avocado, peach, *Morus alba*, gardenia, *Salix* spp. *Rhododendron* spp.	Leaf	Infested plant material	Israel	LOW	HIGH	MEDIUM	LOW	**VERY LOW**
Paracoccus marginatus	Papaya mealy bug	Wide host range including *Citrus* spp., papaya, avocado, mango, cherry, pineapple, pomegranate, hibiscus, cotton, tomato, eggplant, capsicum, bean, pea, sweet potato, wattles, coffee	Whole plant above ground	Infested soil and plant material. First instar crawlers capable of short distance dispersal by walking	Asia, Benin, Cameroon, Gabon, Ghana, Kenya, Mauritius, Reunion, Tanzania, Togo, Mexico, USA, Hawaii, Central America and Caribbean, French Guiana, Guam, Northern Mariana Islands, Palau	HIGH	HIGH	HIGH	HIGH[89]	**HIGH**
Paradasynus spinosus	Coreid fruitspotting bug	Avocado, mandarin	Fruit	Infested plant material[90]	Taiwan, Korea, China, Japan	NEGLIGIBLE-LOW	NEGLIGIBLE	NEGLIGIBLE	HIGH	**VERY LOW**

[89] It is a quarantine threat to farmers and horticulturalists in tropical countries around the world. *P. marginatus* is not included on any quarantine schedules because its increase in importance is so recent. Avocado is a main host but has a wide range of hosts.
[90] Information inferred based on common name.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Paraleyrodes goyabae	Whitefly	Avocado, guava, sapodilla	leaves[91]	Adults capable of flight over short distances, infested plant material[91]	Barbados	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	**NEGLIGIBLE**
Paraleyrodes minei	Nesting whitefly	Avocado, citrus	Fruit, leaves	Adults capable of flight over short distances, infested plant material[91]	China, Israel, Lebanon, Malaysia, Singapore, Iran, Syria, Turkey, Benin, Ghana, Morocco, Spain, Bermuda, USA, Mexico, Belize, Puerto Rico, Dominican Republic, Haiti, Guatemala, Honduras, Colombia, Italy, Cyprus, Spain, Portugal	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	LOW	**NEGLIGIBLE**
Paraleyrodes perseae	Whitefly	Avocado	Leaves	Adults capable of flight over short distances, infested plant material[91]	Mexico	NEGLIGIBLE-LOW	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	**NEGLIGIBLE**

[91] Information inferred by common name.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Penthimiola bella	Citrus leafhopper	Citrus, Avocado	fruit	Adults capable of flight[92]	South Africa, Portugal, Europe, Zaire, Tanzania, Madagascar, Cape Verde, Argentina	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Formicoccus njalensis (syn. *Planococcoides njalensis, Pseudococcus njalensis, P. exitiabilis*)	West African cocoa mealybug[93]	Wide host range from woody hosts belonging to 34 plant families including pineapple, coffee, mango, avocado, cocoa[94]	Whole plant above ground	Infested plant material	Cameroon, Congo, DR Congo, Cote D'Ivoire, Ghana, Guinea, Liberia, Nigeria, Benin, Sao Tome & Principe, Senegal, Sierra Leone, Togo	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**
Planococcus ficus	Grape mealybug	Grapes, figs, pomegranate, mulberrytree, apple, avocado, banana, date palm, fig, mango, citrus	Fruit	Adults capable of short distance flight[95]	Iran, Israel, South Africa, Canary Islands, Argentina, Brazil, Italy, France, Spain, Mexico. Asia, California, Pakistan	LOW - MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**
Planococcus lilacinus	Coffee mealy bug	Avocado	Fruit	Infested plant material	Philippines	LOW - MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**

[92] Information inferred based on common name.
[93] Vectors cocoa swollen shoot virus. The virus is not present in Australia.
[94] Australia may have a predator or cocoa mealybug, *Cryptolaemus montrouzieri* Mulz.
[95] Females stay on the same plant for the majority of their lives, only moving to breed, or for survival. Males will sometimes take short flights to other plants and colonies to feed and mate

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Pseudacysta perseae	Avocado lace bug	Avocado, red bay, camphor	Leaves	Infested plant material	Bermuda, USA, Mexico, Cuba, Dominican Republic, Guadeloupe, Guatemala, Martinique, Jamaica, Puerto Rico, Trinidad & Tobago, US Virgin Is, French Guiana, Venezuela	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
***Pseudatelus raptoria* (syn. *Atelocera raptoria*)**	Woolly stink bug	Avocado	Above ground plant parts	Infested plant material, adults capable of flight[96]	South Africa	LOW	HIGH	HIGH	LOW	**VERY LOW**
Pseudotheraptus devastans	Coreid bug	Cashew nut, coconut, cassava, avocado, cocoa	Fruit, stems	Infested plant material	Africa	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Pseudotheraptus wayi	Coconut bug	Coconut, macadamia, cashew nut, carambola, pecan, cinnamon, loquat, mango, avocado, guava, cocoa	Fruit, inflorescence	Infested plant material	Botswana, Cote d'Ivoire, Kenya, South Africa, Tanzania, Zambia	LOW	HIGH	HIGH	HIGH	**MEDIUM**

[96] Information inferred based on common name

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Rastrococcus invadens	Fruit tree mealybug	Breadfruit, pawpaw, mango, banana, frangipani, guava	Whole plant above ground	Long distance dispersal by wind. Hitchhiker on infected plant material	West Indies	LOW	MEDIUM	LOW-MEDIUM	LOW	**NEGLIGIBLE -VERY LOW**
Selenaspidus articulatus	West Indian red scale	Wide host range including cashew nut, jackfruit, tea, lime, lemon, sour orange, pumelo, mandarin, navel orange, grapefruit, coconut, coffee, rubber, mango, banana, rambutan, oleander, European olive, passionfruit, avocado, date palm, roses, sugarcane, mahogany, grapevine	Whole plant above ground	Infested plant material	Philippines, Sri Lanka, Taiwan, Africa, Bermuda, USA, Mexico, Central America and Caribbean, Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Venezuela, Fiji, Solomon Is	LOW	HIGH	HIGH	MEDIUM	**LOW**
Sophonia orientalis	Two-spotted leafhopper	Cinnamon, lime, lemon, navel orange, poinsettia, mangosteen, sweet potato, macadamia, mango, cassava, mulberry tree, avocado, banana, guava, maize	Whole plant above ground	Adults capable of long distance dispersal on wind. Hitchhikers on infested plant material[97]	China, India, Japan, Pakistan, Singapore, Taiwan, Spain, USA, Portugal, Spain, French Polynesia	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**

[97] Adults have fully developed wings and readily fly. The extent of their natural dispersal has never been documented, but it is likely that they can be blown by the wind over considerable distances. All life stages can be readily moved on vegetative plant materials

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Trialeurodes floridensis	Avocado Whitefly	Avocado, guava, acacia	Leaves	Adults capable of flight over short distances, infested plant material[98]	Mexico, USA	LOW-MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**
Trioza aguacate	Psyllid	Avocado	Leaves	Adults capable of long distance flight, infested plant material[98]	Mexico	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Trioza anceps	Psyllid	Avocado	Leaves	Adults capable of long distance flight, infested plant material[98]	Mexico, Guatemala, Central America	LOW	LOW	LOW	LOW	**NEGLIGIBLE**

[98] Information inferred based on common name.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Hymenoptera (Ants & wasps)										
Acromyrmex octospinosus	Leaf cutting ant	Citrus, coffee, cucurbits, yam, cotton, sweet potato, mango, cassava, avocado, sugarcane, cocoa	Leaves[99]	Hitchhiker	Brazil, Mexico, Colombia, Cuba, Ecuador, French Guiana, Galapagos Is, Guadeloupe, Guatemala, Honduras, Nicaragua, Suriname, Trinidad & Tobago, Costa Rica, Guyana, Venezuela	LOW	HIGH[100]	HIGH	LOW	**VERY LOW**
Atta spp.* including *Atta cephalotes	Leaf cutting ant	Wide host range on dicotyledonous plants including coconut, coffee, cucurbits, cotton, sweet potato, mango, cassava, avocado, sugarcane and cocoa	Leaves	Soil movement	Mexico, USA, Arizona, Central America and Caribbean, South America	LOW	HIGH	HIGH	LOW	**VERY LOW**
Blattodea (Termites)										
Neotermes holmgreni	Dry wood termite	Avocado	Whole plant above ground	Adults capable of flight, Infested plant material[101]	Trinidad and Tobago	LOW	LOW-MEDIUM	LOW	UNKNOWN	**UNKNOWN**

[99] Foliage is brought back to specialised underground chambers and used to cultivate a fungus the ants depend upon for nutrition.
[100] Could enter via soil but a queen would have to be present for them to establish.
[101] Information inferred based on genus. *Neotermes* colonies require higher humidity and regular contact with free water, and unlike subterranean termites, they do not forage in the soil.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Lepidoptera (Butterflies & moths)										
Aegeria sp.	Avocado bark borer	Avocado	Trunk, branches[102]	Infested plant material	Not known	LOW	LOW	LOW[103]	LOW	**NEGLIGIBLE**
Amorbia cuneana (syn. *Amorbia essigana*)	Western avocado leafroller	Avocado, laurel, orange, prunus sp., white fir and willow	Leaf, fruit	Adults capable of flight, infested plant material	California, Mexico, Central America	LOW	HIGH	HIGH	LOW	**VERY LOW**
Amorbia emigratella	Mexican leafroller	Avocado, beans, blackberry, broccoli, cocoa, corn, eggplant, gorse, guava, macadamia, orange, papaya, peanut, sweetpotato, tomato	Fruit	Infested soil and plant material. Adults are capable of flight	Mexico and Central America, Southern USA including Hawaii except Lanai Island	LOW	HIGH	HIGH	LOW	**VERY LOW**
Argyrotaenia citrana (syn. *A. franciscana*)	Orange tortrix	Wide host range across over 80 species including lemon, grapefruit, rough lemon, sweet orange, blackberry, raspberry, blueberry, apple, grapevine, avocado, stone fruit	Above ground plant parts	Wind dispersal for short distance spread	USA	MEDIUM	HIGH	MEDIUM	MEDIUM	**LOW**
Ascotis reciprocaria reciprocaria	Looper	Citrus, avocado	Leaf	Adults capable of flight	South Africa	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	**NEGLIGIBLE**

[102] Feeds beneath bark.
[103] Chemical control with chlorpyrifos and methomyl are effective for pest control.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Attacus atlas	Atlas moth	Wide host range including tea, pawpaw, cinnamon, arabica coffee, turmeric, mango, rambutan, avocado, pepper, guava, cocoa	Leaf	Adults capable of flight	Bangladesh, Nepal, Brunei Darussalam, Cambodia, Indonesia, Japan, Malaysia, Myanmar, Philippines, Singapore, Taiwan, India, Thailand, China, Vietnam	MEDIUM	HIGH	HIGH	LOW	**LOW**
Boarmia selenaria (syn. Ascotis selenaria)	Giant Looper	Alfalfa, citrus, coffee, peanuts, tea, avocado[104]	Leaf	Adults capable of flight	Israel, Sicily, India, Formosa, Japan, Burma, Hungary, Kenya, Tanzania, Madagascar	LOW-NEG	MED	MED	LOW	**NEGLIGIBLE -VERY LOW**

[104] Mainly a pest of avocado

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Cacoecimorpha pronubana	Carnation leafroller	Wide host range of over 100 species including wattles, maples, leek, brassica, citrus, carrot, strawberry, avocado, pelargoniums, spruces, pines, pea, poplars, stone fruit, roses, blackberry, raspberry, tomato, potato, lilac, beans, broad beans	Leaves, inflorescence	Adults capable of flight	Azerbaijan, Israel, Turkey, Algeria, Libya, Morocco, South Africa, Tunisia, USA, Albania, Belgium, Croatia, Cyprus, Denmark, Greece, France, Germany, Guernsey, UK, Hungary, Ireland, Malta, Lithuania, Italy, Luxembourg, Netherlands, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland[105]	MEDIUM	HIGH	HIGH	LOW	**LOW**
Cricula trifenestrata	Tea flush worm	Wide host range including cashew, peanut, cinnamon, mango, avocado	Leaves	Adults capable of flight	Indonesia, Philippines, Malaysia, Vietnam, India, Thailand, Myanmar	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

[105] May of reached the limits of its natural range but may still be a threat to glasshouse crops.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Cryptoblabes gnidiella	Honeydew moth, ring-boring orange moth	Wide host range including avocado, citrus, grape, loquat, pomegranate, garlic, corn, sorghum, banana, coffee, plum, peach, apple[106]	Leaves, fruit	Adults capable of flight	India, Indonesia, Israel, Lebanon, Malaysia, Pakistan, Russia, Thailand, Turkey, Congo, Egypt, Liberia, Malawi, France, Morocco, Brazil, Nigeria, Sierra Leone, South Africa, Zaire, Bermuda, Austria, Cyprus, Gibraltar, Italy, Greece, Malta, Portugal, Spain, Ukraine, Hawaii, New Zealand, Fiji, Uruguay	MEDIUM	MEDIUM	HIGH	LOW	**VERY LOW**
Cryptaspasma perseana		Avocado	Fruit	Dispersal unknown	Mexico, Guatemala	UNKNOWN	UNKNOWN	UNKNOWN	LOW	**UNKNOWN**
Ctenopseustis herana[107]	Brown-headed leafroller	Wide host range including avocado, pome fruit, stone fruit, apples, eucalyptus, oak, acacia, pine,	Leaves, fruit	Adults capable of flight	New Zealand	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Ctenopseustis obliquana	Brown-headed leafroller	Apple, Radiata pine, willow, eucalypt, oak, grape, apricot, peach, avocado, blackberry, macadamia, dock, clover, kiwi	Leaves, fruit	Adults capable of flight	New Zealand	MEDIUM	HIGH	HIGH	HIGH	**HIGH**

[106] Citrus, avocado, pomegranate and grape are the major hosts

[107] The two brown-headed leafrollers C. herana and C. obliquana are identical at all stages - adult moths, eggs, larvae or pupae.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Caloptilia perseae *(Syn. Gracilaria perseae)*	Avocado leaf roller	Avocado	Leaves	Adults capable of flight, infested plant material	Mexico, Cuba, Florida	LOW	NEGLIGIBLE-LOW	NEGLIGIBLE-LOW	LOW	**NEGLIGIBLE**
Histura perseavora	Avocado destroyer	Avocado	Fruit[108]	Adults capable of flight	Guatemala	UNKNOWN	UNKNOWN	UNKNOWN	HIGH[109]	**UNKNOWN**
Marmara salictella	Citrus peel miner	Grapefruit, oleanders, grape, avocado	Stem	Adults capable of flight, infested plant material	California, Arizona	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Megalopyge lanata	Stinging flannel moth caterpillar	coffee, mango, almond, guava, avocado, nut, orange, cashew, rose	Leaves	Adults capable of flight	Guyana, Venezuela, Tobago, Trinidad, West Indies	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Papilio garamas garamas	Magnificent swallowtail	Magnolia, avocado	Leaves	Adults capable of flight	Mexico, Central America, South America	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Papilio victorimus morelius	Victorine swallowtail	Avocado	Leaves	Infested plant material	West Mexico	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Phyllocnistis hyperpersea		Avocado, red bay	Leaves	Adults capable of flight	USA	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**

[108] Larvae bore into fruit pedicels.
[109] A previously unknown insect that was taxonomically found to be distinct after being discovered in Guatemala. It now is a USA quarantinable pest. It has the potential to be a serious pest.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Phyllocnistis perseafolia		Avocado	Leaves	Adults capable of flight	Columbia	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Platynota stultana	Omnivorous leafroller	Very wide host range of over 25 plant families including apple, pears (*Pyrus* spp.), asparagus avocado *Rubus* spp., carnation, celery, clover, sugar beet, maize, cotoneaster, cotton, *Ribes* spp., cyclamen, chrysanthemum, eucalyptus, ginkgo, grape, citrus juniper, peach, peanut, capsicum, pine, rose, sorghum, soybean, tomato, walnut and yew	Leaves, fruit	Adults capable of flight, hitchhiker	Mexico, USA	MEDIUM[110]	HIGH	HIGH[111]	UNKNOWN	**UNKNOWN**
Pyrrhopyge chalybea	Orange – rimmed firetip	Avocado	Leaves	Adults capable of flight	Mexico	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Sabulodes aegrotata	Omnivorous looper	Citrus, eucalyptus, avocado	Leaves, fruit	Adults capable of flight	USA	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	**NEGLIGIBLE**

[110] This species is native to North America. There have been border interceptions reported in the past.
[111] Larvae are able to balloon allowing spread to occur.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Spodoptera eridania	Southern armyworm	Wide host range including onion, garlic, celery, groundnut, asparagus, beetroot, cabbage, cauliflower, camellia, capsicum, pawpaw, chickpea, watermelon, lemon, navel orange, arabica coffee, coriander carrot, melon, carnation, yam, soyabean, cotton, sunflower, sweet potato, lettuce, lavender, flax, perennial ryegrass, apple, lucerne, mint, banana, tobacco, avocado, beans, grasses, guava, rhubarb, tomato, eggplant, potato, cowpea, grape	Leaves, fruit	Adults capable of flight, infested plant material	Benin, Cameroon, Gabon, Nigeria, Bermuda, Mexico, Antigua & Barbuda, Bahamas, Barbados, Costa Rica, Cuba, St Lucia, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Honduras, Peru, Chile, Jamaica, Martinique, Nicaragua, Panama, Puerto Rico, St Vincent & the Grenadines	LOW-MEDIUM	MEDIUM	MEDIUM	UNKNOWN	**UNKNOWN**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Spodoptera littoralis	Cotton leafworm	Wide host range containing over 40 families including onion, celery, asparagus, tea, beetroot, cabbage, grape, watermelon, sour orange, arabica coffee, pumpkin, carrot, carnation, Eucalyptus, cotton, sunflower, soyabean, sweet potato, lettuce, plum, lucerne, banana, tobacco, rice, avocado, beans, guava, pomegranate, tomato, maize, eggplant, potato, spinach, wheat, cowpea	Fruit, leaves	Adults capable of flight[112], infested plant material	Asia, Africa, Europe	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Stathmopoda auriferella	Apple heliodinid	Apple, coffee, sunflower, grapes, citrus, mango, kiwi fruit, avocado, peach, pomegranate, prickly acacia (*Vachellia nilotica*), sorghum	Fruit, leaves, buds	Adults capable of flight	Gambia, Kenya, Nigeria, Sierra Leone, South Africa	LOW[113]	MEDIUM	MEDIUM	UNKNOWN	**UNKNOWN**
Stenoma catenifer	Stenomid (avocado) moth, avocado fruit borer, seed moth	Avocado	Whole fruit above ground	Adults capable of flight	Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Brazil, Argentina, Colombia, Ecuador, Guyana, Peru, Venezuela, Guernsey	HIGH	HIGH	HIGH	HIGH	**HIGH**

[112] Adults fly at night, mostly between 20:00 and midnight. The flight range during a 4 hour period can be up to 1.5km cabi.org/isc/datasheet/51070
[113] Unlikely to naturally disperse to Australia based on current distribution (currently found in eastern Asia, including Indonesia, and southern Africa).

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Stericta albifasciata	Avocado moth	Avocado	Leaves	Adults capable of flight	Trinidad and Tobago	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Thaumatotibia leucotreta (syn. *Cryptophlebia leucotreta)*	False codling moth	Wide host range including cotton, lima bean, common bean, sorghum, maize, cowpea, olive, lychee, pineapple, carambola, *Prunus* spp., avocado, cherry, citrus, macadamia	Whole plant above ground	Natural spread unlikely based on distribution. Hitchhiker	Israel, Africa	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Xyleutes punctifer (syn. *Voousia punctifer*)		Avocado	Stem	Adults capable of flight, infested plant material		LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Zeuzera coffeae	Coffee carpenter, red borer	Wide host range including Acacia, tea, chestnuts, cinnamon, citrus, coffee, walnut, apple, avocado, poplars, mahogany, cocoa, grape	Stems	Adults capable of flight	Asia, Papua New Guinea	LOW	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Peridroma saucia	Variegated cutworm, pearly underwing moth	Wide host range including raspberry, capsicum, cabbage, tomato, beetroot, lettuce, artichoke, lucerne, tobacco, maize, onion, passionfruit, avocado, celery, asparagus, cucumber, carrot, strawberry, cotton, grape and cherry	Whole plant above ground	Adults capable of flight	Armenia, China, Israel, Japan, South Korea, Sri Lanka, Syria, Taiwan, Turkey, Morocco, Spain, Tunisia, North America, Costa Rica, Mexico, Guatemala, Jamaica, Puerto Rico, Argentina, Colombia, Peru, Ecuador, Chile, Uruguay, Brazil, Venezuela, Europe	MEDIUM	MEDIUM	MEDIUM	UNKNOWN	**UNKNOWN**
Orthoptera (Locusts & grasshoppers)										
Zonocerus elegans	Elegant grasshopper	Wide host range including onion, cashew, pineapple, citrus (lime, lemon, mandarin, navel orange), coffee, carrot, sunflower, sweet potato, banana, tobacco, avocado, frangipani, Solanaceae	Whole plant above ground	Adults capable of flight	Africa	LOW	HIGH	HIGH	LOW	**VERY LOW**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Zonocerus variegatus	Variegated grasshopper [114]	Wide host range including onion, cashew, pineapple, cotton, citrus (lime, lemon, mandarin, navel orange), coffee, carrot, sunflower, sweet potato, mango, cassava, banana, tobacco, avocado, frangipani, grasses, Solanaceae	Whole plant above ground	Adults capable of flight	Africa	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Psocoptera (Booklice, barklice, barkflies)										
Pseudocaecilius citricola		Avocado	Leaves, stem	Infected plant material[115]	Dominican republic	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Thysanoptera (Thrips)										
Dinurothrips hookeri		Wide host range including banana, avocado, tomato, sweet potato	Leaves	Adults capable of flight	Martinique, Florida, Brazil, Guam	LOW	MEDIUM	MEDIUM	MEDIUM	**LOW**
Frankliniella bispinosa	Florida flower thrips[116]	Wide host range including capsicum, navel orange, strawberry, tobacco, wild radish, roses, rye, wheat, blueberries, corn, cucumber, watermelon, squash, beans, eggplant, ornamentals, pine, avocado, mango, lychee	Leaves, flowers, fruit	Adults capable of flight, wind dispersal	Republic of Georgia, Florida, Bermuda, Bahamas	HIGH	HIGH	HIGH	NEGLIGIBLE	**NEGLIGIBLE**

[114] Vector of cassava bacterial blight (*Xanthomonas axonopodis pv. manihotis*) which is not present in Australia
[115] Lives under webs on the foliage of trees
[116] Vectors tomato spotted wilt virus (tomato spotted wilt)

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Frankliniella bruneri		Avocado	Flowers, possibly fruit	Adults capable of flight, wind dispersal[117]	Mexico	LOW	HIGH	LOW	LOW	**NEGLIGIBLE**
Frankliniella cephalica[118]		Avocado, small white flowers (*Mangifera* sp., *Ligustrum* sp., *Bidens pilosa*), mango	Fruit, leaves	Adults capable of flight, wind dispersal[117]	Mexico, Central America, Chile, Colombia, Brazil, Bermuda, Trinidad, Japan, Taiwan, Argentina	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Frankliniella chamulae		Avocado	Flowers, fruit	Adults capable of flight, wind dispersal[117]	Mexico	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
***Frankliniella gemina* (syn. *F. rodeos*)**	Thrips	Wide host range including faba bean, soybean, tomato, lucerne, avocado, strawberry, grape	Leaves, flowers	Adults capable of flight, wind dispersal[117]	Argentina	MEDIUM	MEDIUM	MEDIUM	LOW	**VERY LOW**
***Pseudophilothrips perseae* (syn. *Liothrips persea*)**		Avocado	Fruit	Adults capable of flight, wind dispersal[119]	Florida, California, Mexico, Central and South America, Argentina, Chile	LOW-MEDIUM	MEDIUM	MEDIUM[120]	MEDIUM	**LOW**

[117] Information inferred based on genus.
[118] A new vector for tomato spotted wilt virus.
[119] Information inferred based on common name
[120] Higher by nursery trees.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Neohydatothrips burungae	Avocado neohydatothrips	Avocado, citrus, marigold	Leaves	Adults capable of flight, infected plant material	California, Panama, Honduras, Nicaragua, Guatemala, Costa Rica, Jamaica, Mexico, Colombia, Brazil	LOW	NEGLIGIBLE	NEGLIGIBLE	LOW	**NEGLIGIBLE**
Retithrips syriacus	Castor or black vine thrips	Wide host range including peanut, pecan, chestnuts, coconut, coffee, persimmon, quince, cotton, walnut, poplar, apple, mango, cassava, banana, myrtle, avocado, bean, pistachio, guava, European pear, roses, black plum, cowpea, grape	Fruit, leaves	Adults capable of flight, wind dispersal	India, Iraq, Tunisia, USA	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Scirtothrips aceri		Avocado	Fruit	Adults capable of flight, wind dispersal	Mexico, Central America, California, Chile	LOW-MEDIUM	LOW-MEDIUM	LOW-MEDIUM	LOW-MEDIUM	**NEGLIGIBLE-LOW**
Scirtothrips perseae (syn. *S. aguacata, S. kupande*)	Avocado thrips	Avocado	Fruit, leaves	Hitchhiker on infected plant material[121]	Mexico, USA, Guatemala	HIGH	HIGH	HIGH	HIGH	**HIGH**

[121] Not likely to be spread on mature fruit.

Pathogens

Table 21. Avocado pathogen threat summary table.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Bacteria (including phytoplasmas)										
Pseudomonas syringae pv. syringae, Pantoea agglomerans[122] ***Xanthomonas campestris* (avocado pathovars)**	Bacterial canker complex, avocado blast complex[123]	Wide host range including onion, leek, capsicum, chrysanthemum, citrus, cucumber, pumpkin, garden dahlia, hibiscus, walnut, lettuce, magnolia, mango, lucerne, rice, stone fruit, passionfruit, avocado, bean, poplar, azalea, rose, tomato, willows, clover, blueberry, grape, maize	Whole plant	Transmitted by infested plant material	Mexico[124]	HIGH	HIGH	HIGH	HIGH	**HIGH**

[122] Syn. *Erwinia herbicola*.
[123] Although *P. syringae* and *X. campestris* are found throughout Australia, the SA and Cal organisms are considered to be new 'pathovars'. Attacks plants from the seedling stage through to maturity.
[124] More research is required to understand the bacterial complex, the avocado specific pathovar and it's geographic range. Other geographic areas the bacterial complex could be found is California, Florida, Israel and South Africa

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
***Xylella fastidiosa* with vectors**[125]	Avocado leaf scorch	Wide host range including Fabaceae, Altingiaceae, Apocynaceae, Araliaceae, Asteraceae, Betulaceae, Brassicaceae, Caryophyllaceae, Celastraceae, Cornaceae, Ericaceae, Fagaceae, Ginkgoaceae, Juglandaceae, Lamiaceae, Lythraceae, Magnoliaceae, Malvaceae, Moraceae, Oleaceae, *Persea* (including avocado) Plantaginaceae, Poaceae, Sapindaceae, Ulmaceae, Vitaceae, Urticaceae, Rutaceae,	Whole tree	Transmitted by infected plant material and leafhoppers especially *Homalodisca vitripennis* but also *Philaenus spumarius, Graphocephala atropunctata*	North and Central America, Europe, Taiwan	HIGH	HIGH	HIGH	LOW	**LOW**

[125] Native vectors may be present in Australia

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
***Xylella fastidiosa* without vectors**[125]	Avocado leaf scorch	Wide host range including Fabaceae, Altingiaceae, Apocynaceae, Araliaceae, Asteraceae, Betulaceae, Brassicaceae, Caryophyllaceae, Celastraceae, Cornaceae, Ericaceae, Fagaceae, Ginkgoaceae, Juglandaceae, Lamiaceae, Lythraceae, Magnoliaceae, Malvaceae, Moraceae, Oleaceae, *Persea* (including avocado) Plantaginaceae, Poaceae, Sapindaceae, Ulmaceae, Vitaceae, Urticaceae, Rutaceae,	Whole tree	Transmitted by infected plant material and leafhoppers especially *Homalodisca vitripennis* but also *Philaenus spumarius, Graphocephala atropunctata*	North and Central America, Europe, Taiwan	HIGH	HIGH	HIGH	LOW	**LOW**

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Fungi (including Oomycetes)										
Akaropeltopsis machaeriifolii	Sooty blotch	Avocado	Branches, stems, leaf veins and fruit	Rain-splash	Southern Africa	MEDIUM	HIGH	HIGH	LOW	**LOW**
Armillaria mellea	Armillaria root rot (shoestring root rot)	Wide host range including fir trees, acacia trees, maple trees, sycamore tree, Chinese gooseberry, grape, kiwifruit, alder tree, birch tree, cedar tree, cypress tree, sour orange, lime, mandarin, fig, ash tree, walnut, roses, ornamental species apple, mora, black mulberry, European olive, prickly pear, pine trees, apricot, sweet cherry, sour cherry, almond, peach, plum, black cherry, European pear, oak, avocado, blackcurrant, lilac, flowering currant	Roots[126]	Soilborne	China, India, Iran, Japan, Korea, Syria, Turkey, Africa, Canada, Mexico, USA, Columbia, Europe	LOW	HIGH	MEDIUM	LOW	**VERY LOW**

[126] Visible symptoms may not appear until fungus is well established in the roots. Can destroy the entire root system and kill the tree. Once symptoms appear it is very difficult to save a tree, and disease may have spread to the roots of adjacent trees. After aerial parts of infected trees are dead, the fungus remains alive in the roots to infect any replanted, susceptible trees, such as citrus, peach, or avocado. Fumigate before replanting. Let soil dry out between irrigations

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Botryosphaeria disrupta	Botryosphaeria branch cankers	Wide host range mostly of woody trees including avocado.	Stems and branches	Wind, rain-splash, insect feeding, and contaminated pruning tools	Mexico, Central, South America	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**
Elsinoë perseae (syn. *Sphaceloma perseae)*	Avocado scab	Avocado	Whole plant above ground	Wind, rain, insects and infected material	Philippines, Taiwan, Guinea, Morocco, South Africa, Zambia, Zimbabwe, Bermuda, Mexico, USA, Central America, Caribbean, Peru, Argentina, Brazil, Guyana, Venezuela	HIGH	HIGH	HIGH	HIGH	**HIGH**
Fusarium euwallaceae sp. nov.		Avocado	Whole plant	Insect feeding[127]	Israel, California	HIGH	HIGH	HIGH	LOW	**LOW**
Ganoderma zonatum	Butt rot	Wide host range including woody dicots including avocado although mostly infects palm species	Roots and trunk	Soil, infected wood, wind	USA	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Grovesinia moricola (syn. *G. pyramidalis, Cristulariella pyramidalis*)	Zonate leaf spot	Soursop, pecan, avocado	Leaves	Infected plant material, rain splash and possibly airborne spores[128]	USA, Brazil	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**

[127] *Fusarium euwallaceae sp. Nov*. is a symbiotic fungus that is grown by *Euwallacea sp.* (ambrosia beetles) as a source of nutrition
[128] Information inferred based on genus

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Marasmiellus scandens	White thread blight	Wide host range including bamboo, pineapple, soursop, cinnamon, coffee, durian, avocado, tea, mangosteen, rubber, lychee, mango, sapodilla, Jamaica cherry, plantain, rambutan, strawberry guava, Malay apple, cocoa	Leaves	Airborne, soil, plant material and water.	Asia, Africa, Americas	LOW	LOW	LOW	LOW[129]	**NEGLIGIBLE**
Mycosphaerella perseae	Leaf spot or Silver spot	Avocado	Leaves	Infected plant material, rain splash and possibly airborne spores	Brunei Darussalam, India, Indonesia, Malaysia, Cote d'Ivoire, Ghana, St Lucia, Brazil, Fiji, Papua New Guinea, Solomon Islands	LOW	MED	HIGH	LOW	**VERY LOW**
Oidium perseae-americanae sp. nov	Powdery Mildew	Avocado	Leaves	Infected plant material, rain splash and possibly airborne spores	New Caledonia, Brazil, Sao Paulo	LOW	HIGH	HIGH	LOW	**VERY LOW**
Oncobasidium theobromae	Vascular-streak dieback of cocoa	Avocado, cocoa	Whole plant	Transmitted by infected plant material[130]	China, India, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Papua New Guinea	LOW	HIGH	HIGH	MEDIUM	**LOW**

[129] Of little economic significance on cocoa when it is kept under control.
[130] Transmission via seed, airborne spores or surface contamination are extremely unlikely.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Phyllachora gratissima	Red-brown leaf spot (tar spot)	Avocado	Leaves	Infected plant material, rain splash and possibly airborne spores[131]	Mexico	LOW	HIGH	HIGH	LOW	**VERY LOW**
Phymatotrichopsis omnivora *(syn. P. omnivorum and Ozonium omnivorum)*	Texas root rot	Wide host range of over 2000 species including cotton, avocado, olive, apple, pear, grains, peanuts, soybeans, common beans, lucerne, almond, walnut, pistachio, *Rubus* spp., *Prunus* spp., poplar, elm, oak, grapevine, fig and tomato	Roots	Soil, and infected roots and stems	Mexico, USA, Brazil, Venezuela	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Phytophthora mengei	Bark canker	Avocado	Lower trunk and limbs	Soilborne pathogen. Spread in surface water, infested soil and infected nursery plants, and through mechanical and insect wounds	California, Mexico	HIGH	HIGH	HIGH	HIGH	**HIGH**

[131] Information inferred based on common name.

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Phytophthora ramorum	Sudden oak death, Ramorum leaf blight	Wide host range including oak tree, Douglas-fir tree, blueberry, avocado	Branch	Plant material, water, soilborne	North America, Europe	HIGH	HIGH	HIGH	HIGH	**HIGH**
Raffaelea lauricola	Laurel wilt	Lauraceae including avocado	Whole plant	Vectors[132]	Japan, Myanmar, Taiwan, USA, South East Asia,	HIGH	HIGH	HIGH	HIGH	**HIGH**
Rosellinia bunodes	Black root rot	Wide host range including lime, navel orange, grapefruit, coffee, yam, cassava, West Indian arrowroot, nutmeg, avocado, potato, cocoa, banana, fig, carnation, tea	Whole plant	Soil, infected plant material	India, Indonesia, Japan, Malaysia, Philippines, Sri Lanka, Taiwan, Central African Republic, Congo Democratic Republic, Nigeria, Uganda, USA, Mexico, Central America, Argentina, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Venezuela, Papua New Guinea	MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**

[132] Vectored by *Xyleborus glabratus*. According to preliminary studies, avocado fruit is not a pathway. New Ambrosia species were discovered (*Euwallacea sp. aff. fornicatus and Microperus sp.*) in Queensland and were found to be carriers of the fungal symbiont under experimental conditions (Geering, 2013)

SCIENTIFIC NAME	COMMON NAME	HOST(S)	AFFECTED PLANT PART	DISPERSAL	DISTRIBUTION	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Rosellinia pepo	Black root rot	Breadfruit, jackfruit, pigeon pea, lime, coffee, taro, banana, nutmeg, avocado and cocoa	Roots	Soil, infected plant material	Central African Republic, Mexico, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Puerto Rico, Martinique, St Lucia, Trinidad & Tobago, Colombia, French Guiana, Brazil, Suriname, Venezuela	MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**
Nematodes										
Xiphinema californicum		Citrus, coconut, lucerne, maize, sorghum, alfalfa, avocado, rose., grapevine, olive, sweet potato	Roots	Soil, seedlings, nursery stock	North America (Mexico, USA), South America (Chile, Peru, Brazil)	MEDIUM	HIGH	LOW	LOW	**VERY LOW**

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