Final Report

Biosecurity Plan for the Lychee, Papaya and Passionfruit Industries

Project leader:

Stuart Kearns

Report authors:

Dr Stephen Quarrell

Delivery partner:

Plant Health Australia

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Biosecurity Plan for the Lychee, Papaya and Passionfruit Industries (MT18006)

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Level 7
141 Walker Street
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Telephone: (02) 8295 2300

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Public summary

Australia's biosecurity system works in a dynamic environment with major challenges growing and evolving rapidly. Through this project, Plant Health Australia (PHA), with Horticulture Innovation levy investment, has developed a separate Biosecurity Plan for each of the Australian lychee, papaya and passionfruit industries. These three Biosecurity Plans (the Plan) recognise that the operating environments affecting the biosecurity of these Australian tropical fruit industries is vastly different today to that of the past, and that these industry's response capabilities need to keep pace, if they are to remain relevant and effective into the future.

These Plans lay the foundations for a stronger biosecurity system and more resilient lychee, papaya and passionfruit industries by identifying and prioritising the growing number of exotic pests and pathogens that could, if introduced, impact on their crop production and trade. These Plans also analyse the various preparedness resources needed to manage these risks and provide a program of current and future activities that will strengthen their biosecurity responses preparedness.

These Plans were developed with valuable input from industry groups including Australian Lychee Growers Association (ALGA), Australian Papaya (AP), Passionfruit Australia Inc. (PAI) along with biosecurity and crop protection experts from state, territory and commonwealth governments.

There are three major components to a Biosecurity Plan. The first is a review of all known exotic pest and disease species that are known to infect the target crop. These reviews highlighted 119 different exotic pests and diseases species that impact lychee production, 78 exotic species known to impact passionfruit and 131 exotic species that affect papaya. These species' reviews informed the development of risk ratings for each of the identified exotic pests and diseases. The risk ratings focus on the potential of each species to enter, establish and spread within Australia and an estimate of their potential economic impact. Species that receive a high or extreme risk rating are deemed a 'High Priority Pest' (HPP) of that industry. Of those species reviewed, five species were deemed HPPs of the lychee industry, ten species HPPs of the passionfruit industry and 13 species HPPs of the papaya industry.

The second component was an analysis of the preparedness resources that are currently available to each HPP. The resources included contingency plans, fact sheets, diagnostic and surveillance protocols and taxonomic reference specimens.

The third and final component of a Biosecurity Plan is the development of an Implementation Plan that describes the critical activities that, if implemented, will improve the industries' biosecurity preparedness and response capabilities. The Implementation Plans, were developed and reviewed annually through a Biosecurity Reference Panel (BRP), comprising of industry and government representatives. The Implementation Plans' outline strategies, communication and engagement activities specific to the lychee, papaya and passionfruit industries, as well as activities and resources utilised by other industries that share the same exotic pest and disease threats and identifies potential international and domestic collaboration opportunities.

Keywords

Biosecurity Plan, High Priority Pests, Biosecurity Implementation, pests, diseases

Introduction

The Australian tropical fruit industry is highly diverse, growing more than 60 fruit species in a commercial or semi-commercial capacity[1], with most production occurring in tropical and subtropical regions of northern Australia including the Northern Territory and along the eastern seaboard from Far North Queensland to Northern New South Wales. Tropical fruits are seeing increasing demand globally due to their sensorial attractiveness and a recognition of their nutritional value[2]. Three such examples are Australia's lychee, papaya and passionfruit industries, which have observed annual increases in market value of 4.7%, 6.3% and 2.8% respectively since 2012[3-6], and in 2023 had an estimated combined market value of $117M[7]. Protecting these emerging tropical fruit industries from the threat of exotic pests and diseases is critical to the future growth, sustainability and profitability of these industries.

Biosecurity planning provides industries with knowledge of the exotic pests and diseases that pose the greatest threat to their production and trade and describes strategies and actions that improve their biosecurity preparedness and response capability. It also provides a mechanism for industry, governments and other stakeholders to assess current biosecurity practices and future biosecurity needs. The identification, prioritisation and management of key biosecurity risks, through the development and implementation of a Biosecurity Plan is a critical industry preparedness activity.

In collaboration with Australian Lychee Growers Association (ALGA), Australian Papaya (AP), Passionfruit Australia Inc. (PAI) and Commonwealth and State Governments, Plant Health Australia (PHA) has developed Biosecurity Plans for the lychee, papaya and passionfruit industries. These Plans will provide a framework for improved biosecurity preparedness and practice through increasing industry awareness and risk mitigation relating to exotic pest incursions.

There are three major components to the Biosecurity Plan. The first is the review of exotic pest species that are known hosts of the chosen industry. This species' review informs the development of risk ratings for each of the exotic pests identified. These risk ratings focus on the potential of each pest to enter, establish and spread within Australia and an estimate of their potential economic impact. The species that receive high risk ratings are given 'High Priority Pest' (HPP) status.

The second component is an analysis of the available preparedness resources in relation to the HPPs including contingency and continuity plans, fact sheets, diagnostic protocols and reference specimens.

The third and final component is the development of an Implementation Plan that describes the critical activities that are designed to improve biosecurity preparedness and response capability. The Implementation Plan, developed through consultation with industry and government stakeholders, outlines the strategies and activities that are the most important for the exotic pests of greatest concern to the chosen industry, The activities outline in the Implementatin Plan include any communication and engagement activities required, activities and resources currently utilised by other industries that share some of the same exotic pests threats and identifies potential international and domestic collaboration opportunities. It also highlights RD&E needs that may be addressed in the future.

The Biosecurity Plans for the lychee and papaya industries were first published in 2011 and passionfruit industry in 2012. Since then, the status of some important exotic pests of these industries have changed. The primary purpose of this 5-year project was to review of these industry's Biosecurity Plans thereby improving each their biosecurity preparedness and response capability.

Methodology

Results

The development of the Biosecurity Plans for the Lychee Industry (version 2.0), Papaya Industry (version 2.0) and Passionfruit Industry (version 2.0) commenced with an extensive literature review and tabulation of exotic pests and diseases of each crop utilising a range of resources, including their previous Biosecurity Plans (version 1.0), available scientific literature and other noted sources such as the Centre for Agriculture and Biosciences International (CABI). With the assistance of ALGA, PAI, and AP a Technical Expert Group (TEG) was then formed to review the literature gathered and to characterise each species based on its risk profile. The risk ratings were based on an assessment for their potential to enter, establish and spread in Australia and their potential economic impact to each industry. The TEG was coordinated by PHA and included representatives from ALGA, PAI, AP and state and territory agriculture agencies (Table 1). The TEG met on the 17th of August 2020.

Through this process, the information was compiled into several tables of important exotic and endemic pest species.

These included:

- **Threat Summary Tables (TST)**. An overview including risk assessments of all known exotic lychee, papaya and passionfruit pests and diseases.
- **High priority Pest lists (HPP)**. These species based on the risk assessment process have the potential to cause substantial economic impact on the lychee, papaya and passionfruit industries, either through production losses or market access issues.
- **Other Pests of Biosecurity Significance**. These species are economically important to the lychee, papaya or passionfruit industries and are considered in the prioritisation of RD&E investment but do not undergo a formal pest risk assessment. They are economically important in least one of the following ways:
  - currently under quarantine arrangements or restricted to regions within Australia,
  - notifiable by law,
  - have market access implications,
  - able to be prevented from entering a farm through good biosecurity practice.

Table 1. Members of the Technical Experts Group (TEG) and Biosecurity Implementation Group (BIG).

NAME	ORGANISATION	AREA OF EXPERTISE	MEMBER OF TEG	MEMBER OF BIG
Jill Houser	ALGA	Industry	✓	✓
Gerard Kath	Papaya Australia	Industry	✓	✓
Joe Zappala	Papaya Australia	Industry		✓
Dennis Chant	Passionfruit Australia	Industry	✓	✓
Jane Richter	Passionfruit Australia	Industry	✓	
Greg Chandler	Hort Innovation	Biosecurity, R,D&E	✓	
Matt Adkins	DPI NSW	R,D&E	✓	
Ruth Huwer	DPI NSW	Entomology	✓	✓
Fucheng Shan	DPIRD WA	Research	✓	✓
Touhidur Rahman	DPIRD WA	Entomology	✓	
Alison Mackie	DPIRD WA	Pathology, Research		✓
Ceri Pearce	DAF QLD	Pathology	✓	✓
Fiona Giblin	DAF QLD	Pathology	✓	✓
Lindy Coates	DAF QLD	Pathology	✓	
Christine Horlock	DAF QLD	Pathology	✓	
Ian Newton	DAF QLD	Entomology	✓	✓
Jose Liberato	DITT NT	Pathology	✓	✓
Stuart Kearns	PHA	Biosecurity	✓	
Victoria Ludowici	PHA	Biosecurity	✓	
Bosibori Bett	PHA	Biosecurity	✓	
Trevor Dunmall	PHA	Biosecurity	✓	✓
Rebecca Powderly	PHA	Biosecurity		✓
Stephen Quarrell	PHA	Biosecurity		✓

Once compiled, these lists formed the basis for each industry's Biosecurity Plan. Implementation Plans were then developed for each industry with the assistance of a Biosecurity Implementation Group (BIG). The BIG was convened by PHA and again comprised of representatives from each industry and the relevant state authorities (Table 1).

Implementation Plans are a critical component of the Biosecurity Plan. The Implementation Plan highlights HPP-focussed biosecurity activities including RD&E activities that are underway and those activities that may be addressed in the future. It is developed in accordance with industry priorities and resource availability and aims to improve preparedness and response capability. A number of these priorities are still being addressed by industry.

The Implementation Plans describe the activities within the five strategic priority areas of the National Biosecurity Strategy and provides industry with a plan with agreed activities and timeframes. The five strategic areas include:

1. Preparedness and Response
2. Capacity and Capability
3. Communications and Engagement
4. Innovation, Research Development and Extension
5. Collaboration and Partnerships

The BIG met on the 12th of May 2021 to develop the Implementation Plan and then annually (20th July 2022, 6th June 2023, 23rd April 2024 & 24th October 2024) to review and discuss each Biosecurity Plan including the HPP lists and Implementation Plans.

Following the completion of the Plan in 2021, it was provided to each industry peak body (ALGA, PAI, AP) for comment and endorsement followed by endorsement by the Plant Health Committee (PHC) comprising Chief Plant Health Managers from each State/Territory and a representative from the office of the Australian Chief Plant Protection Officer.

Results and discussion

The Biosecurity Plans for the Australian lychee, papaya and passionfruit industries have been completed. The Plans feature an analysis of all known exotic pests and diseases of the Australian lychee, papaya and passionfruit industries. The risk analysis of the species listed within each TST subsequently identified five HPPs for the lychee industry, 13 HPPs for the papaya industry and ten HPPs for the passionfruit industry (Table 2, Appendices 1-3). The HPPs identified are those likely to have the potential to cause substantial economic impact on these tropical fruit industries, either through production or market access issues.

A further suite of pests and diseases was identified as Other Pests of Biosecurity Significance (Table 2, Appendices 1-3). These pests are economically important to the lychee, papaya or passionfruit industries and are considered in an effort to prioritise RD&E investment but do not undergo a formal pest risk assessment due to their already being found in Australia but are geographically restricted. The species listed in these tables include pets such as Queensland fruit fly (*Bactrocera tryoni*), which is not currently found in Western Australia or Tasmania and Papaya mealybug (*Paracoccus marginatus*), which was first reported in the Northern Territory in July 2023 and is know also found in South Eastern Queensland in 2024[8].

Table 2. Total number of exotic pest and disease species highlighted within the lychee, papaya and passionfruit industry Biosecurity Plan's Threat Summary Tables (TST), High Priority Pests lists (HPP) and Other Pests of Biosecurity Significance tables.

Industry	Threat Summary Table	High Priority Pests	Other Pests of Biosecurity Significance
Lychee	119	5	1
Papaya	131	13	6
Passionfruit	78	10	3

The Implementation Plans were created in consultation with the BIG to provide guidance into future biosecurity related activities that aim to improve industry preparedness and response capability. The Implementation Plans describe the activities within five strategic priority areas and provide these industries with an overarching plan with agreed activities and time frames. These plans can be found in their respective Biosecurity Plans in Appendices 1-3. Many of the activities highlighted within these Implementation Plans are either ongoing or yet to be commenced due to limited resource availability.

The primary purpose of grouping these industries together in developing their Biosecurity Plans was to exploit synergies in their respective exotic pest and disease threats, thereby reducing their Plan development costs and levy spend. However, the synergies were not always evident with only one exotic pest common between the lychee and passionfruit industries and only three species common between all three. Indeed, of the 328 species identified across all the three industry's TSTs, only 22 species (6%) were common to at least two industries (Table 3). Although the exotic threats did not always demonstrate the expected commonalities, this project did reduce meeting overheads through shared meeting costs and PHA and jurisdiction time investment during the TST risk rating, Implemenation Plan development and annual review phases of the project and therefore did provide a cost effective way of developing Biosecurity Plans.

Table 3. Number of pest and disease species identified within the lychee, papaya and passionfruit Threat Summary Tables common within each industry combination.

	Lychee & Papaya	Papaya & Passionfruit	Passionfruit & Lychee	All industries
Common exotic pest species	5	13	1	3

Discussion

The relative size of the Australian lychee, papaya and passionfruit industries is small when compared to other fruit crops, but all are vulnerable to number of exotic pest and disease species. The development of Biosecurity Plans for the lychee, papaya and passionfruit industry has provided both industry and government with a prioritised list of exotic pests, and a range of activities that, if implemented, will improve biosecurity preparedness and response capability. Of these species reviewed, five species known to impact lychee production and trade received were elevated to 'High Priority Pest' (HPP) status, ten species were elevated for passionfruit industry and 13 species were regarded as HPPs for the papaya industry. These pests and diseases should be the focus for both industry and government to combine efforts in minimising the risk of entry and increase preparedness activities in the event an incursion does arise. In the event of a detection, both industry and government need to have well considered and tested plans that can be enacted expediently to either eradicate the pest, or if eradication is not feasible, have plans in place that will provide these tropical fruit industries with the greatest opportunity to continue production and trade.

Biosecurity planning and Biosecurity Plans themselves should be seen as a critical pathway to increase collaboration and coordination of biosecurity effort by all stakeholders. Importantly, the focus needs to not only be on the HPPs but also on collaborative efforts to improve preparedness and response capability more broadly. The collaborative, multi-industry approach to biosecurity planning undertaken throughout this project, though not without its challenges, should be seen as a method to improve industry preparedness in a cost-effective manner. Once developed, the Biosecurity Plans provide a clear understanding of the exotic threats posed to these industries and provide focus regarding future biosecurity RD&E investments including the development of extension activities and resources.

As demonstrated throughout the process of developing these Biosecurity Plans, gaining input from a range of technical specialists (e.g., entomologists, pathologists) can be challenging. This is due to several factors, including time constraints, the increasing number of exotic pests being identified, changing taxonomy, geographic distribution and limits to available funding. PHA has provided several recommendations aimed at improving these industry's biosecurity planning, ensuring that future biosecurity plans continue to highlight the most important exotic pests and provide both industry and government with recommended courses of action to address biosecurity threats.

While the Australian Government manages biosecurity at the border and pre-border and is instrumental at minimising the risk of entry of exotic pests, as the border is not impervious and on occasions, exotic pests do enter Australia. Being

prepared in the event of a HPP being detected in Australia is critical in ensure the best result from the response plans that are put in place. Identifying which of these pests pose the greatest threat to these industries has been a key outcome of this project together with Implementation Plans that will guide future investment and associated activities.

To improve biosecurity preparedness and increase response capability it is important that both industry and government commence implementing the strategies and activities described in the Implementation Plan. These activities, along with other biosecurity related actions being undertaken by ALGA, PAI, AP, Governments and others will continue to build and strengthen biosecurity for these industries.

Outputs

Table 4. Output summary

Output	Description	Detail
Biosecurity Plan for the Lychee Industry (version 2.0)	Technical review of exotic invertebrate and pathogens that pose a threat to the Australian lychee industry, an implementation plan describing critical activities that are designed to improve the Lychee industry's biosecurity preparedness and response capability	Biosecurity Plans are high level planning documents and have been provided to ALGA and Hort Innovation and uploaded onto the Biosecurity Portal. The Portal has access restricted to the relevant peak body(s), RDCs and State and Federal Government agencies. The Plan will be further disseminated further at ALGA's discretion.
Biosecurity Plan for the Papaya Industry (version 2.0)	Technical review of exotic invertebrate and pathogens that pose a threat to the Australian papaya industry, an implementation plan describing critical activities that are designed to improve the papaya industry's biosecurity preparedness and response capability	Biosecurity Plans are high level planning documents and have been provided to AP and Hort Innovation and uploaded onto the Biosecurity Portal. The Portal has access restricted to the relevant peak body(s), RDCs and State and Federal Government agencies. The Plan will be further disseminated further at AP's discretion.
Biosecurity Plan for the Passionfruit Industry (version 2.0)	Technical review of exotic invertebrate and pathogens that pose a threat to the Australian passionfruit industry, an implementation plan describing critical activities that are designed to improve the passionfruit industry's biosecurity preparedness and response capability	Biosecurity Plans are high level planning documents that have been provided to PAI and Hort Innovation and uploaded onto the Biosecurity Portal. The Portal has access restricted to the relevant peak body(s), RDCs and State and Federal Government agencies. The Plan will be further disseminated further at PAI's discretion.
Milestone Reports	Progress reports on Biosecurity Plan's development and the implementation of	Milestone reports are submitted to Hort Innovation and disseminated at their discretion.

	critical activities that aim to improve the lychee, papaya and passionfruit industry's biosecurity preparedness and response capability	
Final Report	Final report reviewing the outcomes of project MT18006.	Final reports are submitted to Hort Innovation and disseminated at on the Hort Innovation website.

Outcomes

Table 5. Outcome summary

Outcome	Alignment to fund outcome, strategy and KPI	Description	Evidence
Knowledge and Awareness	**Papaya (Outcome 1), Passionfruit (Outcome 1) and Lychee (Outcome 2)** **SIPs:** "*Increased profitability, efficiency and sustainability through innovative R&D and sustainable pest and disease management*" **Strategy:** "*Improve industry preparedness and resilience to biosecurity threats.*" **KPIs:** • Maintenance/tracking of the implementation of an industry biosecurity plan. • Development of risk analyses of high priority pests including entry pathways, establishment and spread potential	Enhanced industry understanding of exotic pest threats (invertebrate pests and pathogens) that may, if introduced, have a significant impact on Australian lychee, papaya and passionfruit production and trade.	Development in consultation with and subsequent endorsement of Threat Summary Tables, High Priority Pest list and Biosecurity Implementation Plans by Australian Lychee Growers Association (ALGA), Australian Papaya (AP), Passionfruit Australia Inc (PAI) and the Plant Health Committee (PHC).

Monitoring and Evaluation

This project had three key objectives:

1. Support the Australian Lychee, Papaya and Passionfruit industries in satisfying their biosecurity obligations.
2. Ensure that the Lychee, Papaya and Passionfruit industries and stakeholders have identified exotic pest risks and mitigation actions necessary to managing risks effectively.
3. Establish a valid base for decisions on future investment in biosecurity-related RD&E.

Table 6. Key Evaluation Questions

Key Evaluation Question	Project performance	Continuous improvement opportunities
To what extent has the project achieved its expected outcomes?	This project improved biosecurity preparedness of the lychee, papaya and passionfruit industries for exotic pests and diseases through the development of a separate industry and PHC endorsed Biosecurity Plans for each industry (Objective 2). The planning process also involved the development of Biosecurity Implementation tables for each industry, which provides insight into their level of biosecurity preparedness and in turn provides a gap analysis regarding their biosecurity preparedness and future RD&E needs (Objectives 2 & 3). All of the industry representatives stated they were limited in time and financial resources to enact at least some of the activities within their respective Implementation Plans, which has limited some aspects of the project's objectives.	This project provided in sights regarding the biosecurity planning process namely the development of Threat Summary Tables (TST) and Biosecurity Implementation tables. This has led to improvements in the format of the TST, which are currently being implemented in new Hort Innovation funded projects. The relatively infancy, scale, and/or resource base of the Australian lychee, papaya and passionfruit industries also highlighted a need to improve the Implementation table development processes for small industries. This process is currently in review at PHA. The limited financial and physical resources of these industries highlighted limitations in their ability to prepare for exotic pest and disease incursions. In response to this reality, PHA is currently investigating whether aggregating biosecurity RD&E resources across multiple small tropical fruit industries including those represented by AgriFutures may help mitigate some of these limitations. Similarly, ALGA is investigating their currently levy allocation and is investigating the feasibility of implementing a PHA levy to enable the financial resourcing of the activities highlighted within their Biosecurity Implementation Plan.
How relevant was the project to the needs of intended beneficiaries?	This project met the needs of the industries in improving their biosecurity preparedness through the generation of Biosecurity Plans including the development of the TST, HPP, Other pests of biosecurity significance and Implementation tables and therefore improved their biosecurity preparedness. This project also addressed their biosecurity obligations as signatories of the Emergency Plant Pest Response Deed (EPPRD) as outlined in the project's objectives.	As stated above, all of the industries acknowledged the benefit of developing the Biosecurity Plans and that the project's format did bring cost benefits. However, two of the industry partners believed that the TEG and BIG meetings could have been more focused on their specific industry thereby improving their time efficiency. PHA is currently considering how this could be achieved without significantly increasing project costs.

	When interviewed, all industry representative acknowledged that the Biosecurity Plans identified their respective HPPs. However, two of the industry partners also stated that this project was frustrating due to the inherent "*differences in growing systems, and pest and disease*" threats between industries. Despite this, one partner stated that it is "*good to have the Plan*". Another stated that the Biosecurity Plans should be reviewed more often (i.e., annually) rather than "*waiting 5 years and then paying for a full review*" and would like to see any cost savings observed through this format directed towards funding biosecurity-related extension activities indicating that they did see value in the project despite having some issues with the project's design.	
How well have intended beneficiaries been engaged in the project?	As Biosecurity Plans are a high level, peak-body facing documents therefore industry engagement was monitored though attendance of key industry stakeholders (ALGA, AP, PAI) at the TEG and BIG meetings.	As stated above, the industry partners were adequately engaged throughout the project through both TEG (year 1) and BIG meetings (years 1-5).
To what extent were engagement processes appropriate to the target audience/s of the project?	The project's key industry stakeholders (ALGA, AP, PAI) were engaged throughout the project including during the TEG (2 times in year 1) and during the annual BIG meetings in years 2-5.	The industry stakeholders believed the number of meetings was sufficient. However, due to multi-industry structure of this project and in turn the differences crop management and exotic threats the duration of the meetings was deemed excessive and the meeting agendas not always relevant to all parties. If a project structure like this is to be adopted in future projects, consideration should be made to structure and TEG and BIG meetings to minimise any unnecessary industry time commitment.
What efforts did the project make to improve efficiency?	Due to multi-industry structure of this project, it was highly efficient and saw the generation of three Biosecurity Plans at a significantly lower cost than that observed in other projects seeking to conduct a full review of a single industry Plan. These savings were largely borne through reducing the PHA salary component and meeting costs	As outlined above, the industry partners saw issue with this project's overlapping-industry structure. Although they recognised these project efficiencies enabled the full review of their Biosecurity Plans. They also believed that this structure lacked time efficiencies from the industry's side due to the low number of shared pests and

	including reduced travel and the adoption of online meetings formats rather than a significant overlap in exotic pest and disease threats (see Table 3).	diseases.

Recommendations

During the development of the Biosecurity Plans and throughout the associated consultation processes there were several issues identified. The following recommendations have been developed to address these issues:

1. Development of smaller Biosecurity Plan review projects. Industry support exists for an abbreviated ongoing project format that enables the annual review of the industry's TST and HPPs to account for changes in taxonomy, hosts, geographic distribution and/or economic impact, which may change the risk ratings posed by each pest. This 'mini review' would enable these lists to remain current and would lessen the financial burden (or need) for a full five yearly review. This review would be undertaken with the opportunity for collaboration with Commonwealth, State and Territory jurisdictions. The development of a new Biosecurity Plans if needed could then be undertaken expediently with a greater focus on an assessment of industry preparedness.
2. Development of a Biosecurity Forum for Emerging Tropical Fruit Industries. In relative terms the Australian lychee, papaya and passionfruit industries are small compared to Australia's other commercial fruit industries and therefore lack sufficient levy funding to further develop their biosecurity preparedness whilst addressing their other RD&E priorities. Indeed, these resource limitations have led to restricted implementation of the activities outlined within their Implementation Plans. Furthermore, other small and/or emerging tropical fruit industries such as custard apple, jackfruit, rambutan and dragon fruit either have little or no RD&E levy to aid in their biosecurity preparedness. It is therefore recommended that a Emerging Tropical Fruit Biosecurity Forum be considered that is comprised of representatives from Australia's smaller tropical fruit industries. This Forum would meet annually to explore common biosecurity issues and potentially enable sufficient economies of scale through cross-industry funding channels to enable the implementation of cross-industry biosecurity preparedness activities including extension material development.
3. Develop and implement a tropical fruit industry biosecurity strategy. This strategy would provide a strategic perspective to protecting the Australian tropical fruit industries from the threat of exotic pests with input into the development of the strategy from a range of stakeholders. Within the strategy a framework would be created to provide the structure and capacity needed for increased visibility of the range of investments and activities needed to improve preparedness and response capability (e.g., Contingency and Continuity Plan development, surveillance, training). This visibility would provide opportunities to demonstrate a return on investment and could be used to inform a targeted approach to future biosecurity related projects.
4. Development of extension resources that increase industry awareness of biosecurity preparedness and HPPs. The generation of extension resources fell outside the scope of this project with the primary publication generated being the Biosecurity Plans. It is recommended that an abbreviated version of the plan focussing on HPP identification and/or symptom diagnosis be considered. These outputs could be developed and extended to industry through current Hort Innovation funded extension projects such as LY23001, PF22001 and PP16001.
5. Undertake an assessment of the HPPs from a tropical fruit trade/market access/produce movement perspective. Following this analysis, pests which have the potential to have significant impact on trade would be identified, cross-industry Continuity Plans developed which would identify options and where possible, develop protocols that would allow safe and cost-effective interstate and international tropical fruit movement in the event of a pest detection/incursion.

Refereed scientific publications

None to report

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Intellectual property

No project IP or commercialisation to report

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Appendices

- Appendix 1 – Biosecurity Plan for the Lychee Industry (version 2.4)
- Appendix 2 – Biosecurity Plan for the Papaya Industry (version 2.4)
- Appendix 3 – Biosecurity Plan for the Passionfruit Industry (version 2.4)

Biosecurity Plan for the Lychee Industry

A shared responsibility between government and industry

Version 2.4 November 2024

Plant Health AUSTRALIA

Hort Innovation
Strategic levy investment

LYCHEE FUND

ALGA

Location: Level 1
1 Phipps Close
DEAKIN ACT 2600
Phone: +61 2 6215 7700
Email: biosecurity@phau.com.au
Visit our website www.planthealthaustralia.com.au

An electronic copy of this plan is available through the email address listed above.

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Revision history

VERSION NUMBER	DATE	DETAILS
2.0	October 2021	Biosecurity Plan for the Lychee Industry
2.1	July 2022	Biosecurity Plan for the Lychee Industry (updated following BRP #1)
2.2	June 2023	Biosecurity Plan for the Lychee Industry (updated following BRP #2)
2.3	May 2024	Biosecurity Plan for the Lychee Industry (updated following BRP #3)
2.4	November 2024	Biosecurity Plan for the Lychee Industry (updated following BRP #4)

Acknowledgements

The Biosecurity Plan for the Lychee 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 Lychee Industry (Version 2.0)* was formally endorsed by the Lychee industry (through the Australian Lychee Growers Association (ALGA) in September 2021, and all state and territory governments (through the Plant Health Committee) in November 2021.

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 28 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, Forestry and Fisheries 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.

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LIST OF ACRONYMS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACIAR	Australian Centre for International Agricultural Research
ACPPO	Australian Chief Plant Protection Officer
AgVic	Agriculture Victoria
ALGA	Australian Lychee Growers Association
APC	AUSPest*Check*®
APVMA	Australian Pesticides and Veterinary Medicines Authority
AS/NZS	Australian Standard/New Zealand Standard
BICON	Australian Biosecurity Import Conditions Database
BIRA	Biosecurity Import Risk Analysis
BISOP	Biosecurity Incident Standard Operating Procedure
BRP	Biosecurity Reference Panel
BMP	Best Management Practise
BOLT	Biosecurity On-Line Training
BP	Biosecurity Plan
CABI	Centre for Agriculture and Bioscience International
CCEPP	Consultative Committee on Emergency Plant Pests
CPHM	Chief Plant Health Manager
DAF NT	Department of Agriculture and Fisheries, Northern Territory
DAF Qld	Department of Agriculture and Fisheries, Queensland
DAFF	Department of Agriculture, Fisheries and Forestry
DAWE	Department of Agriculture, Water and the Environment (now DAFF)
DEECA	Department of Energy, Environment and Climate Action, Victoria
DITT NT	Department of Industry, Tourism and Trade, Northern Territory (now DAF NT)
DPI NSW	Department of Primary Industries, New South Wales
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
ILO	Industry Liaison Officer
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
LLC	Local Control Centres
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
NPBS	National Plant Biosecurity Strategy
NPPP	National Priority Plant Pest
NSP	National Surveillance Protocol
NSW	New South Wales
NRE Tas	Department of Natural Resources and Environment, Tasmania
NT	Northern Territory
ORC	Owner Reimbursement Costs
PA	Papaya Australia
PAI	Passionfruit Australia Inc
PaDIL	Pest and Disease Image Library
PBRI	Plant Biosecurity Research Initiative
PHA	Plant Health Australia
PHC	Plant Health Committee
PIC	Property Identification Code
PIRSA	Primary Industries and Regions South Australia
PPIM	Plant Property Identification Model
QA	Quality Assurance
R&D	Research and Development
RDC	Research and Development Corporation
RD&E	Research, Development and Extension
SA	South Australia
SARDI	South Australian Research and Development Institute
SCC	State Coordination Centres
SDQMA	Subcommittee for Domestic Quarantine and Market Access (now SMART)
SMART	Subcommittee on Market Access, Risk and Trade
SNPHS	Subcommittee for Plant Health Surveillance
SPHD	Subcommittee on Plant Health Diagnostics
SPS	Sanitary and Phytosanitary
T2M	Transition to Management
TBA	To be announced
TRP	Technical Review Panel
TST	Threat Summary Table
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[1], 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 27.

[1] https://www.planthealthaustralia.com.au/response-arrangements/emergency-plant-pest-response-deed-epprd/

EXECUTIVE SUMMARY

To ensure their future viability and sustainability, it is important that the Australian Lychee Industry, represented by the Australian Lychee Growers Association (ALGA) as the peak industry body, minimise the risks posed by exotic pests and respond effectively to plant pest threats. This Biosecurity Plan is a framework to coordinate biosecurity activities and investment for the Australian Lychee Industry. It provides a mechanism for industry, Australian Commonwealth, State and Territory governments, and relevant stakeholders (referred to as key stakeholders throughout the remainder of this biosecurity plan) to better prepare for and respond to, incursions of pests that could have significant impacts on these industries. It identifies and prioritises exotic plant pests (not currently present in Australia) and other pests of biosecurity concern and focuses on future biosecurity challenges.

The Biosecurity Plan for the Lychee Industry (this biosecurity plan) was developed in concert with the development of biosecurity plans for the Australian Papaya and Australian Passionfruit Industries. Facilitated by Plant Health Australia (PHA) and involving the collaboration of plant health and biosecurity experts from relevant Commonwealth, State and Territory agriculture agencies, and representatives from the ALGA, Papaya Australia and Passionfruit Australia. These parties will be referred to as key stakeholders in the remainder of this document.

Key stakeholders were represented in the Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG) and these groups provided advice in the development of the three Plans (Lychee Biosecurity Plan, Papaya Biosecurity Plan, Passionfruit Biosecurity Plan).

A key part of the biosecurity planning process was the development of Threat Summary Tables (TST) for the Lychee Industry (Table *1*). Containing over 100 exotic plant pests, these tables demonstrate the potential biosecurity threats faced by the industry. Each pest on the list was given an overall risk rating based on four criteria; entry potential, establishment potential, spread potential, and potential for economic impact. In this biosecurity plan, other pests of biosecurity significance for the lychee industry were also identified as good biosecurity practices benefit the ongoing management of and surveillance for these pests.

The Biosecurity Plan 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 lychee industry. This enables identification of gaps and prioritisation of specific actions, as listed in the Biosecurity Implementation Table (Table 2; Table 3). The development of this table will increase the industry's biosecurity preparedness and response capability by outlining specific areas of action which could be undertaken through a government and industry partnership.

The Biosecurity Plan is principally designed for use by decision makers. It provides industry and government with a mechanism to identify exotic plant pests as well as to address the specific strengths and weaknesses of the Australian Lychee Industry's current biosecurity position. It is envisaged that annual reviews of this biosecurity plan will be undertaken to assess progress against agreed activities, with another formal review conducted after five years.

The Biosecurity Plan is a document outlining the commitment to the partnership between the key stakeholders to improve biosecurity.

SIGNIFICANT BIOSECURITY THREATS

Document overview

The Biosecurity Plan for the Australian Lychee Industry focuses on the following five key areas over the years 2021-2026 (i.e. the life of this Biosecurity Plan).

High priority exotic pests and other pests of biosecurity significance

A key outcome of this biosecurity plan is the identification of the exotic high priority pests, and other pests of biosecurity significance for the Australian Lychee industry. This section includes:

- the High Priority Pests (HPP), which are the most significant exotic threats affecting the Australian Lychee industry as identified through a prioritisation process; and
- the other pests of biosecurity significance, identified in consultation with the Australian Lychee industry.

The exotic HPP list and other 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.

Implementing biosecurity for the Australian Lychee Industry 2021-2026

This section includes the biosecurity implementation plan and a gap analysis of the current level of preparedness for HPP of the Australian Lychee 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. The TEG, the BIG and the BRP all contained representatives of the three industries as well as technical experts from Australian commonwealth, state and territory governments.

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 biosecurity threats considered in this biosecurity plan are detailed in Threat Summary Tables (TST; Appendix 2: Threat Summary Tables). From the prioritisation process undertaken in the TST, pests with an overall rating of high were determined to be HPP (Table 1).

Risk mitigation and preparedness

This section provides a summary of activities to mitigate the impact of pest threats on the Australian Lychee 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 exotic 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 RD&E, such as researching integrated pest management (IPM) strategies, and chemical control are also provided.

Response management

This section provides a summary of the processes in place to respond to emergency plant pest (EPP)[2] incursions that would affect the Australian Lychee Industry. Areas covered in this section include the Emergency Plant Pest Response Deed (EPPRD), PLANTPLAN (outlines the generic approach in 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 other pests of biosecurity significance to the Australian Lychee Industry. This section provides information on the High Priority Pest (HPP) list, and the other pests of biosecurity significance for the Australian Lychee Industry. These pest lists, provide the Australian Lychee Industry, commonwealth, state and territory governments, and other relevant stakeholders with the information needed to prioritise resources for biosecurity risk management.

The exotic HPP list and other 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 activities.

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

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

Lychee industry high priority exotic pests

Table 1 provides an overview of the top ranked biosecurity pest threats (invertebrates, pathogens and nematodes) for the Australian Lychee industry. Further details on each pest along with the basis for the likelihood ratings are provided on page 60. 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.

Table 1. Lychee industry High Priority Pest list.

Common name	Scientific name	Host(s)	Affected plant part	Movement and dispersal	Geographic distribution[3]	Entry potential	Est.[4] potential	Spread potential	Economic impact	Overall risk
Invertebrates										
Coleoptera (beetles and weevils)										
Lychee longicorn beetle	*Aristobia reticulator*	Guava, longan	Branches		China, India, Bangladesh, Laos, Myanmar, Nepal, Thailand, Vietnam	MEDIUM	HIGH	HIGH	HIGH	HIGH
Citrus longicorn beetle, Black and white citrus longhorn, citrus trunk borer	*Anoplophora chinensis*	Polyphagous attacking living trees including *Citrus* spp., *Acacia* spp., apple, pear, willow, fig, poplar, maple, rose	Trunk		Asia (China, Indonesia, Japan, Democratic Republic of Korea, Republic of Korea, Malaysia, Myanmar, Philippines, Taiwan, Turkey, Vietnam), Europe (Croatia, Guernsey, Italy, Switzerland, UK)	MEDIUM	HIGH	HIGH	HIGH	HIGH
Lepidoptera (butterflies and moths)										
Lychee fruit borer; Lychee stem-end borer	*Conopomorpha sinensis*	Longan, cocoa, rambutan	Trunk, branches, fruit, leaf, shoot	Infested plant material and windborne crawlers; Adults capable of flight.	Asia (Brunei Darussalam, China, India, Indonesia, Malaysia, Philippines, Sri Lanka, Taiwan, Thailand) Oceania (Papua New Guinea, Samoa)	HIGH	HIGH	HIGH	HIGH	HIGH
Asian spongy moth	*Lymantria dispar* (Syn. *Bombyx dispar)*	Okra, cashew, groundnut, tea, cinnamon, Citrus, mango, avocado	Leaves, whole plant		Asia, Africa, North America, Europe.[5]	MEDIUM	HIGH	HIGH	HIGH	HIGH

[3] (CABI, 2023).

[4] Establishment potential.

[5] Asia (Afghanistan, Armenia, Azerbaijan, China, India, Iran, Iraq, Israel, Japan, Kazakhstan, DPR Korea, Republic of Korea, Kyrgyzstan, Lebanon, Mongolia, Syria, Taiwan, Tajikistan, Turkey, Turkmenistan, Uzbekistan)
Africa (Algeria, Morocco, Tunisia)
North America (Canada, USA)
Europe (Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Macedonia, Moldova, Netherlands, Poland, Portugal, Romania, Russian Freedom, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK, Ukraine, Yugoslavia (Serbia and Montenegro)

Common name	Scientific name	Host(s)	Affected plant part	Movement and dispersal	Geographic distribution[3]	Entry potential	Est.[4] potential	Spread potential	Economic impact	Overall risk
Pathogens										
Fungi										
Brown blight; downy blossom blight of litchi	*Phytophthora litchii (Syn. Peronophytho ra litchii)*	Longan	Fruit, flowers, leaves		Asia (China, Taiwan, Thailand, Vietnam) Oceania (Papua New Guinea) Europe (Netherlands)	HIGH	HIGH	HIGH	HIGH	HIGH

Other pests of biosecurity significance

Introduction

This section identifies other pests of biosecurity significance for the Australian lychee industry. By identifying pests which are either currently under quarantine arrangements or which lychee producers already 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 industry.

Identification of other 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

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

- currently under quarantine arrangements or 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.

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 in Australia. Pollination services of the European honey bee are provided by beekeepers to growers of pollinator-reliant crops.

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

Established and exotic pests of European honey bees as well as exotic pest bees can have a major impact on crop pollination services. Honey bee pests and pest bees can also impact unmanaged colonies which also provide pollination.

Lychees rely on a range of native and established insect species for pollination, including European honey bees. A list of the high priority bee pests and pest bees which could impact the Lychee industry can be located on the PHA website planthealthaustralia.com.au/industries/honey-bees/ and the BeeAware website beeaware.org.au/pests/

Table 2. Other pests of biosecurity significance.

Common name (Scientific name)	Hosts	Affected plant part	Distribution in Australia	State movement controls or market impact by pests	Factsheets	Comments
Invertebrates						
Acari (mites and ticks)						
Varroa mite (*Varroa destructor*)	*Apis cerana, A. mellifera*.	Brood and adults (honey bee life stage)	NSW and Vic[6].	Movement restrictions of hives and other equipment apply for Qld[7], SA[8], NT[9], WA[10], Vic[11], ACT[12], Tas[13]	PHA[14], BeeAware[15], NSWDPI[16]	A 2-year transition to management (T2M) plan was approved in February 2024.[17]
Lepidoptera (butterflies and moths)						
Mango shoot looper (*Perixera illepidaria*)	Mango, lychee, longan, rambutan, cashew, pistachio	Leaves, flowers, fruit	Qld, NT.		QDAF[18], DPIRD[19]	

[6] https://www.dpi.nsw.gov.au/emergencies/biosecurity/current-situation/varroa-mite-emergency-response
[7] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/animal/industries/bees/move
[8] https://pir.sa.gov.au/biosecurity/animal_health/animal_species/bees/moving_bees_and_bee_products
[9] https://nt.gov.au/industry/agriculture/livestock-and-animals/honey-bees-and-beekeeping
[10] https://www.agric.wa.gov.au/livestock-animals/livestock-species/bees
[11] https://agriculture.vic.gov.au/biosecurity/moving-livestock-and-animals/moving-bees-interstate
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[18] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/priority-pest-disease/mango-shoot-looper
[19] https://www.agric.wa.gov.au/mango-shoot-looper-biosecurity-alert

Implementing biosecurity for the Australian Lychee Industry 2021-2026

This section includes the biosecurity implementation plan and a gap analysis of the current level of preparedness for HPP of the Australian Lychee Industry. The Biosecurity Implementation Group (BIG), comprising of representatives of key stakeholders and other relevant experts, developed the implementation plan that sets out the Biosecurity Plans shared goals and objectives. It is intended that the implementation plan is revisited by the BRP regularly over the next five years to maintain its relevance. The TEG, the BIG and the BRP contain representatives of the three industries as well as scientific and technical experts from Australian commonwealth, state and territory governments, and other relevant organisations.

Biosecurity Implementation Table

The Biosecurity Implementation Table aims to build upon the themes outlined in the Intergovernmental Agreement on Biosecurity (IGAB)[20] and the National Plant Biosecurity Strategy (NPBS)[21] by providing a clear line of sight between the development of this Biosecurity Plan and broader plant health policy and legislation.

This table also aims to provide focus and strategic direction for plant biosecurity activities relating to the Australian Lychee Industry over the next five years (i.e. the life of this Biosecurity Plan). The Biosecurity Implementation Table provides specific recommendations for potential biosecurity activities identified by key stakeholders to improve biosecurity preparedness for pest threats.

Biosecurity is a shared responsibility between the key stakeholders and other stakeholders. The Biosecurity Implementation Table has been produced to help coordinate actions and resources in the Australian biosecurity system. Activities may require additional funding to be sourced prior to commencement. Implementing the specific actions listed in the Biosecurity Implementation Table, will not only strengthen Australian Lychee Industry biosecurity systems, but also the broader Australian plant biosecurity systems. Future versions of this table will also track progress on the activities described.

The Biosecurity Implementation Table previously outlined eight strategy areas where industry and government should align their biosecurity efforts. The eight strategy areas were:

- Capacity and Capability
- Education and Awareness
- Preparedness and Response
- Surveillance
- Diagnostics
- Established Pests of Biosecurity Concern
- Research, Development & Extension
- Legislation and Regulatory Issues of Importance

During the life of the Biosecurity Plan, changes have been made to the structure of the Implementation Table to better align with the structure of the IGAB and the NPBS. The Implementation Table has been updated to reflect this new structure below.

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

Table 3. The Biosecurity Implementation Table for the Australian Lychee industry 2021-2026.

Biosecurity Plan Strategy	Action	Output	Outcome	Potential Partners	Current Activities	Timeframe
1. Preparedness and Response	1.1 Develop a Biosecurity Incident Standard Operating Procedures (BISOP) which is designed to guide industry and government in the event of an exotic pest/pathogen incursion.	Lychee BISOP which identifies and documents corporate knowledge, organisational procedures, and roles/responsibilities for responding to a biosecurity incident/incursion.	The BISOP will provide industry and government with operational guidance when responding to a biosecurity incursion/response.	Australian Lychee Growers Association (ALGA), Plant Health Australia (PHA).		
	1.2 Describe and evaluate current biosecurity risk pathways into Australia and determine appropriate mitigation measures.	Lychee biosecurity pathway risk analysis.	Greater understanding of the biosecurity risks associated with pathways will provide the opportunity to develop pre-emptive mitigation measures.	ALGA, Department of Agriculture, Fisheries and Forestry (DAFF), State and Territory Governments (where appropriate).		
	1.3 Understand current surveillance programs undertaken by industry and government.	Surveillance analysis and a Lychee industry surveillance program.	Early detection of key exotic pests and an improved knowledge of geographic spread of established pests.	ALGA, Commonwealth, State and Territory Governments, Subcommittee on National Plant Health Surveillance (SNPHS), PHA.		Ongoing
	1.4 Participate in future simulation exercises that test the preparedness and response of the biosecurity system to exotic pest and/or pathogen incursions.	Simulation exercises.	Participating industries and governments are better prepared to respond to a pest incursion.	ALGA, Commonwealth, State and Territory Governments, Hort Innovation, PHA.		Ongoing
	1.5 Review the availability of crop protection products available to manage exotic pests and pathogens and identify gaps in control options.	A list of important pests and control options are available with gaps identified.	Industry will have a list of identified gaps in control options for important pests and pathogens.	ALGA, State and Territory Governments (where appropriate), Australian Pesticides and Veterinary Medicines Authority (APVMA), collaborating industries.		
	1.6 Prioritise identified gaps in pest control options and develop options to address gaps.	A plan to address crop protection gaps.	A prioritised list of pests and control options with strategies developed to gain access.	ALGA, APVMA, collaborating industries, crop protection companies.		
	1.7 Review availability of diagnostics for the high priority pests and assess the capability to perform diagnostics (normal capacity and surge capacity).	Diagnostic tools and methods that provide accurate and timely identification of pests and pathogens.	Increased accuracy and rapid diagnosis of pests/pathogens will provide greater opportunity for eradication and/ or management.	ALGA, State and Territory Governments (where appropriate), collaborating industries, Subcommittee on Plant Health Diagnostics (SPHD).		Ongoing
	1.8 Maintain an understanding of relevant biosecurity legislation and regulations in all states/territories.	Regular legislation and regulation update.	Any specific state/ territory or discordant requirements identified. Increase industry	ALGA.		Ongoing

			awareness of legislation and regulations impacting their businesses.			
	1.9 Develop Owner Reimbursement Costs (ORC) that provide a framework for calculating ORC payments for Lychee growers in the event of a response.	Current ORC framework and cost structure.	ORC framework and costs structures remain relevant to key industry sectors.	ALGA, State and Territory Governments (where appropriate), Rural Assistance Authorities (RAA), PHA.		2024
2. Capacity & Capability	2.1 Ensure Australian Lychee Growers Association (ALGA) executives regularly undertake biosecurity training (e.g., Emergency Plant Pest Response Deed (EPPRD), Biosecurity OnLine Training (BOLT)).	Biosecurity skilled members and staff.	Knowledge and understanding of biosecurity systems and processes will provide ALGA with greater capacity to contribute to biosecurity for the benefit of their industry.	ALGA, Hort Innovation, PHA.		2022
	2.2 In collaboration with industry and governments, gain an understanding of diagnostic capacity within both government and private providers and assess methods to address capacity and capability gaps.	Diagnostic capacity analysis.	Increased diagnostic capacity or a greater understanding of gaps and methods to address these gaps.	ALGA, Hort Innovation, collaborating industries, State and Territory Governments.		
	2.3 Build and maintain international networks of production and biosecurity specialists who can contribute to growth of knowledge and skills within the Australian Lychee industry.	International Biosecurity Network.	Improved preparedness to manage both established and exotic pests.	ALGA, Hort Innovation.		Ongoing
	2.4 Development and implementation of a biosecurity training framework for the Lychee industry.	Biosecurity training framework.	Lychee framework with training modules will assist develop a skilled biosecurity focussed workforce.	ALGA, Hort Innovation, PHA.		
3. Communication and Engagement	3.1 ALGA maintains an industry database which holds current contact information for Lychee growers and key industry stakeholders.	Industry database.	Critical information on biosecurity can be delivered rapidly to the industry.	ALGA, other authorised buyers.		Ongoing
	3.2 ALGA delivers an effective industry communications program with multiple delivery methods which has the capacity to deliver relevant biosecurity information, including Beeaware and the National Fruit Fly Council (NFFC).	Lychee communications program.	The Lychee industry is well informed on the range of issues impacting on industry and business.	ALGA.		Ongoing
	3.3 Promote, disseminate, and demonstrate benefits of biosecurity to industry within and across each component of the supply chain.	BOLT courses.	Improved knowledge of biosecurity and process and systems supporting biosecurity.	ALGA, State and Territory Governments, PHA.		Ongoing
	3.4 Prepare articles (including fact sheets) on biosecurity and key pests (exotic and established) for publication in industry journals and website.	Articles, fact sheets, other information.	Industry stakeholders are informed on pests, current management practices and research activities.	ALGA, State and Territory Governments, PHA.	Articles have been developed for ALGA members using PHA's Industry toolkit resources.	Ongoing

	3.5 Ensure industry (in particular, new entrants) are aware of the Emergency Plant Pest Response Deed (EPPRD), the Owner Reimbursement Cost (ORC) Framework and the implications for the industry and business.	Biosecurity awareness material.	Industry retains and builds knowledge of the response and management of exotic pests and pathogens.	ALGA, PHA.		
4. Innovation, Research, Development and Extension	4.1 Review and prioritise Lychee biosecurity Research, Development and Extension (RD&E) annually and identify opportunities for collaboration and cross-sectoral investment.	Lychee biosecurity RD&E plan.	A Lychee innovation and RD&E program that addresses key issues challenging the Lychee industry.	ALGA, Biosecurity Reference Panel (BRP), State and Territory Governments (where appropriate), PHA.		Ongoing
	4.2 Keep informed of activities with SPHD through the national Diagnostic and Surveillance Network Coordinator.	Rapid field diagnostic tools.	More rapid diagnosis of pathogens will asset growers implement the most suitable eradication or management program.	ALGA, State and Territory Governments.		Ongoing
5. Collaboration and partnerships	5.1 Build strong networks among both researchers and regulators in Commonwealth and State/Territory governments.	A robust and collaborative research and regulatory network.	Greater input into future decisions making that may impact on the industry.	ALGA, State and Territory Governments, Universities.		
	5.2 Maintain collaborative arrangements with universities and other research and education providers so opportunities for Lychee research and development activities can be addressed.	Collaborative biosecurity programs.	The Lychee industry maintains access to innovative solutions and products.	ALGA, State and Territory Governments (where appropriate), Universities.		
	5.3 Support addressing gaps in biosecurity preparedness by collaborating with other industries, governments, and other stakeholders.	Collaborative biosecurity programs.	Improved biosecurity preparedness by industry and government.	ALGA, other industries, State and Territory Governments.		
	5.4 Facilitate and maintain an international network of Lychee technical specialists who can contribute to growth of knowledge and skills within the Australian Lychee industry.	Lychee pest and disease network.	Improved capability and capacity to manage both established and exotic pests.	ALGA.		Ongoing
	5.5. Engage in initiatives to improve preparedness and response to cross sectoral pests and or diseases.	Improved preparedness for pests and diseases.	Shared investment into RD&E.	ALGA, Plant Biosecurity Research Initiative (PBRI), PHA.		Ongoing

Australian Lychee Industry - biosecurity preparedness

The following table has been populated with the high priority pests of the Australian Lychee 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 Lychee industry.

Common name (Scientific name)	National Diagnostic Protocol[22]	Surveillance programs[23]	Fact sheets	Contingency plan	EPPRD category[24]	National Priority Plant Pest[25]	Potential Collaborators[26]
Invertebrates							
Coleoptera (beetles and weevils)							
Lychee longicorn beetle *Aristobia reticulator*	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	
Citrus longicorn beetle, Black and white citrus longhorn, citrus trunk borer *Anoplophora chinensis*	Not developed	Not covered by a pest specific surveillance program	PHA[27], QDAF[28]	Developed 2009[29]	Not categorised	No. 34	
Lepidoptera (butterflies and moths)							
Lychee fruit borer; Lychee stem-end borer *Conopomorpha sinensis*	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	
Asian spongy moth *Lymantria dispar* (Syn. *Bombyx dispar)*	NDP 42 V1	SA, Tas, Vic, QLD, National Surveillance Protocol[30]	PHA[31]	Developed 2009[32]	Not categorised	No. 8	Apple & Pear, Nursery & Garden, Plantation forest, Summerfruit, Tree

[22] https://www.plantbiosecuritydiagnostics.net.au/resources/?category=national-diagnostic-protocols
[23] Information presented has been taken from National Plant Biosecurity Status Report 2020, National Plant Health Surveillance Program and the Northern Australian Quarantine Strategy and confirmed through the Plant Health Committee.
[24] https://www.planthealthaustralia.com.au/response-arrangements/emergency-plant-pest-response-deed-epprd/
[25] https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/plant/national-priority-plant-pests-2019
[26] Industries listed in this column identify these pests within their biosecurity plans. Pests listed as a High Priority Pest are indicated by HPP.
[27] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Citrus-longicorn-beetle-FS.pdf
[28] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/priority-pest-disease/exotic-longhorned-beetles
[29] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Citrus-longicorn-beetle-CP-2009.pdf
[30] https://plantsurveillancenetwork.net.au/resources/national-surveillance-protocol-for-spongy-and-nun-moth-lymantria-spp/
[31] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/02/Asian-gypsy-moth-FS-Nursery-and-Garden.pdf
[32] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Gypsy-moth-CP-2009.pdf

Common name (Scientific name)	National Diagnostic Protocol[22]	Surveillance programs[23]	Fact sheets	Contingency plan	EPPRD category[24]	National Priority Plant Pest[25]	Potential Collaborators[26]
							nut, Rubus
Pathogens							
Fungi							
Brown blight; downy blossom blight of litchi *Phytophthora litchii* (Syn. *Peronophythora litchii)*	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	

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 exotic 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 our way of life.

Plant pests include (but are not limited to) insects, mites, snails or diseases (pathogens, including nematodes) that have the potential to adversely affect fresh food, fibre, ornamental crops, honey bees and stored products, as well as environmental flora and fauna. For agricultural systems, if exotic plant 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 plant 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 focus on continuous improvement from industry and governments to keep Australia's plant biosecurity system effective, 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.

Lychee Peak Industry Body

The Australian Lychee Growers Association (ALGA) is the peak industry body for the Australian Lychee Industry. They are a signatory to the EPPRD and are the key industry contact point if a suspect emergency plant pest affecting the Australian Lychee Industry is detected. For a background on the Lychee industry, refer to page 57.

ALGA 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/ .

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. The main activities of PHA are funded from annual subscriptions paid by members. The Australian Government, state and territory governments and 38 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 PHA.

Plant Health Australia 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 Australia's plant industries. Through PHA, current and future needs of the plant biosecurity system can be mutually agreed, issues identified, and solutions to problems found. The independence and impartiality of PHA, allows the organisation 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 Australian Lychee Industry was developed in consultation with the Technical Expert Group and Biosecurity Implementation Group. These groups were comprised of plant health and biosecurity experts and industry representatives from key stakeholders.

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

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

Biosecurity planning

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

Ensuring the Lychee 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 economic and social costs of pest incursions on both growers and the wider community. The information gathered during these processes provides additional assurance that the Australian Lychee 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.

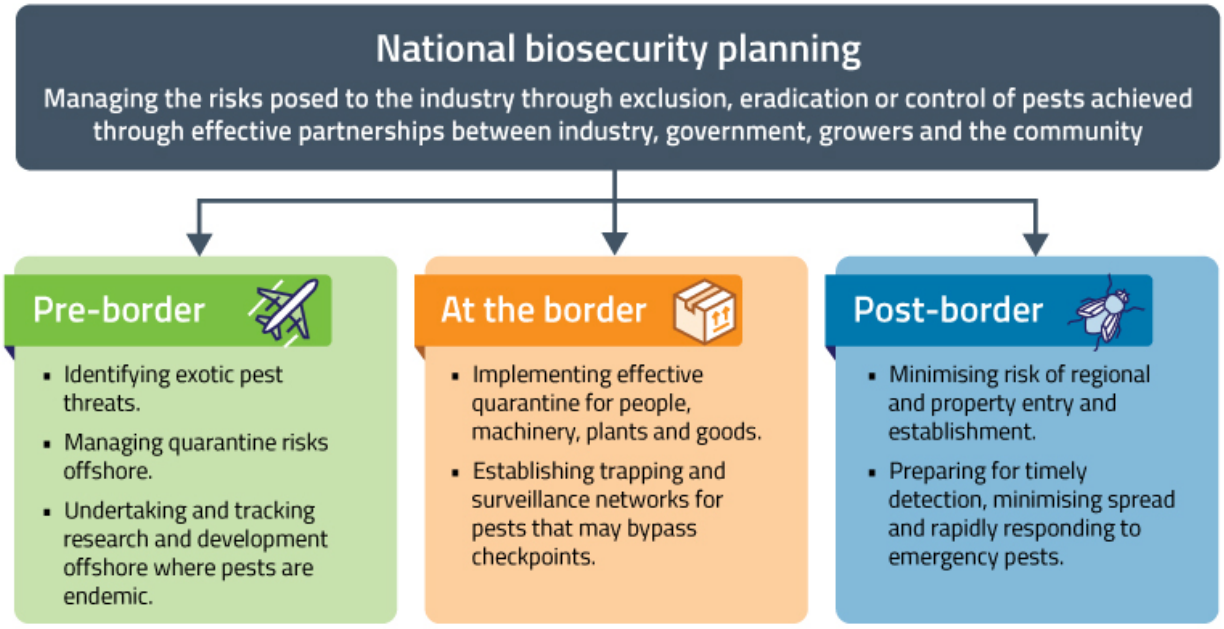

Figure 1. Industry biosecurity: a shared responsibility.

Biosecurity Plan development

With the assistance of Passionfruit Australia, Australian Lychee Growers Association and Papaya Australia, a Tropical Fruits Technical Expert Group (TEG) and a Tropical Fruits Biosecurity Implementation Group (BIG) were formed to work on the review of the Biosecurity Plan for the Lychee industry. These groups were coordinated by Plant Health Australia (PHA) and included representatives from the three industries, relevant Commonwealth, state, and territory agriculture agencies.

Key roles of the Technical Expert Group for the biosecurity plan review process, included:

- identifying and documenting key threats to the Australian Lychee Industry, and
- confirming an agreed high priority pest (HPP) list.

Key roles of the Biosecurity Implementation Group for the biosecurity plan review process, included:

- documenting pest-specific fact sheets, contingency plans, diagnostic protocols, and surveillance programs for HPP,
- documenting the roles and responsibilities of stakeholder groups, and
- populating the Biosecurity Implementation Table for future biosecurity related work to be conducted over the life of this biosecurity plan.

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

NAME	ORGANISATION	AREA OF EXPERTISE	MEMBER OF TEG	MEMBER OF BIG
Jill Houser	ALGA	Industry	✓	✓
Gerard Kath	Papaya Australia	Industry	✓	✓
Joe Zappala	Papaya Australia	Industry		✓
Dennis Chant	Passionfruit Australia	Industry	✓	✓
Jane Richter	Passionfruit Australia	Industry	✓	
Greg Chandler	Hort Innovation	Biosecurity, R&D	✓	
Matt Adkins	NSW DPI	R&D	✓	
Ruth Huwer	NSW DPI	Entomology	✓	✓
Fucheng Shan	WADPIRD	Research	✓	✓
Touhidur Rahman	WADPIRD	Entomology	✓	
Alison Mackie	WA DPIRD	Pathology, Research		✓
Ceri Pearce	DAF QLD	Pathology	✓	✓
Fiona Giblin	DAF QLD	Pathology	✓	✓
Lindy Coates	DAF QLD	Pathology	✓	
Christine Horlock	DAF QLD	Pathology	✓	
Ian Newton	DAF QLD	Entomology	✓	✓
Jose Liberato	NTDITT	Pathology	✓	✓
Stuart Kearns	PHA	Biosecurity	✓	
Victoria Ludowici	PHA	Biosecurity	✓	

Bosibori Bett	PHA	Biosecurity	✓	
Trevor Dunmall	PHA	Biosecurity	✓	✓
Stephen Quarrell	PHA	Biosecurity		✓
Rebecca Powderly	PHA	Biosecurity		✓

Table 6. Scientists and others who contributed information for the review of the biosecurity plan. [33]

NAME	ORGANISATION	AREA OF EXPERTISE
Cherie Gambley	DAF QLD	Virology
Danuta Knihinicki	DPI NSW	Entomology
Denis Persley	DAF QLD	Virology
Jennifer Cobon	DAF QLD	Nematology
Marc Poole	WA DPIRD	Entomology
Nanditha Panthania	DAF QLD	Pathology
Peter Gillespie	DPI NSW	Entomology
Tony Pattison	DAF QLD	Pathology
Sharl Mintoff	NT DITT	Pathology
Merran Neilsen	NT DITT	Pathology
Brian Thistleton	NT DITT	Entomology

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 are documented, and
- contact details and references to available resources are accurate.

In addition to the formal review process above, the document should be revisited annually by a Biosecurity Reference Panel comprised of representatives of relevant industry, government and other stakeholder groups as well as PHA, to ensure currency and relevance of information and to monitor progress with implementation. As an example, the industry biosecurity priorities identified within the biosecurity 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 HPP or changes to legislation are currently being investigated. Such changes would need to include consultation with and agreement of relevant industry groups and governments. This flexibility enhances the plan's currency and relevance.

[33] 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.

THREAT IDENTIFICATION AND PEST RISK ASSESSMENTS

Introduction

This section identifies high-risk exotic plant pest threats to the Australian Lychee 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 Australian Lychee 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 when pest incursions occur. One such mechanism is the EPPRD that has been negotiated between PHA government and industry members. The EPPRD ensures reliable and agreed funding arrangements are in place in advance of EPP incursions and can assist in responses to EPP incursions, particularly for those EPP identified as key threats.

Identification of high-risk exotic plant 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.

Other pests of biosecurity significance are also considered in this biosecurity plan. It has been demonstrated that good biosecurity practice is beneficial for the ongoing management of other pests, as well as for surveillance and early detection of exotic plant pests. Other plant pests cause ongoing hardships for growers and these plant 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 plant pests for the benefit of the Australian Lychee industry.

Exotic plant pests of the Lychee industry

Threat identification

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

- past records,
- industry practice and experience,
- relevant published literature,
- local industry and overseas research, and
- specialist and expert judgment.

At this time, only invertebrate pests (insects, mites, and molluscs) and diseases (pathogens, including nematodes) of plants have been identified for risk assessment in this biosecurity plan, as these organisms dealt with under the nationally agreed EPPRD. At this time, pest plants (weeds) are dealt with under the National Environmental Biosecurity Response Agreement (NEBRA). If exotic pest plants (weeds) of commercial crops were included in the EPPRD in the future, then the inclusion of pest plants (weeds) of lychee crops would be considered at that time.

Pest risk assessments

The assessment process used in this biosecurity plan was developed in accordance with the International Standards for Phytosanitary Measures (ISPM) No. 2[34] and 11 [Food and Agriculture Organization of the United Nations.[35] A summary of the pest risk analysis protocol followed in this biosecurity plan is shown in Table *7*.

While there are similarities in the ranking system used in this document and the Biosecurity Import Risk Analysis (BIRA)[36] process followed by the Department of Agriculture, Fisheries and Forestry (DAFF), 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.

Modifications of the DAWR[37] (Department of Agriculture and Water Resources, 2016) protocol have been made to suit the analysis required in the biosecurity plan development process, including, but not limited to:

- Entry potential: The determination of entry potential in this biosecurity plan considers 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 in the BIRA process, which only considers legal importation of plants or plant commodities.
- Potential economic impact of pest establishment in this document only considers the impacts on the Australian lychee industry. The BIRA process has a wider scope, including the impacts on all of Australia's plant industries, trade, the environment, social amenity and public health.
- Risk potential and impacts: The categories used in this biosecurity plan for describing the entry, establishment, spread, and potential economic impacts (see page 2925) differs in comparison to that used in the 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

[34] FAO (2007).
[35] FAO (2004).
[36] https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/bira-guidelines-2016.pdf
[37] Now the Department of Agriculture, Fisheries and Forestry (DAFF).

The objective of risk assessment is to clearly identify and classify biosecurity risks and to provide data to assist in the evaluation and mitigation 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 Threat Summary Tables (page 60) present a list of potential plant pest threats to the Australian Lychee 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 TST 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 human-assisted spread (including illegal means such as smuggling). This is a broader view of potential risk than the BIRA process conducted by Department of Agriculture, Fisheries and Forestry which focuses 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 biosecurity plans, sharing similar pest ratings. However, the economic impact of a pest is considered at an industry specific level (i.e., only for the Australian Lychee Industry in this biosecurity plan), and therefore this rating may differ between biosecurity plans.

Description of terms used in pest risk tables

The descriptions below relate to terms used in Table 1 and elsewhere in the document. Table 1 provides an overview of the top ranked biosecurity pest threats (invertebrates, pathogens and nematodes) for the Australian Lychee industry. Further details on each pest along with the basis for the likelihood ratings are provided in the TST. 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.

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 pest has limited potential to survive and become established within Australia given the combination of all known factors.
Low	The pest has the potential to survive and become established in approximately one - third or less of the range of hosts. The pest could have a low probability of contact with susceptible hosts.
Medium	The pest has the potential to survive and become established in between approximately one-third and two-thirds of the range of hosts.
High	The pest has potential to survive and become established throughout most or all of the range of hosts. Distribution is not limited by environmental conditions that prevail in Australia. Based upon its current world distribution, and known conditions of survival , it is likely to survive in Australia wherever major hosts are grown
Unknown	The establishment potential of the pest 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.

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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[38] and Commonwealth and state/territory legislation.

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the Australian Lychee Industry (Figure 2). Such risk mitigation and preparedness practices are the joint 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 commonwealth, state and territory governments, and Australian Lychee 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 individual situation.

Figure 2. Examples of biosecurity risk mitigation activities.

[38] https://www.ippc.int/en/core-activities/standards-setting/ispms/

Barrier quarantine

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

National level – importation restrictions

The Department of Agriculture, Fisheries and Forestry (DAFF) is the Australian Government department responsible for maintaining and improving international trade and market access opportunities for agriculture, fisheries, forestry, and food industries. DAFF 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.

DAFF is responsible for developing biosecurity (i.e. SPS) risk management policy and reviewing existing quarantine measures for the importation of live animals and plants, and animal and plant products. In particular, DAFF undertakes import risk analyses to determine which products may enter Australia, and under what quarantine conditions. DAFF 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, DAFF 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 DAFF under the Australian Government *Biosecurity Act 2015*. Quarantine policies are developed through the Biosecurity Import Risk Analysis (BIRA) process. This process is outlined in the BIRA Guidelines 2016 (Department of Agriculture and Water Resources, 2016). DAFF maintains barrier quarantine services at all Australian international sea and airports, 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 DAFF.

The Australian Biosecurity Import Conditions Database (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. BICON can be accessed at agriculture.gov.au/import/bicon. For export conditions see the Manual of Importing Country Requirements (MICoR) database at https://micor.agriculture.gov.au/Pages/default.aspx.

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 DAFF on 1800 900 090, or visit the website at awe.gov.au/biosecurity-trade/import/online-services/bicon.

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.

State and regional level – movement restrictions

The ability to control movement of materials that can carry and spread lychee pests is of high importance. Each state/territory may have quarantine legislation in place to control the importation of lychee fruit and or lychee pest carriers interstate and intrastate, and to manage agreed pests if an incursion occurs (contact details in 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 Subcommittee on Market Access, Risk and Trade (SMART; previously the Subcommittee 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 lychee can be obtained by contacting your local state or territory agriculture department directly (contact details in Table 9), or through the SMART website[39] 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 and weed seed. 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 agriculture department (contact details in Table 8).

[39] https://interstatequarantine.org.au/

Table 8. 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*	https://www.environment.act.gov.au/__data/assets/pdf_file/0007/902293/act-biosecurity-strategy-2016-2026.pdf	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	https://www.dpi.nsw.gov.au/biosecurity/managing-biosecurity/legislation	(02) 6391 3384
NT	Department of Agriculture and Fisheries, Northern Territory https://daf.nt.gov.au/biosecurity	*Plant Health Act 2008* *Plant Health Regulations 2011*	https://industry.nt.gov.au/__data/assets/pdf_file/0011/396587/Plant-Quarantine-Manual.pdf	(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*	https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/379138/qld-biosecurity-manual.pdf	132 523
SA	Primary Industries and Regions SA pir.sa.gov.au	Plant Health Act 2009 Plant Health Regulations 2022	pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia	(08) 8207 7820
TAS	Biosecurity Tasmania, a part of the Department of Natural Resources and the Environment Tasmania https://nre.tas.gov.au/biosecurity-tasmania	Biosecurity Act 2019 Plant Quarantine Act 1997 Weed Management Act 1999	https://nre.tas.gov.au/documents/Plant%20Biosecurity%20Manual%20Tasmania.pdf	1300 368 550
VIC	Agriculture Victoria, a part of the Department of Energy, Environment and Climate Action https://agriculture.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 Agriculture Management Act 2007	https://www.agric.wa.gov.au/qtine/default.asp	(08) 9368 3333

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 QLD website (Restrictions on moving plant material, soil and related equipment into Queensland | Business Queensland).

Further details can be obtained from the DAF Queensland Customer Service Centre by phoning 13 25 23 or by fax 07 3404 6900.

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 8). 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) 9368 3333.

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 pest entry 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 44). The Australian Lychee 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, minimises costs associated with eradication and are necessary to meet the treaty obligations of the WTO SPS Agreement with respect to the area freedom status of Australia, Australian states and territories and intra state/territory 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 SPS 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 No. 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, detection techniques available and the potential impact of the pest.

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 pests. Targeted surveillance is important to determine the presence or absence in each area (state/territory or region).

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, Fisheries and Forestry (DAFF) maintains barrier quarantine services at all international ports and in the Torres Strait region. DAFF 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).[40] NAQS surveillance programs relevant to the Australian Lychee Industry are listed in Table 9.

State surveillance programs

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

[40] https://www.agriculture.gov.au/biosecurity-trade/policy/australia/naqs

- communication, training and extension strategies with industry,
- biosecurity training, and
- 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 agriculture agencies run diagnostic programs whereby samples of pests suspected to be EPP or HPP can be forwarded to the local agency and diagnosed for the presence of exotic pests free of charge. Official surveillance programs that target pests of the Australian Lychee Industry (exotic or those under official control in a region or state/territory) are shown in Table 9.

Table 9. Official surveillance programs that target pests of the Lychee industry (as of July 2020). [41]

SURVEILLANCE PROGRAM	TARGET PEST(S)	TARGET HOST(S)
Australian Government		
External Territories Surveillance Program	High priority exotic pests	Various environmental, production and ornamental plants
International Plant Health Surveillance Program	High priority exotic pests	Tropical horticultural, environmental and agricultural species
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Bee swarms at first points of entry
National Border Surveillance Program	Specific high priority exotic pests and any pest belonging to key taxonomic groups	Plant families of high economic importance and known or potential key hosts of specific exotic pests, focusing on regulatory import pathway risks
National Plant Health Surveillance Program (delivered through states and territories)	High priority exotic pests including exotic gypsy moth and fruit fly species	Various, based on the species surveyed
Northern Australia Quarantine Strategy – exotic fruit fly trapping	Exotic fruit flies including *Bactrocera dorsalis, B. latifrons, B. trivialis, B. umbrosa, Zeugodacus atrisetosa, Z. cucurbitae, Z. decipiens*	Various
Northern Australia Quarantine Strategy – pest and disease surveys	123 high priority exotic pests, diseases and weeds	Tropical horticultural, environmental and agricultural species
Within New South Wales		
Exotic fruit flies – Riverina	Mediterranean fruit fly (*Ceratitis capitata*), other tri lure responsive exotic fruit flies	Various horticultural crops (citrus, stone fruit)
Exotic longhorn beetle trapping	Asian longhorn beetle (*Anoplophora glabripennis*), Japanese pine sawyer beetle (*Monochamus alternatus*), brown mulberry longhorn beetle (*Apriona germari*)	Various hosts around ports

[41] Information presented has been taken from the National Plant Biosecurity Status Report 2020 and confirmed by the Sub-committee on National Plant Health Surveillance (sub-committee of the Plant Health Committee) and NAQS

National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including *Bactrocera albistrigata, B. carambolae, B. caryae, B. correcta, B. curvipennis, B. dorsalis, B. facialis, B. kandiensis, B. kirki, B. melanotus, B. occipitalis, B. passiflorae, B. psidii, B. trilineola, B. trivialis, B. umbrosa, B. xanthodes, B. zonata, Ceratitis capitata, Zeugodacus cucurbitae, Z. tau,* gypsy moth (*Lymantria* spp.), 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
Serpentine leafminer	Serpentine leafminer (*Liriomyza huidobrensis*)	Multiple horticultural and ornamental hosts
Within the Northern Territory		
Area Freedom Surveillance Program	Queensland fruit fly (*Bactrocera tryoni*)	Horticultural crops
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca, Aethina tumida,* acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris,* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including citrus canker (*Xanthomonas axonopodis* pv. *citri*), huanglongbing (*Candidatus* Liberibacter spp.), Asiatic citrus psyllid (*Diaphorina citri*), giant African snail (*Achatina fulica*), glassy winged sharpshooter (*Homalodisca vitripennis*), Pierce's disease (*Xylella fastidiosa*), banana black sigatoka (*Mycosphaerella fijiensis*), red imported fire ant (*Solenopsis invicta*), electric ant (*Wasmannia auropunctata*), yellow crazy ant (*Anoplolepis gracilipes*), *Bactericera cockerelli*, *Candidatus* Liberibacter solanacearum, potato leafminer, pea leafminer, serpentine leafminer (*Liriomyza huidobrensis*), American leafminer (*Liriomyza trifolii*), vegetable leafminer (*Liriomyza sativae*), exotic fruit flies (*Bactrocera* spp. and *Ceratitis* spp.)	Multiple
Plant Pest Diagnostic Service – horticulture	All pests and pathogens that can affect horticultural crops (mango, chilli, watermelon, Cucurbitaceae)	Horticultural crops
Regional Fruit Fly Monitoring and Surveillance	Exotic fruit flies (*Bactrocera* spp. and *Ceratitis* spp.)	Horticultural crops
Within Queensland		
Area freedom surveys	Multiple pests	Multiple
Exotic Fruit Fly in the Torres Strait Program	Exotic fruit fly including *Bactrocera* and *Zeugodacus* spp.	Multiple
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

National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca, Aethina tumida,* acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris,* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple, including exotic fruit flies and Mediterranean fruit fly (*Ceratitis capitata*), exotic gypsy moths, Pierce's disease (*Xylella fastidiosa*) and glassy winged sharpshooter (*Homalodisca vitripennis*), and brown marmorated stink bug (*Halyomorpha halys*).	Multiple
Bee pest and pest bee diagnostic service	Multiple pests	European honey bee
Within South Australia		
Area freedom surveys	Multiple pests	Multiple
Bee surveillance – endemic disease	American foulbrood (*Paenibacillus* spp.)	European honey bees
Mediterranean fruit fly	Mediterranean fruit fly (*Ceratitus capitata*)	Horticultural crops
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple, including exotic invasive ants (tramp ants), Asian and African citrus psyllids (*Diaphorina citri*, *Candidatus* Liberibacter africanus), huanglongbing (*Candidatus* Liberibacter asiaticus), citrus canker (*Xanthomonas axonopodis* pv. *citri*), glassy winged sharpshooters (*Homalodisca vitripennis* and *H. coagulata*), brown mamorated stink bug (*Halyomorpha halys*), xylella (*Xylella fastidiosa*)	Multiple
Ports of Entry Trapping Program	Multiple – *Bactrocera albistrigata, B. carambolae, B. caryae, B. correcta, B. curvipennis, B. dorsalis, B. facialis, B. kandiensis, B. kirki, B. melanotus, B. occipitalis, B. passiflorae, B. psidii, B. trilineola, B, trivialis, B. tryoni, B. umbrosa, B. xanthodes, B. zonata, Ceratitis capitata, C. rosa, Zeugodacus cucurbitae, Z. tau*	Various fruit fly hosts
Mediterranean fruit fly	Mediterranean fruit fly (*Ceratitis capitata*)	Horticultural crops
Queensland fruit fly	Queensland fruit fly (*Bactrocera tryoni*)	Horticultural crops
Within Tasmania		
Bee surveillance – endemic disease and pests	American foulbrood (*Paenibacillus* spp.), European foulbrood (*Melissococcus pluton*), chalkbrood (*Ascophera apis),* sacbrood (*Nosema apis, N. ceranae),* sacbrood virus (*Morator aetatulas*), greater wax moth *(Galleria mellonella)*, lesser wax moth (*G. achroia grisella)*, European wasps (*Vespula germanica*), *Braula coeca,* bumble bee *(Bombus terestris)*	European honey bees
Fruit fly trapping surveillance	*Bactrocera dorsalis, B. tryoni, Ceratitis capitata* and exotic fruit flies	Host fruit trees, fruit and vegetables
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Aethina tumida*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Brown marmorated stink bug (*Halyomorpha halys*), citrus canker (*Xanthomonas citri* subsp. *citri*), gypsy moths (including *Lymantria albescens, L. atameles, L. concolor, L. dispar asiatica, L. dispar dispar, L. dispar japonica, L. dissoluta, L. fumida, L. marginata, L. minomonis, L.*	Multiple

	monacha, L. postalba, L. pulverea, L. sinica, L. umbrosa, L. xylina), huanglongbing (*Candidatus* Liberibacter asiaticus), *Bactericera cockerelli*, *Diaphorina citri*, *Trioza erytreae*, *B. trigonica*, *Trioza apicallis*, Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*), *Bactrocera, Zeugodacus* and *Ceratitis spp.* (exotic fruit fly species)	
Within Victoria		
Alert contacts	All plant pests	All hosts, general surveillance
Exotic fruit flies – Sunraysia	Mediterranean fruit fly (*Ceratitis capitata*)	Various horticultural crops (citrus, stone fruit)
MyPestGuide e-surveillance	All plant pests	All hosts, general surveillance
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including citrus canker (*Xanthomonas axonopodis* pv. *citri*), exotic fruit flies (*Bactrocera* spp., *Ceratitis captitata*), Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*), plum pox virus, Asian gypsy moth (*Lymantria dispar* and other *Lymantria* spp.), brown marmorated stink bug (*Halyomorpha halys*), Asian citrus psyllid (*Diaphorina citri*), African citrus psyllid (*Trioza erytreae*) and spotted wing drosophila (*drosophila suzukii*)	Multiple
Passive MedFly Program	Mediteranean fruit fly (*Ceratitis capitata*)	Fruit trees in backyards
Urban Plant Health Network	Various, including brown marmorated stink bug (*Halyomorpha halys*), Asian citrus psyllid (*Diaphorina citri*), African citrus psyllid (*Trioza erytreae*), Asian honeybee, red imported fire ant (*Solenopsis invicta*), spotted wing drosphila (drosophila suzukii) and glassy winged sharpshooter (*Homalodisca vitripennis*)	Multiple plant hosts in periurban landscape, including community gardens
Within Western Australia		
Ant Blitz	Browsing ant (*Lepisiota frauenfeldi*), Red Imported Fire Ant (*Solenopsis invicta*), Small black sugar ant (*Lepisiota capensis*)	Urban areas
Biosecurity Blitz	All plant pests	General surveillance, all hosts
Medfly Area Freedom (Ord River Irrigation Area)	Mediterranean fruit fly (*Ceratitis capitata*)	Many horticultural hosts
MyPestGuide e-surveillance	All plant pests	All hosts, general surveillance
National Bee Pest Surveillance Program	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including Asian citrus psyllid (*Diaphorina citri*), citrus canker (*Xanthomonas axonopodis* pv. *citri*), citrus longicorn beetle (*Anoplophora chinensis*), glassy winged sharpshooter (*Homalodisca vitripennis*), xylella (*Xylella fastidiosa*), brown marmorated stink bug (*Halyomorpha halys*)	Pome and citrus crops
Port of Entry – Asian gypsy moth trapping	Asian gypsy moth (*Lymantria dispar*)	More than 600 forest, orchard, ornamental and native species
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

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 plant pests early and implementing eradication or management responses.

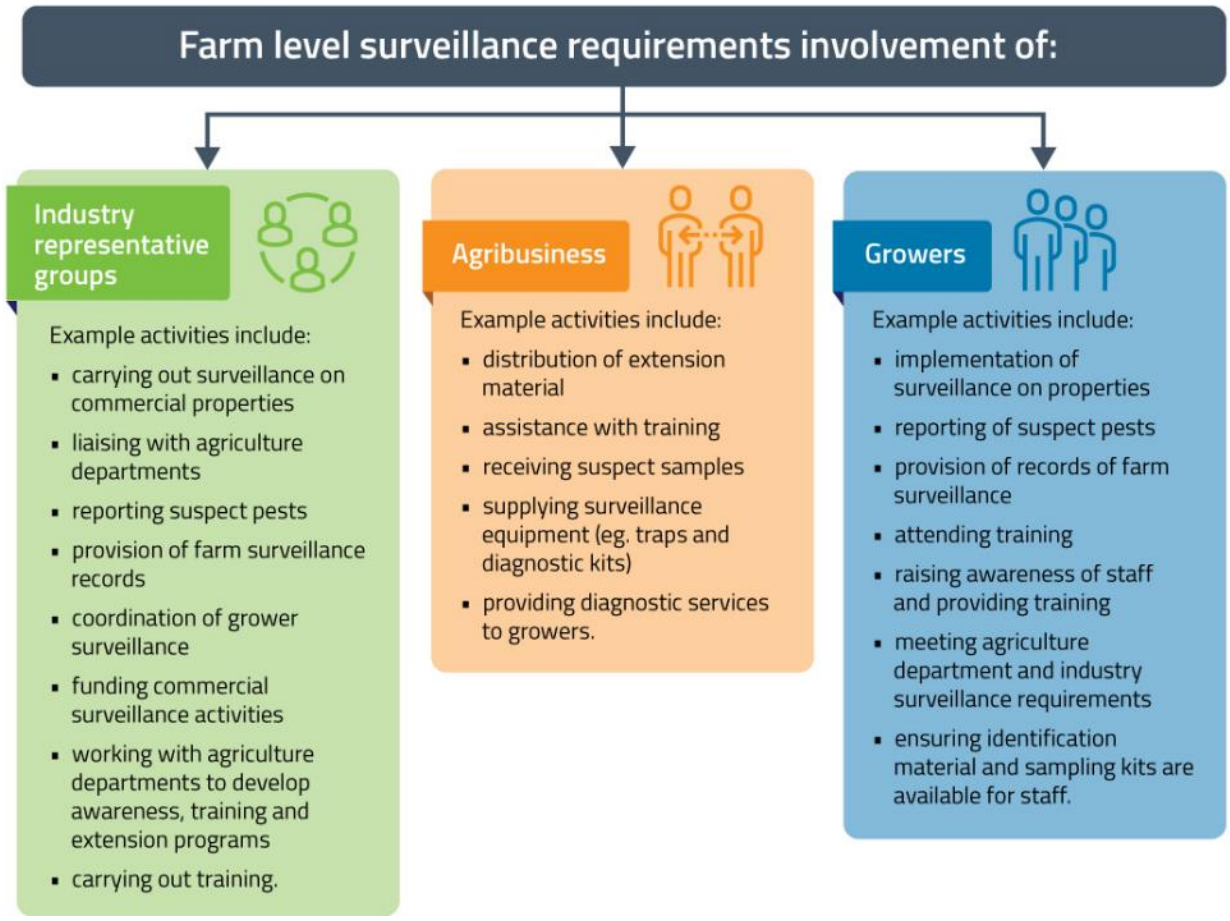

Figure 3. Examples of farm level surveillance activities.

Training

A key component of biosecurity preparedness is ensuring personnel engaged are 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 relevant governments and peak industry bodies who will be involved in responding to exotic plant pest incursions 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 Australian Lychee 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 pest threat-related documents

Table 1 have been identified as high priority plant pest threats to the Australian Lychee Industry by members of the Technical Expert Group. 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 contain information on high priority plant pests across most plant industries, including the lychee industry.

Table 10. Sources of information on high priority pest threats for the Lychee industry.

SOURCE	WEBSITE
CABI – Crop Protection Compendium	cabi.org/cpc/
DAF QLD Priority plant pests and diseases	https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease
Department of Agriculture, Water and the Environment	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 Passionfruit industry biosecurity (Table 11).

Table 11. Industry and government contact details.

AGENCY	WEBSITE/EMAIL	PHONE	ADDRESS
National			
Australian Lychee Growers Association (ALGA)	australianlychee.com.au algaeo@australianlychee.com.au	0417 639 927	PO Box 6120 Mooloolah Qld 4553
Department of Agriculture, Water and the Environment	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	41 George St Brisbane, QLD 4000
Northern Territory			
Department of Industry, Tourism and Trade	https://industry.nt.gov.au/	(08) 8999 5511	Berrimah Farm, Makagon Road Berrimah, NT 0828
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	sardi@sa.gov.au	(08) 8303 9400	2b Hartley Grove

Research and Development Institute			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	DPIRD, 1 Nash Street, Perth, Western Australia 6000 DPIRD, Locked Bag 4, Bentley Delivery Centre, WA 6983

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 lychee that are not currently known to be present in Australia.

Farm biosecurity measures can be used to minimise the impacts of both exotic and established plant pests The farm biosecurity and hygiene measures outlined in this section, can be considered as options for each farm's risk management. Many of these measures can be implemented in a range of different ways, so that the individual needs of any given farm can be addressed, and each farm can have an appropriate level of biosecurity.

Farm biosecurity measures, reporting procedures and hygiene strategies that reduce the impact of plant pest threats covered in this document are:

- selection and preparation of appropriate planting material,
- appropriate use of chemical and other plant pest control measures,
- control of vectors,
- control of alternative hosts,
- management of 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,
- managing the movement of people,
- how to safely visit other farms/orchards (including interstate and international trips) – what to watch out for when you return,
- including farm biosecurity in industry best management practice and quality assurance schemes, and
- an example farm biosecurity checklist.

Development of an specific farm biosecurity plan tailored to the needs of an individual business or farm is a good way to integrate best practice biosecurity into day-to-day operations (farmbiosecurity.com.au/planner/). Further information on farm biosecurity can be found at farmbiosecurity.com.au or by contacting ALGA (algaeo@australianlychee.com.au)

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 12. 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 12. 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 https://www.daf.qld.gov.au/contact/report-a-biosecurity-pest-or-disease
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 include timeframes for reporting and have implications for those who do not report. It is important that individuals know the obligations for their state or territory.

Some lychee 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 agriculture agency of the presence of those pests within a defined timeframe.

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. Over time, as more resources are produced for pests of the Australian Lychee 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 HPP (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 TST (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 4 for a list of current fact sheets available for lychee 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. 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 how to diagnose or identify a specific plant pest, or related group of pests. National Diagnostic Protocols (NDP) are nationally agreed diagnostic protocols for the unambiguous taxonomic identification of a pest in a manner consistent with ISPM No. 27 – Diagnostic Protocols for Regulated Pests. NDP include diagnostic procedures and data on the pest, its hosts, taxonomic information, and detection and identification.

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

Endorsed NDP 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 lychee pests 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. The Handbook is endorsed by the Subcommittee on Plant Health Diagnostics (SPHD).

Research Development and Extension

Research, Development and Extension – Linking Biosecurity Outcomes to Priorities

Through the biosecurity planning process, gaps in knowledge or the extension of knowledge will have been identified and 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 goals 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 places 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 Lychee industry

Export is a focus for the Lychee industry with approximately 25% of production exported. Lychees are exported to a range of countries including Hong Kong, Singapore, New Zealand, Canada and the USA. The industry has identified China, Taiwan, Thailand and Vietnam as important future export markets. The development of these markets may be hampered by the establishment of exotic pests in Australian production regions. Table 13 provides a summary of the distribution of high priority pests in relation to these markets.

Table 13. Current distribution of high priority pests in current export markets (Indonesia, New Zealand, USA) and potential export markets (China, Taiwan, Thailand and Vietnam).

SCIENTIFIC NAME	COMMON NAME	COUNTRIES WHERE PEST IS PRESENT
COLEOPTERA (Beetles and weevils)		
Anoplophora maculata	White spotted longicorn beetle	Taiwan
Anoplophora chinensis	Citrus longicorn beetle	China
Aristobia reticulator	Lychee longicorn beetle	China, Thailand, Vietnam
LEPIDOPTERA (Butterflies & moths)		
Conopomorpha sinensis	Lychee fruit borer	China, Taiwan, Thailand, Vietnam
Lymantria dispar	Asian gypsy moth	China, North America (under eradication)
Fungi		
Phytophthora litchii	Brown blight	China, Taiwan, Thailand, Vietnam

Implementation actions

To help maintain or facilitate market access, in the event of an incursion, the Australian Lychee Industry in partnership with the DAFF and the relevant state and territory governments should develop the following, for the HPP pests:

- Surveillance plans including a method for collecting and storing surveillance data,
- Diagnostic protocols that have been assessed in the Australian environment, and
- Biosecurity treatment measures if not already in place (e.g. irradiation or fumigation).

Implementation of these actions is recommended for pests with market access implications as this data is likely to be important 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 1. 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 incident response 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 the detection of an Emergency Plant Pest (EPP) within Australia.

The following section includes key contact details and communication procedures that should be used in the event of an exotic plant pest incursion affecting the Australian Lychee Industry. A list of pest-specific documents that may support incident response activities, are also provided. Over time, documents produced for plant pests relevant to the Australian Lychee Industry will be included in updated versions of this biosecurity plan 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 commonwealth, state and territory governments, 38 plant industries (including ALGA) and PHA (collectively known as the signatories), that facilitates the rapid and efficient responses EPP incursions. The EPPRD is a legally binding document that outlines the basic operating principles and guidelines for EPP eradication responses.

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 associated with eradication activities undertaken in response to the detection of EPP 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 suspected 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
- Mechanisms to support early detection and response to EPP.
- Rapid responses to EPPs (excluding weeds)
- A framework to ensure that 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.
- 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 representatives 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/).

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 EPP when it is technically feasible and cost beneficial to do so. The details of this investment are documented in response plans, including how the costs are shared; 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 shared costs of a response are divided between affected industries and governments in an equitable manner, directly related to the benefit obtained by each signatory 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. The categories indicate 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. These categories do not indicate the likelihood of EPP eradication or the overall importance of an EPP, 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 14. 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 EPP 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 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 for categorisation of a specified EPP, a group of independent scientific technical experts (known as the categorisation group) will be convened to assess all known information about the EPP and to identify the public and private benefits. Full details can be found in *Clauses 7 and 9 of the EPPRD* (planthealthaustralia.com.au/epprd*)*.

Lychee EPP categorised to date

EPPs relevant to the Lychee industry that are categorised and listed within Schedule 13 of the EPPRD.

Table 15. Formal categories for pests of the Lychee industry listed in Schedule 13 of the EPPRD (as of July 2021).

FORMAL CATEGORY	SCIENTIFIC NAME	COMMON NAME
2	*Bactrocera dorsalis* (syn. *B. invadens, B. papayae, B. philippiensis*)	Oriental fruit fly

How to respond to a suspect EPP

Following the detection of a suspect EPP, the relevant state or territory 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 formerly engaged in the response process. These are determined based on the known hosts of the EPP. All positive detections of EPP or suspect EPP must undergo secondary identification from an independent laboratory, usually from another state or territory. Confirmation of the identification should not delay the reporting of the EPP (or suspect EPP) to the ACPPO or the CCEPP.

Figure 4. Reporting of suspect EPPs and notification process.

Once a pest incursion is confirmed to be an EPP, and the formal notification processes are complete, all signatories affected by the EPP participate in the national management of the EPP. Formal activities undertaken by signatories to respond to an EPP incursion are documented in a Response Plan. This is primarily through the two national decision-making committees, both of which ALGA have a representative on:

- The Consultative Committee on Emergency Plant Pests (CCEPP) which provide scientific and technical expertise on the pest, mitigating measures and response activities, and
- The National Management Group (NMG) which acts on recommendations from the CCEPP and make the final decisions about EPP responses (such as approving formal response plans) and funding.

Technical and economic considerations are reviewed by the CCEPP, 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 to accept the presence of the pest and transition to long term management).

The relevant state/territory agriculture department is responsible for the on-ground activities stipulated by the Response Plan, 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, and
- control or containment measures.

Each response to an EPP is different 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 (ORC) 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 Australian Lychee Industry.

The value of ORC 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

ALGA is the peak industry body for the Australian Lychee Industry, i.e. signatory to the EPPRD, and will be the key industry contact point if an exotic plant pest affecting the lychee industry is detected and responded to using the arrangements in the EPPRD. ALGA will have responsibility for relevant industry communication and media relations (see PLANTPLAN for information on approved communications during an incursion). The representatives nominated for the CCEPP and the NMG by ALGA will be contacted (Table 16) regarding any meetings of the CCEPP or NMG. It is important that all Parties to the EPPRD ensure their representatives for these committees are nominated to PHA promptly, and that PHA is updated swiftly when personnel or their contact details change.

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

Table 16. Contact details for ALGA.

Website	australianlychee.com.au
Postal address	PO Box 6120 Mooloolah Qld 4553
Email	algaeo@australianlychee.com.au
Phone	0417 639 927

References

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

APPENDIX 1: PROFILE OF THE AUSTRALIAN LYCHEE INDUSTRY

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

The Australian Lychee Growers Association (ALGA) is the national peak body that represents the interests of over 250 growers and the industry (ALGA, 2024). To ensure a long-term sustainable future, ALGA has developed a strategic plan which involves working with non-government organisations, Australian commonwealth, state, territory and local governments, industry and consumers to monitor the agri-political, research and export market access issues faced by the Australian Lychee Industry (ALGA, 2024). ALGA is currently collaborating with the above-mentioned groups on several projects in the following areas (ALGA, 2024):

- Market Access
- Postharvest Research
- Improved Agronomy
- New Lychee Varieties and
- Promotions

ALGA are members of Plant Health Australia (PHA) and signatories to the Emergency Plant Pest Response Deed (EPPRD) (ALGA, 2018). Lychee growers pay a Research and Development levy set at 5.5 cents per kilogram and a marketing levy is set at 2.5 cents per kilogram (Department of Agriculture, Water and the Environment 2021. In 2019/20 the industry produced 2,434 tonnes of lychee fruit valued at AUD$31.9 M (Australian Horticulture Statistics Handbook (2019/20).

Lychees	Marketing	R&D	TOTAL
Fresh	2.5 cents per kilogram	5.5 cents per kilogram	**8 cents per kilogram**
Processing	-	1 cent per kilogram	**1 cent per kilogram**

Figure 5. Lychees levy and charge rates as of November 2024.[42]

Crop production profile

Lychee (*Litchi chinensis)* is a long-lasting evergreen tree belonging to the family Sapindaceae that comprises shrubs, climbers and trees (Coates et al., 2003). There are about 131 species that make up this family including longan and rambutan. *Litchi chinensis* can further be categorised into three subspecies namely subsp. *chinensis*, subsp. *philippinensis* and subsp. *javensis* based on the characteristics of the fruit, twig thickness, flower arrangement and stamen count (CABI, 2019)

Lychee trees can grow up to a height of 30 m. The fruit which develops from pollinated flowers is a sweet scented fleshy edible drupe that has a sweet and sour taste, covering a shiny brown seed, sheathed in a red leathery thick skin (AgriFutures Australia, 2019). The fruit can be either heart shaped, round or ovoid with a diameter of 3-3.5 cm (CABI, 2019). The flower panicles of a lychee tree emerge at the end of multiple branches (terminal inflorescence) over a span of four to six weeks from July to October (BeeAware, 2019) in Australia. Although only 200 flowers are pollinated of which just about five to 60 grow into mature fruit, a panicle can have around 3,000 flowers (BeeAware, 2019).

The lychee tree is known to have originated from Southern China, and has subsequently been spread to

[42] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/levies/rates/lychee

South Africa, South-east Asia, India, Madagascar, West Indies, France and England (CABI, 2019). The three subspecies are known to have come from different places which is how they have received their names. Subsp. *chinensis* is native to Northern Indo-China and is known to grow in the wild in the northern parts of Vietnam and Cambodia (CABI, 2019). Subsp. *philippinensis* is only known to grow in the Philippines in the wild with a wide distribution and subsp. *javensis* is cultivated in Southern Indo-China and West Java (CABI, 2019).

Lychees were introduced into Australia more than 150 years ago, with the first lychee trees being brought into northern Australia in the 1870s by Chinese immigrants. The oldest lychee orchard in Australia is near Cairns in tropical Queensland and is run by direct descendants of the first Chinese settlers in this region. Over this time the industry has developed from a "small exotic fruit" industry into a progressive and robust industry.

Industry Status

There are approx. 250 lychee orchards spread throughout growing regions along the east coast of Australia; businesses range in size from large, medium to small establishments.

Over the past 10 years a number of smaller orchards in North Queensland have been destroyed by cyclones and unpredictable weather events, this has not impacted on the overall annual tonnage as additional plantings were already underway with yields replacing any loses.

The main growing areas in Queensland are the Atherton Tablelands and Mareeba, coastal areas down to Rockhampton and Bundaberg, south to Nambour and the Sunshine Coast hinterland. New South Wales has a small number of growers with suitable growing regions extending south to Coffs Harbour.

Season

Depending on climatic conditions, the Australian lychee season commences in mid-October in Far North Queensland and ends in late March in Northern New South Wales. This gives the Australian industry a significant advantage over other suppliers on world markets as no other country can offer such a long line of supply of quality controlled fresh lychee product.

The majority of other lychee producing countries are in the Northern Hemisphere resulting in Australia's Southern Hemisphere lychee season being counter seasonal to these production areas.

Industry Value

There are 16 varieties of lychee grown commercially in Australia yielding an annual production of 3,215 tonnes with local value of production (LVP) of $47.8 million in 2022/23 (Australian Horticulture Statistics Handbook 2022/23).

Lychees are imported into Australia from China, Thailand and Vietnam counter seasonally to Australian production. These imports are seen as an advantage by the Australian Lychee Industry, as they increase consumer awareness and exposure to fresh lychee throughout the year.

However, the majority of lychee fruit currently imported from China and Thailand are of poor quality with a short shelf life, due to the use of cold treatment as the preferred market access protocol; each shipment takes between 14-21 days to reach Australia. Conversely, lychee fruit from Vietnam are irradiated, and then air freighted arriving much more quickly and in better condition.

Being a labour-intensive industry, lychee production currently provides thousands of full time and casual jobs, which greatly benefit regional and rural communities. This income and employment is critical to these communities due to the current long term decline or mechanisation of many other rural and regional industries.

Industry Structure

The Australian Lychee Growers Association (ALGA) is the national peak industry body representing the Australian Lychee Industry. ALGA has developed a strategic plan to ensure the sustainable growth of the industry.

Major Cultivars

There are more than 40 varieties of lychee grown in Australia. However, the industry is largely based on varieties including Kwai May Pink, Tai So, Fay Zee Siu, Souey Tung, Kaimana, Salathiel and Wai Chee.

Newer varieties now reaching marketable production size include Baitaying, Chompogo, Erdon Lee, Red Ball, Linsansue, and Sansuelin.

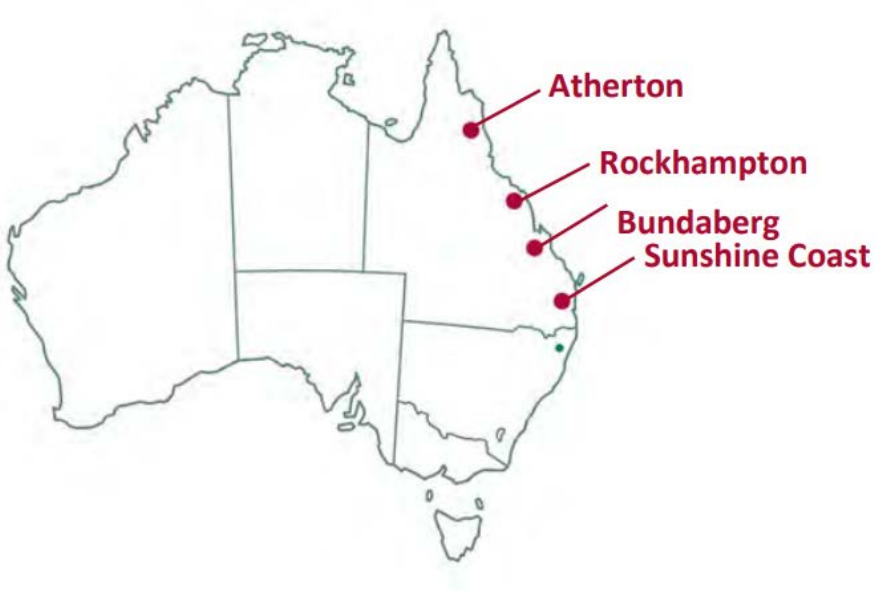

Figure 6. Major Lychee Production Areas in Australia (Hort Innovation, 2019).

The lychee industry of Australia has a supply window from mid-October until April, making it the longest supply window in the world (Hort Innovation, 2019). However, in recent years there has been a decline in grower numbers resulting in lower volumes production A challenge for industry is to grow production to service demand, especially if export demand continues to grow. Recognising the limitations involved with lychee production and working towards building effective models for increasing export is the way forward for the Australian lychee industry (Hort Innovation, 2019).

References

Hort Innovation (2024). *Australian Horticulture Statistics Handbook (AHSH) 2022/23*. Horticulture Innovation Australia Limited, Sydney NSW. Available online at: https://public.tableau.com/app/profile/flopenanalytics/viz/HortStatsOnlinev1_1FY23-HIADRAFTMain/MainPage

APPENDIX 2: THREAT SUMMARY TABLES

The information provided in the Threat Summary Tables is an overview of exotic plant pest threats to the Lychee industry. More than 115 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, 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 29. Additional information on several the pests listed in the TSTs can be found in Table 4.

Invertebrates

Table 17. Lychee invertebrate threat summary table.

SCIENTIFIC NAME	COMMON NAME	PRIMARY HOSTS	AFFECTED PLANT PART	MOVEMENT & DISPERSAL	GEOGRAPHIC RANGE	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Aristobia reticulator	Lychee longicorn beetle[44]	Lychee, guava, longan	Branches		China, India, Bangladesh, Laos, Myanmar, Nepal, Thailand, Vietnam	MEDIUM	HIGH	HIGH	HIGH	HIGH
Conopomorpha sinensis	Lychee fruit borer; Lychee stem-end borer	Lychee, longan, cocoa (*Theobroma cacao*), cola (*Cola acuminata*), rambutan (*Nephelium lappaceum*), Fijian longan (*Pometia pinnata*)	Trunk, branches, Fruit, leaf, shoot		Asia (Brunei Darussalam, China, India, Indonesia, Malaysia, Philippines, Sri Lanka, Taiwan, Thailand) Oceania (Papua New Guinea, Samoa)	MEDIUM	HIGH	HIGH	HIGH	HIGH
Cricula trifenestrata (Syn. *C. trifenestrata javana; C. trifenestrata kransi*)	Tea flush worm	Lychee, okra, cashew nut, groundnut, tea, cinnamon, citrus, mango, avocado, black pepper, common jujube, jujube	Leaves, whole plant		Asia (Bangladesh, Brunei Darussalam, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Pakistan, Philippines, Thailand, Vietnam)	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Eriophyes dimocarpi[45]	Longan and lychee witches' broom disease	Lychee, longan, rambutan	Inflorescence , leaves		Asia (Cambodia, Vietnam)	HIGH	HIGH	HIGH	HIGH	HIGH
Lymantria dispar (Syn. *Bombyx dispar; Hypogymna*	Asian gypsy	Polyphagous including *Acacia* (wattles), *Acer* (maples), *Alnus* (alders), *Betula*	Leaves, flowers		Asia (Afghanistan, Armenia, Azerbaijan, China, India, Iran, Iraq,	HIGH	HIGH	HIGH	HIGH	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] Agarwala, B. K., & Bhattacharjee, P. P. (2015). Redescription of *Aristobia reticulator* (F., 1781)(Coleoptera: Cerambycidae: Lamiinae), with a taxonomic note and record of a new food plant for adults in northeastern India. The Coleopterists Bulletin, 69(2), 205-212.
[45] https://www.pestnet.org/SummariesofMessages/Pests/PestsEntities/VirusesPhytoplasmas/Flowerfruitabortion,longan,Cambodia.aspx

dispar; Liparis dispar; Ocneria dispar; Phalaena dispar; Porthesia dispar; Porthetria dispar) [46]	moth	(birches), *Carpinus* (hornbeams), *Carya* (hickories), *Castanea* (chestnuts), *Cedrus* (cedars), *Eucalyptus, Fagus* (beeches), *Juglans* (walnuts), *Larix* (larches), *Liquidambar styraciflua* (Sweet gum), *Litchi chinensis* (lichi), *Lithocarpus edulis*, *Malus* (ornamental species apple), *Picea (spruces), Pinus* (pines), *Pistacia vera* (pistachio), *Populus* (poplars), *Prunus* (stone fruit), *Pyrus communis* (European pear), *Quercus* (oaks)			Israel, Japan, Kazakhstan, DPR Korea, Republic of Korea, Kyrgyzstan, Lebanon, Mongolia, Syria, Taiwan, Tajikistan, Turkey, Turkmenistan, Uzbekistan) Africa (Algeria, Morocco, Tunisia) North America (Canada, USA) Europe (Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Macedonia, Moldova, Netherlands, Poland, Portugal, Romania, Russian Freedom, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK, Ukraine, Yugoslavia (Serbia and Montenegro)					
Pseudotheraptus wayi	Coconut bug	Coconut, cashew, pecan, cinnamon, loquat, lychee, macadamia, mango, avocado, guava, cocoa	Fruit, flowers, young stem, leaves, inflorescences	Both nymphs and adults feed on the host plant, causing wilting and necrosis of young stems, leaves, inflorescences, and fruits as they suck sap and inject toxins into the host tissue.	Africa (Botswana, Cote d'Ivoire, Kenya, South Africa, Tanzania, Zambia)	MEDIUM	HIGH	HIGH	HIGH	HIGH
Selenaspidus articulatus [(Syn. *Aspidiotus* (Selanaspidus) *articulatus; Aspidiotus* (Selenaspidus) *articulatus v. simplex; Aspidiotus articulatus; Aspidiotus rufescens; Aspidiotus simplex; Pseudaonidia articulatus* (Morgan)*; Selenaspis articulatus* (Morgan)]	West Indian red scale	Lychee, cashew nut, cherimoya, soursop, jackfruit, bilimbi, carambola, sea poison tree, camel's foot, beauty-leaf, tea, citrus, coconut, croton, coffee, fig, forest trees (woody plants), round kumquat, cape jasmine, gliricidia, shrubby althaea, flame of woods, jasmine, lantana, mamey apple, mango, banana, plantain, European olive, passionfruit, avocado, date-palm, Mexican frangipani, roses, sugarcane, mahogany, Indian tamarind, grapevine	Fruit, leaves, stem, growing point	Infested plant material and windborne crawlers; Adults capable of flight.	Asia (Philippines, Sri Lanka, Taiwan), Africa (Angola, Benin, Cameroon, Côte d'Ivoire, Eritrea, Ethiopia, Ghana, Guinea, Kenya, Madagascar, Mali, Mauritius, Mozambique, Niger, Nigeria, Réunion, Sao Tome and Principe, Sierra Leone, Somalia, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe) North America (Bermuda, Mexico, USA) Central America and Caribbean (Antigua and Barbuda, Bahamas, Barbados, Belize, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica,	LOW	HIGH	HIGH	HIGH	HIGH

[46] Eradicated in New Zealand

					Martinique, Montserrat, Nicaragua, Panama, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago) South America (Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Venezuela) Oceania (Fiji, Solomon Islands)					
Anoplophora chinensis	Citrus longicorn beetle, Black and white citrus longhorn, citrus trunk borer	Polyphagous attacking living trees including *Citrus spp., Acacia spp*., apple, pear, willow, lychee, fig, poplar, maple, rose	Trunk		Asia (China, Indonesia, Japan, Democratic Republic of Korea, Republic of Korea, Malaysia, Myanmar, Philippines, Taiwan, Turkey, Vietnam), Europe (Croatia, Guernsey, Italy, Switzerland, UK)	MEDIUM	HIGH	HIGH	HIGH	HIGH
Bactrocera dorsalis (Syn. Bactrocera; Bactrocera invadens; Bactrocera papayae; Bactrocera philippinensis;	Oriental fruit fly, Philippine fruit fly, Invasive fruit fly, Asian Papaya fruit fly	Lychee, papaya, passionfruit, red fruit passion flower, giant granadilla, corkystem passionflower, red-bead tree, cashew nut, cherimoya, pond apple, soursop, bullock's heart, wild custard apple, sugar apple, black currant tree, coral berry, sugar palm, breadfruit, jackfruit, champedak, monkey jack, bilimbi, carambola, Akee apple, toddy palm, Alexandrian laurel, perfume tree, Indian caper, bell pepper, chilli, tummy wood, caranda, white sapote, evergreen chinkapin, Chittagong wood, citrus, watermelon, scarlet-fruited ivy gourd, coffee, melon, cucumber, giant pumpkin, marrow, Burma simpoh, longan tree, persimmon, loquat, weeping fig, Indian laurel tree, cluster tree, sacred fig tree, sycamore fig, governor's plum, rukam, round kumquat, oval kumquat, mangosteen, dragon fruit, wild mango, bottle gourd, langsat, Indian laurel, acerola, apple, mango, sapodilla, Spanish cherry, bitter gourd, black mulberry, banana, plantain, avocado, common bean, cutleaf groundcherry, black pepper, Fijian longan, trifoliate orange, canistel, apricot, sweet cherry, sour cherry, plum, peach, Japanese	Fruit	Infested plant material (including fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the soil[33]	Asia (Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Christmas Island (Indian Ocean), India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, United Arab Emirates, Vietnam) Africa, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Liberia, Madagascar, Mali, Mauritania, Mayotte, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe) North America (USA) Europe (Italy) Oceania (Federated states of Micronesia, French Polynesia, Northern Mariana Islands, Palau, Papua New Guinea)	HIGH	HIGH	HIGH	LOW	LOW

		plum, strawberry guava, guava, pomegranate, European pear, Oriental pear tree, mangrove, downy rose-myrtle, marula, grey bitter-apple, tomato, aubergine, watery rose-apple, clove, black plum, sea apple, rose apple, Malay apple, water apple, Singapore almond, cocoa, limeberry, christmas palm, shea tree, common jujube, jujube, pomelo, tropical almond, star fruit, sour orange, calamondin orange								
Ceratitis rosa	Natal fruit fly	Polyphagous including lychee, cashew, papaya, citrus, grape, soursop, sugar apple, carambola, chilli, coffee, pumpkin, longan tree, persimmon, loquat, mangosteen, apple, mango, blackberry, *Musa* spp., avocado, prickly pear, apricot, plum, peach, nectarine, guava, European pear, tomato, tobacco, cocoa, grapevine, common jujube	Fruit	Infested plant material, adults capable of flight. Larvae pupate in the soil	Africa (Ethiopia, Kenya, Lesotho, Malawi, Mozambique, South Africa, Swaziland, Tanzania, Zambia)	LOW	HIGH	MEDIUM	MEDIUM	LOW
Aleurocanthus woglumi	Citrus black fly	Polyphagous including citrus, avocado, cashew nut, jackfruit, papaya, coconut, coffee, lychee, mango, sapodilla, banana, passionfruit, quince, guava, frangipani, pomegranate, pears, roses, grapevine, ginger	Leaves, stems	Infested plant material and machinery, adults capable of flight. Natural movement, infested soil and plant material and vectors	Asia (Bangladesh, Bhutan, Cambodia, China, Christmas Island (Indian Ocean), India, Iran, Laos, Malaysia, Maldives, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, United Arab Emirates, Vietnam, Yemen), Africa (Kenya, Seychelles, South Africa, Swaziland, Tanzania, Uganda, Zimbabwe), North America (Bermuda, Mexico, USA), Central America and Caribbean (Antigua and Barbuda, Bahamas, Barbados, Belize, British Virgin Islands, Cayman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Guadeloupe, Guatemala, Haiti, Jamaica, Netherlands Antilles, Nicaragua, Panama, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Trinidad and Tobago), South America (Brazil, Ecuador, French Guiana, Guyana, Suriname, Venezuela),	MEDIUM	MEDIUM	LOW	LOW	NEGLIGIBLE

					Oceania (Papua New Guinea)					
Aonidomytilus albus	Tapioca scale	Papaya, mango, cassava, roses, sage, *Solanum* (nightshade)	Leaves, stems		Africa (Angola, Cabo Verde, Democratic Republic of the Congo, Côte d'Ivoire, Gambia, Ghana, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mauritius, Mozambique, Nigeria, Senegal, Somalia, Tanzania, Uganda, Zambia) Asia (Bahrain, China, Hong Kong, India, Indonesia, Malaysia, Sri Lanka, Taiwan, Thailand) North America (Antigua and Barbuda, Bahamas, Barbados, British Virgin Islands, Cuba, Dominica, Dominican Republic, Grenada, Guadeloupe, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, U.S. Virgin Islands, United States) South America (Argentina, Brazil, Colombia, French Guiana, Guyana, Peru, Suriname)	MEDIUM	HIGH	HIGH	LOW	LOW
Apoderus blandus	Red weevil[47]	Lychee	Young Leaves		Asia (India)	LOW	UNKNOWN	MEDIUM	LOW	LOW
Archips micaceana	Leaf rolling moth, Bell moth, Soybean leafroller	Polyphagous including eucalyptus, grapes, lychee, citrus, mango, soybean, tea, pineapple, strawberry and peanut/groundnut, breadfruit, coffee	Leaves, stems and fruit		Asia (Laos, Malaysia, Myanmar, Singapore, Thailand, Vietnam)	LOW	HIGH	HIGH	MEDIUM	LOW
Cryptophlebia peltastica[48]	No common name	Lychee, macadamia, sweet orange, jackbean, wonderbean, tamarind	Fruit		Africa (Madagascar, Mauritius, Seychelles, South Africa)	LOW	HIGH	HIGH	MEDIUM	LOW
Eumeta crameri (Syn. *Clania crameri; Cryptothelea crameri*)[49]	Faggot worm	Lychee, tea, coconut, Indian tamarind, cocoa, gliricidia	Leaf		Asia (India, Indonesia, Vietnam) Africa (Sierra Leone)	MEDIUM	HIGH	MEDIUM	MEDIUM	LOW
Gatesclarkeana erotias (Syn. *Argyroploce erotias* Meyrick)	No common name	Lychee, carambola, tea, mango, lantana	Leaves, stems		Asia (India, Sri Lanka, Timor, Thailand)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Gonimbrasia belina (Syn.	Mopane	Lychee, radiata pine	Leaves		Africa (Angola, Botswana, Cameroon,	LOW	UNKNOWN	UNKNOWN	MEDIUM	LOW

[47] Kumar, A. Kumar A., Nath, V. Kumar, R. New threats of insect pests and disease in litchi (Litchi chinensis Sonn.) in India. Acta Horticulturae 2014 No.1029 417-424. http://www.actahort.org/books/1029/1029_53.htm

[48] http://idtools.org/id/leps/tortai/Cryptophlebia_peltastica.htm

[49] Kumar, V., Kumar, A., Nath, V. and Kumar, R. (2014) Acta Horticulturae No.1029, 417-424

Acanthocampa belina; Imbrasia belina; Nudaurelia belina; Saturnia belina)	worms				Chad, DRCongo, Eritrea, Ethiopia, Kenya, Mozambique, Namibia, South Africa, Tanzania, Uganda, Zambia, Zimbabwe)					
Indarbela dea (Syn. *Arbela dea; Lepidarbela dea*)	Bark borer	Lychee, jackfruit, casuarina, longan, pineapple, leucaena, pomegranate	Trunk, branches		Asia (China, India, Vietnam)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Indarbela quadrinotata (Syn. *Arbela quadrinotata; Cossus abruptus; Lepidarbela quadrinotata; Squamura quadrinotata*)	Bark eating caterpillar	Lychee, wattles, cashew nut, tea, citrus, loquat, eucalyptus, common fig, rubber, mango, sapodilla, Spanish cherry, horse radish tree, mulberry, Indian gooseberry, poplars, apricot, guava, pomegranate, roses, teak, cocoa, jujube	Trunk, branches		Asia (Bangladesh, India, Myanmar, Pakistan, Sri Lanka)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Lymantria mathura[50]	Pink gypsy moth; rosy gypsy moth; Russian gypsy moth; sal defoliator	Polyphagous: Lychee, chestnut, mango, oaks, larches, poplars, pines, stone fruit, black plum, beech	Leaves, flowers		Asia (Bangladesh, China, India, Japan, DPR Korea, Republic of Korea, Nepal, Taiwan) Europe (Russian Federation)	HIGH	MEDIUM	MEDIUM	MEDIUM	LOW
Planococcus litchi	Mealybug	Lychee, longan, rambutan, loquat, sugar apple	Fruit, leaves, branches		Asia (Brunei, China, Hong Kong, Japan, Philippines, Singapore, Thailand, Vietnam)	MEDIUM	HIGH	HIGH	LOW	LOW
Pseudococcus comstocki	Comstock mealybug	Polyphagous (over 35 hosts) including lychee, longan, citrus, coffee, apple, pear, banana, stone fruit, common fig, mulberry tree, pomegranate	Whole plant, leaves, stems, fruit		Asia (Armenia, Azerbaijan, Cambodia, China, Republic of Georgia, Japan, Kazakhstan, Korea, DPR, Korea, Republic of, Kyrgyzstan, Sri Lanka, Syria, Taiwan, Tajikistan, Thailand, Turkmenistan, Uzbekistan, Vietnam) Africa (Saint Helena) North America (Canada, Mexico, USA) South America, Argentina, Brazil) Europe (Croatia, France, Russian Federation, Ukraine)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Tessaratoma quadrata	Stink bug	Lychee, longan, apple, pear	Fruit, flowers		Asia (China, India, Indochina, Nepal, Vietnam)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Xylosandrus compactus[51]	Black twig borer, Shot-hole borer	Wide host range including coffee, tea, avocado, macadamia, lychee, eucalypts, soursop, sugar apple, chestnuts, Spanish cedar, cinnamon, mango, chinaberry, pines, pomegranate, cocoa.	Branches		Asia (Cambodia, China, East Timor, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam) Africa (Benin, Cameroon, Central	MEDIUM	MEDIUM	HIGH	MEDIUM	LOW

[50] Intercepted only in USA, Widespread in Bangladesh, China and India
[51] Restricted distribution in East Timor and USA

					African Republic, Comoros, Congo, Congo Democratic Republic, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Mauritania, Mauritius, Nigeria, Réunion, Senegal, Seychelles, Sierra Leone, South Africa, Tanzania, Togo, Uganda, Zimbabwe) North America (USA) Central America and Caribbean (British Virgin Islands, Cuba, Curaçao, Netherlands Antilles, Puerto Rico, US Virgin Islands) South America (Brazil, Peru) Europe (Italy) Oceania (American Samoa, Fiji, Papua New Guinea, Samoa, Solomon Islands)					
Cryptophlebia illepida (Syn. *Argyroploce illepida* (Butler)*; Argyroploce vulpes; Cryptophlebia illepida illepida* (Butler)*; Cryptophlebia illepida* var. fulva*; Cryptophlebia illepida* var. suffusa*; Cryptophlebia tetrao; Cryptophlebia vulpes; Olethreutes illepida; Teras illepida*)	Koa seedworm	Lychee, koa (*Acacia koa*), macadamia, mango, Bauhinia (camel's foot), leucaena, *Phaseolus* (beans)	Fruit Nut (Macadamia)		North America (Hawaii)	LOW	HIGH	HIGH	MEDIUM	LOW
Potosia brevitarsis (Syn. *Ceotocia brevitarsis* Lewis*; Neotocia brevitarsis* (Lewis)*; Liocola brevitarsis* (Lewis)*; Potosia brevitarsis* (Lewis)*; Protaetia (Calopotosia) brevitarsis* (Lewis)	White spotted flower chafer; Flower beetle	Polyphagous including lychee, grape, corn, sunflower, peach	Flowers, fruit		Asia (China, Republic of Korea) Europe	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Chondracris rosea	Citrus locust	Polyphagous including citrus, rice, soyabean, sweet potato, lychee, tea, rambutan, cotton, groundnut, hemp, coconut, durian, *Musa* spp., guava, castor bean, sugarcane, teak, cocoa, maize	Leaves, stems and growing tips		Asia (China, Indonesia, Japan, Republic of Korea, Laos, Malaysia, Pakistan, Philippines, Taiwan, Thailand, Vietnam)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Myllocerus undecimpustulatus	Sri Lankan weevil	Golden apple, groundnut, pigeon pea, mulberry, sorghum, black plum, mung bean, jujube, sugarcane, mango, pomegranate, citrus, peach, lychee, eggplant	Leaf		Asia (India, Indonesia, Pakistan), USA (Florida)	UNKNOWN	MEDIUM	HIGH	MEDIUM	UNKNOWN

Ceroplastes pseudoceriferus (Valid name: Ceroplastes ceriferus[52]	Horned wax scale	Malabar ebony, lychee, mango	Leaves, flowers		Asia (China, Republic of Korea)	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Gymnandrosoma aurantianum (Syn. *Ecdytolopha aurantium* (Lima); *Ecdytolopha torticornis*)	No common name	Lychee, citrus, macadamia, plantain, cocoa	Fruit		Central America and Caribbean (Costa Rica, Trinidad and Tobago)South America (Argentina, Brazil)	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Odontotermes formosanus (Syn. *Coptotermes formosanus*)	Formosan subterranean ant	Lychee, tea, coffee, sugarcane, red maple, Atlantic white cedar, citrus, eucalyptus, pines, bald cypress	Roots, stems	Infested soil, machinery and plant material. Natural dispersal distance by annual flight is approx. 1 km per decade	Asia (China, Japan, Taiwan) Africa (South Africa) North America (USA) Central America and Caribbean (United States Virgin Islands) Oceania (Marshall Islands, US Minor Outlying Islands)	HIGH	HIGH	HIGH	MEDIUM	MEDIUM
Paradasynus longirostris	Hong Kong stink bug	Lychee, longan	Fruit, leaves		Asia (China, Thailand)	LOW	HIGH	HIGH	HIGH	MEDIUM
Parlatoria cinerea	Apple parlatoria	Polyphagous including lychee, *Annona muricata*, bougainvillea, *Citrus spp*., Cupressus, Gardenia, Jasminum, *Malus sylvestris*, *Mangifera indica,* Rosa, Viburnum and *Vitis vinifera*	Branches, stems, flowers, fruit, and post-harvest stages and rarely on roots of citrus		Asia (Israel) South America (Argentina, Brazil)	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Planococcus spp. (including P. angkorensis, P. halli, P. kraunhiae)	Japanese mealybug	Citrus, coffee, sugarcane, *Dioscorea spp.,* fig, lychee, guava, pomegranate, jam, persimmon, citrus, pear, fig, olive, grape, yam, rose apple	Twigs, leaves, stems, roots	Infested plant material and machinery	North America (Caribbean) South America (Brazil, Colombia)	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Tessaratoma papillosa	Lychee stink bug	Lychee, longan, citrus, plum, peach, pear, olive, banana	Above ground plant parts: Fruit, flowers, stems	Infested plant material and machinery, adults capable of flight.	Asia (China, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam) Middle East	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Oligonychus litchi	Spider mite	Polyphagous including lychee, mango, grape, peach, apple, avocado, persimmon, pear and a range of ornamentals	Leaves		China, Taiwan	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Oligonychus thelytokus	Spider mite	Polyphagous including lychee, mango, cotton, rose, azalea, coffee, avocado, citrus, cassava, cotton, pepper,	Leaves	Infested plant material, machinery and	Africa (South of Sahara, Comoros, East Africa, Madagascar, Seychelles,	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM

[52] *(Scalenet -http://scalenet.info/catalogue/Ceroplastes%20ceriferus/)*

		strawberry and a range of ornamentals (e.g., azalea and roses)		wind dispersal	Reunion, Ivory Coast, Congo) Oceania (New Caledonia, French Polynesia, Papua New Guinea, Indonesia), Japan					
Tetranychus mexicanus	Spider mite	Polyphagous including papaya, cotton, lychee, passionfruit, Spanish cedar, citrus, cocoa, pecan, coconut, avocado, banana, peanut, guava, sugar cane, strawberry, pear, apple, peach, star fruit, bean, cassava; wide range of ornamental plants	Leaves		Central America and Caribbean (Barbados, Costa Rica, Cuba, Nicaragua, El Salvador, Honduras, Guadeloupe, Martinique) South America (Brazil, Suriname, Argentina, Columbia, Paraguay, Peru, Uruguay, Venezuela)	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Oligonychus (Tetranychus) bicolor	Spider mite; avocado red mite	Polyphagous including lychee, grape, oak, chestnut, hickory, maple, spruce, birch, papaya, mango, coffee, castor bean, *Eucalyptus* spp.	Leaves, foliage	Infested plant material and soil	Asia (Iran, Taiwan)North America (Canada, United States)Central America and Caribbean (Costa Rica, Cuba)	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Oligonychus yothersi (Syn. *Tetranychus yothersi*)	Spider mite; avocado red mite	Polyphagous including lychee, papaya, mango, coffee, avocado, banana, cassava, pomegranate, grape, castor bean, *Eucalyptus grandis* and *Eucalyptus urophylla,* other *Eucalyptus* spp., *Grevillea* sp., *Camellia sinensis;* also, a range of ornamental plants	Leaves Foliage	Infested plant material and soil	Asia (Iran) North America (USA [Hawaii]), , Central America and Caribbean (Costa Rica, Cuba, Nicaragua), South America (Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru), China	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Adoretus versutus	Rose beetle	Polyphagous including lychee, Acacia, cashew nut, groundnut, camel's foot, bougainvillea, papaya, *Citrus* spp., coffee, taro, yam, fig, sweetpotato, apple, plantain, banana, avocado, beans, longan, plum, guava, pear, radish, roses, sugarcane, aubergine, sorghum, Malay apple, Singapore almond, cocoa, cowpea, cowpea, grape, ginger, Eucalyptus	Leaves Foliage (adults), roots (larvae) for cut flowers inflorescence	Infested plant material and machinery, adults capable of flight, eggs and larvae are soilborne	Asia (Bangladesh, British Indian Ocean Territory, India, Indonesia, Malaysia, Pakistan, Sri Lanka), Africa (Madagascar, Mauritius, Réunion, Saint Helena, Seychelles) Oceania (American Samoa, Cook Islands, Fiji, Samoa, Tonga, Vanuatu, Wallis and Futuna Islands)	MEDIUM	MEDIUM	MEDIUM	HIGH	MEDIUM
Aulacaspis longanae	Longan diaspidid scale[53]	Longan, lychee	Leaves		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
Biston (= *Buzura*) *suppressaria*	Tea looper	Polyphagous including lychee, tea, mango, guava, wattles, chrysanthemum, eucalyptus, plum	Leaves		Asia (China, India, Indonesia, Sri Lanka)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Cossus cossus	Carpenter moth, goat moth	Sweet cherry, lychee, citrus, apple, olive, peach, pear, plum, quince, artichoke, walnut, grapevine, chestnut, ash, oak, poplar, willow, maples, beetroot, birches	Trunk, branches, stems	Adults capable of flight	Asia (Armenia, Cambodia, China, Georgia (Republic of), India, Tajikistan, Turkey, Turkmenistan, Uzbekistan) Africa (North Africa) Europe (Belgium, Bulgaria, Finland,	LOW	LOW	LOW	LOW	NEGLIGIBLE

[53] Chen, F. G., Wu, Z. Q., & Su, D. K. (1980). New coccids of the genus Aulacaspis in China. Acta Zootaxonomica Sinica, 5(3), 289-296.

					France, Hungary, Ireland, Italy, Netherlands, Poland, Russian Federation, United Kingdom)					
Cossus spp.	Carpenter moths	Polyphagous including lychee, longan, maples, beetroot, birches, chestnuts, walnut, apple, olive, American plum, sweet cherry, plum, peach, Japanese plum, European pear, common oak, willows, limes, grape	Trucks, branches		Asia (Armenia, Cambodia, China, Georgia (Republic of), India, Tajikistan, Turkey, Turkmenistan, Uzbekistan), Africa (North Africa), Europe (Belgium, Bulgaria, Finland, France, Hungary, Ireland, Italy, Netherlands, Poland, Russian Federation, UK)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Dudusa synopla [54]	Leaf-eating caterpillar	Lychee, rambutan, lac tree	Leaves		Asia (Thailand, India)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Ernothrips lobatus [55]	Thrips	Lychee, longan	Leaves, shoots		Asia (China, Indonesia, Thailand, Japan, Taiwan, Malaysia)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Homona coffearia Nietner (Syn. *Capua coffearia; Godana simulana; Homona fasciculana; Homona fimbriana; Homona menciana; Homona socialis; Tortrix coffearia)* [56]	Leaf roller (Syn. Tea tortrix; tea flushworm ; tea tortricid)	Lychee, Acacia, groundnut, jackfruit, carambola, cabbage, tea, Siam weed, chrysanthemum, camphor laurel, cinnamon, citrus, coffee, crotalaria, quince, jewelvine, December tree, eucalyptus, batai wood, strawberry, soyabean, silky oak, rosemallows, indigo, apple, mango, rambutan, tobacco, pelargoniums, Fijian longan, guava, hoary-pea, cocoa, cowpea	Leaves		Asia (Bangladesh, China, India, Indonesia, Japan, Laos, Malaysia, Philippines, Sri Lanka, Taiwan, Vietnam) Oceania (Australia, Papua New Guinea, Solomon Islands)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Homona difficilis	Leaf roller	Lychee, longan, rambutan	Leaves		Asia (Vietnam, Borneo, Thailand)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Maladera castanea	Asiatic garden beetle	Polyphagous including lychee, longan, sweetpotato, turfgrasses	Leaves, flowers, fruit		Asia (Republic of Korea)	LOW	LOW	MEDIUM	LOW	NEGLIGIBLE
Miresa albipuncta	Leaf-eating caterpillar (Syn. Slug caterpillar)	Lychee, longan, rambutan, cacao, Indian jujube	Leaves, trunks		Asia (India)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Perixera illepidaria (Syn: Anisodes illepidaria)	Leaf-eating caterpillar	Lychee, mango	Leaves		Asia (India)	LOW	LOW	LOW	LOW	NEGLIGIBLE

[54] http://www.mothsofborneo.com/part-4/dudusa/notodontidae_2_2.php
https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/ba/memos/2004/plant/ll_finalb.pdf

[55] Bagnall, R. S. (1926). XII.—Brief descriptions of new Thysanoptera.—XV. Annals and magazine of natural history, 18(103), 98-114.
Bhatti, J. S. (1967). Thysanoptera nova Indica. Published by the author. Delhi, 1-24.
Mound, L. A. (1968). A review of RS Bagnall's Thysanoptera collections. Bulletin of the British Museum (Natural History)(Entomology), 11, 1-181.

[56] H. coffearia does not occur in Australia and Australian records under this name should be referred to as H. spargotis (Whittle et al., 1987). Whittle, C. P., Bellas, T. E., Horak, M., & Pinese, B. (1987). The sex pheromone and taxonomic status of Homona spargotis Meyrick sp. rev., an Australian pest species of the coffearia group (Lepidoptera: Tortricidae: Torticinae). Australian Journal of Entomology, 26(2), 169-179.

Proctophana tomentosa	No common name	Lychee	Leaves		Brazil	LOW	LOW	LOW	LOW	NEGLIGIBLE
Spodoptera eridania	Southern armyworm	Okra, onion, Welsh onion, garlic, red ginger, celery, peanut, asparagus, beetroot, *Brassica napus* var. oleifera, black mustard, cabbages, cauliflowers, collards, cruciferous crops, bell pepper, papaya, quinoa, chickpea, watermelon, Citrus, lemon, navel orange, coffee, coriander, melon, cucumber, pumpkin, carrot, carnation, yam, Eucalyptus, soyabean, cotton, sunflower, kenaf, China-rose, sweetpotato, lettuce, lavender, leucaena, flax, apple, cassava, lucerne, mints, Peppermint, Spear mint, banana, watercress, oleander, tobacco, rice, passionfruit, elephant grass, avocado, beans, lima bean, common bean, pea, Poaceae (grasses), guava, European pear, rhubarb, castor bean, roses, raspberry, willows, Brazilian pepper tree, tomato, eggplant, potato, spinach, dandelion, clovers, blueberry, cranberry, faba bean, cowpea, grapevine, cocoyam, maize	Fruits, leaves		Africa (Benin, Cameroon, Gabon, Nigeria) Europe (Denmark, Netherlands, Slovenia) North America (Antigua and Barbuda, Bahamas, Barbados, Bermuda, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, United States) South America (Argentina, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Statherotis discana (*Syn. Olethreutes discana, Statherotis leucaspis, Platypeplus leucaspsis Meyr.*)	Lychee leaf roller	Lychee, longan, rambutan, carambola	Leaves		Asia (China, India, Indonesia, Japan, Laos, Malaysia, Philippines, Taiwan, Thailand, Vietnam)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Tessaratoma javanica	Longan stink bug	Lychee, longan tree, honey tree	Fruit, flowers		Asia (India, Indonesia, Philippines, Thailand, Vietnam)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Thaumatotibia leucotreta (Syn. *Cryptophlebia roerigii; Cryptophlebia leucotreta; Olethreutes leucotreta; Thaumatotibia roerigii*) [57]	False codling moth	Polyphagous including lychee, pineapple, carambola, cotton, *Citrus* spp., capsicum, cotton, mango, avocado, peach, maize, soursop, guava, lima bean, common bean, sorghum, cowpea, olive, *Prunus* spp., cherry, macadamia, castor bean, pomegranate, Australian brush-cherry, water apple, tomato (secondary host)	Leaves, fruit, seed	Infested plant material and soil. Adults capable of flight.	Asia (Israel), Africa (Angola, Benin, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Congo Democratic Republic, Côte d'Ivoire, Eritrea, Ethiopia, Gambia, Ghana, Kenya[14], Madagascar, Malawi, Mali, Mauritius, Mozambique, Niger, Nigeria, Réunion, Rwanda, Saint Helena, Senegal, Sierra Leone, Somalia, South Africa, Sudan,	LOW	LOW	HIGH	MEDIUM	VERY LOW

[57] Intercepted only in Denmark, Finland, Italy, Spain, Sweden and UK. Eradicated from Netherlands

					Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe), Europe (Denmark, Finland, Germany, Italy, Netherlands, Spain, Sweden, UK)					
Thysanofiorinia leei	Scale	Lychee, rambutan	Leaves, stems		Hawaiian Islands, Hong Kong, India, Taiwan, USA	LOW	LOW	LOW	LOW	NEGLIGIBLE
Disella litchii[58]	Mite	Lychee	Leaves		Asia (China)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Popillia mutans	Scarab beetle	Lychee, longan, pineapple	Leaves, flowers, fruit, roots (pineapple)	Infested soil and plant material. Adults are capable of flight	Asia	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Cnesteboda celligera[59]	Leaf roller	Lychee, mango, rambutan, lac tree	Leaf		Asia (Taiwan, Hong Kong, Sri Lanka)	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Cratopus humeralis[60]	No common name	Citrus, lychee	Leaves, flowers, fruit, roots		Island of Reunion	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Dolichothrips indicus[61]	No common name	Lychee	Flowers		Asia (India)	MEDIUM	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Eccopsis praecedens (Syn. Olethreutes praecedens)[62]	Leaf roller	Lychee	Leaves, flowers, fruit		Asia (China, India)	LOW	LOW	UNKNOWN	LOW	UNKNOWN
Indarbela tetraonis (Syn. *Arbela tetraonis*)	Bark borer	Lychee, cashew nut, citrus, jackfruit, guava	Trunk, branches		Asia (Bangladesh, India)	LOW	UNKNOWN	UNKNOWN	LOW-MEDIUM	UNKNOWN
Rapala varuna orseis	Indigo flash	Lychee, rambutan, red ash, loquats	Flowers, leaves		Asia (Bangladesh)	LOW	LOW	LOW	UNKNOWN	UNKNOWN
Statherotis leucaspis (Syn: Olethreutes leucaspis)	Litchi Leaf roller	Lychee, longan	Leaves		Asia (China, India)	LOW	UNKNOWN	UNKNOWN	LOW - MEDIUM	UNKNOWN
Zeuzera coffeae (Syn. *Zeuzera roricyanea*) & *Z. reticulata*[63]	Coffee carpenter	Polyphagous including lychee, longan, grape, walnut, tea, coffee, cotton, apple, cassava, avocado, citrus, okra, breadfruit trees, hickories, cinnamon, leucaena, teak, mahogany, grapevine,	Stems, branches		Asia (Bangladesh, China, India, Indonesia, Malaysia, Myanmar, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam) Oceania (Papua New Guinea)	LOW	UNKNOWN	UNKNOWN	LOW (	UNKNOWN

[58] https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/ba/memos/2004/plant/ll_finalb.pdf
Zhang, Z. Q., Hong, X. Y., Fan, Q. H., & Xin, J. (2010). Xin Jie-Liu Centenary: Progress in Chinese Acarology. Magnolia Press.

[59] https://www.gbif.org/species/1743998

[60] Waite, G. K., & Hwang, J. S. (2002). Pests of litchi and longan. Tropical fruit pests and pollinators: biology economic importance, natural enemies and control. Wallingford: CABI, 331-359.
Quilici, S., & Langlois, A. (1993). Bioecological survey of weevils damaging fruit crops in Reunion Island. IOBC/WPRS Bulletin, 16(7), 30-40.

[61] Menzel, C. M., & Waite, G. K. (2005). Litchi and longan: botany, production and uses. Cabi Publishing.

[62] Peña, J. E., Sharp, J. L., & Wysoki, M. (Eds.). (2002). Tropical fruit pests and pollinators: biology, economic importance, natural enemies, and control. CABI.

[63] This pest could be a threat, but only if infested plant material is brought into the country. As Australia does not import coffee plants the threat should be minimal.
Can cause significant damage to coffee. Control measures are limited from overseas experience. Chemicals used previously are no longer available in Australia. Biologicals are yet to be fully proven effective. Larvae tunnel through coffee branches, nominally in the upper part of the trees. Branches and the top part of the main stem easily break off, but the tree usually survives (Winston et al., 2005 and Kuit et al., 2004).

		cocoa								
Comoritis albicapilla (Syn. *Comocritus albicapilla*) [64]	No common name	Lychee	Trunk		Asia (China)	LOW	LOW	LOW	LOW - MEDIUM	NEGLIGIBLE
Adoretus sinicus	Chinese rose beetle	Polyphagous including *Acalypha* (Copperleaf), *Alocasia*, *Cajanus cajan* (pigeon pea), Canna, *Glycine max* (soyabean), *Hibiscus tiliaceus* (coast cottonwood), lychee, *Rosa* (roses), *Theobroma cacao* (cocoa), *Vitis vinifera* (grapevine)	Leaves	Infested plant material and machinery, adults capable of flight, eggs are soilborne	Asia (China, India, Indonesia, Republic of Korea, Malaysia, Singapore, Taiwan, Thailand, Vietnam) North America (USA) Oceania (Federated states of Micronesia, Hawaii, Guam, Northern Mariana Islands, Palau)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Gymnoscelis imparatalis	Leaf-eating caterpillar	Lychee, longan, cinnamon, shaddock, mango, rambutan, pinwheel flower	Leaves, flowers		Asia (Thailand)	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Pingasa ruginaria	Flower eating caterpillar	Lychee, longan, cashew, cinnamon	Leaves, flowers		Asia (Malaya)	LOW	LOW	LOW	UNKNOWN	UNKNOWN
Remelana jangala [65]	Chocolate royal	Coffee, lychee, durian, *Cleistocalyx operculata* and *Kandelia candel* [66],	Fruit	Infested plant material. Adults are capable of flight	Asia (Hong Kong, Indonesia, Malaysia, India, Thailand, Malaysia, Philippines, Singapore, China, Bhutan)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Sphecosesia litchivora	No common name	Lychee, longan	Leaves		Asia (China)	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Attacus atlas	Atlas moth	Lychee, papaya, mango, avocado, guava, water apple, citrus, soursop, sugar apple, jackfruit, tea, camphor, cinnamon, coffee, turmeric, cardamon, pepper, castor bean, big leaved mahogany, cocoa, carambola, cinchona	Leaves	Flight, machinery and infested plant material.	Asia (Bangladesh, Brunei Darussalam, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Philippines, Singapore, Taiwan, Thailand, Vietnam)	MEDIUM	HIGH	HIGH	UNKNOWN	UNKNOWN
Adoretus compressus	Rose beetle	Polyphagous including oil palm, sugarcane, sorghum, cocoa, maize, rice, banana, lychee, okra, rambutan, cotton, sweetpotato, coffee, tea, rose, grape	Leaves	Infested plant material, contaminated soil and tools/machinery and hitchhiking. Adults capable of flight. Eggs are soilborne.	Asia (Malaysia, India, Indonesia, Singapore, Sri Lanka, Thailand, Vietnam, Brunei) Africa (Mauritius, South Africa) Oceania (Hawaii, Papua New Guinea)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Parasa lepida (Syn. *Latoia lepida; Limacodes graciosa;*	Nettle caterpillar,	Polyphagous including tea, citrus, coconut, lychee, mango, cassava,	Leaves, fruit	Infested plant material and	Asia (Bangladesh, Cambodia, China, India, Indonesia, Japan, Laos,	MEDIUM	HIGH	HIGH	UNKNOWN	UNKNOWN

[64] Waite, G. K., & Hwang, J. S. (2002). Pests of litchi and longan. Tropical fruit pests and pollinators: biology economic importance, natural enemies and control. Wallingford: CABI, 331-359.

[65] https://www.gbif.org/species/1924458/metrics There are many subspecies with varying distributions in India. Candidate for natural dispersal from the North.

[66] larvae are also found feeding on flower buds of *Eurya jarponica*

Neaera media; Noctua lepida; Nyssia latitascia; Parasa lepida lepidula)	blue striped nettle bug	banana, poplar, winged bean, cocoa, coffee, capsicum, rubber, pineapple, gardenia, *Eugenia* spp., palm, *Cassia* spp., citrus, *Gliricidia* spp., *Nephelium* spp., *Rosa* spp., rice, cocoa, pea, cotton		machinery, adults capable of flight.	Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam)					
Adoxophyes cyrtosema	Citrus brown banded tortrix	Polyphagous including lychee, citrus, *Dimocarpus* longan, groundnut, *Juglans*, *Clerodendrum, Morus alba*, tea	Leaves	Plant material, adults are capable of flight	Asia (China), Oceania (Tonga, New Hebrides, New Guinea)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Carpophilus obsoletus	Corn sap beetle	Lychee, onion, date-palm, dried stored products, cocoa, maize	Post-harvest		Asia (Indonesia, Malaysia) North America (USA) Central America and Caribbean (Saint Lucia, Trinidad and Tobago)	HIGH	MEDIUM	MEDIUM	LOW	VERY LOW
Cratopus angustatus (Syn. *Cratopus bunnipes*)[67]	No common name	Citrus, lychee	Leaves, flowers, fruit, roots		Island of Reunion	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Crocidosema litchivora	Litchi moth	Lychee	Flowers		North America (United States)	LOW	LOW	LOW	MEDIUM	VERY LOW
Hypomeces pulviger	Green weevil, Gold dust weevil	Polyphagous including *Acacia auriculiformis* (northern black wattle), *Acacia mangium* (brown salwood), *Artocarpus heterophyllus* (jackfruit), *Azadirachta excelsa, Azadirachta indica* (neem tree), *Bauhinia* (camel's foot), *Bombax ceiba* (silk cotton tree), *Cassia fistula* (Indian laburnum), *Casuarina equisetifolia* (casuarina), *Ceiba pentandra* (kapok), *Citrus, Corymbia torelliana* (cadaga), *Eucalyptus camaldulensis* (red gum), *Eucalyptus grandis* (saligna gum), *Eugenia, Falcataria moluccana* (batai wood), *Flindersia brayleana, Gossypium* (cotton), *Helianthus annuus* (sunflower), *Hevea brasiliensis* (rubber), *Hibiscus* (rosemallows), *Ipomoea batatas* (sweet potato), *Ipomoea purpurea* (tall morning glory), *Lagerstroemia speciosa* (Pride of India), Litchi chinensis (lychee), *Mangifera indica* (mango), *Manilkara zapota* (sapodilla), *Morus alba* (mora), *Neolamarckia cadamba* (common bur-flower tree), *Neolamarckia cadamba*	Above ground		Asia (Brunei Darussalam, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Pakistan, Philippines, Singapore, Taiwan, Thailand, Vietnam), Timor Leste	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW

[67] Waite, G. K., & Hwang, J. S. (2002). Pests of litchi and longan. Tropical fruit pests and pollinators: biology economic importance, natural enemies and control. Wallingford: CABI, 331-359. Quilici, S., & Langlois, A. (1993). Bioecological survey of weevils damaging fruit crops in Reunion Island. IOBC/WPRS Bulletin, 16(7), 30-40.

		(common bur-flower tree), *Nephelium lappaceum* (rambutan), *Nicotiana tabacum* (tobacco), *Oryza sativa* (rice), *Palaquium gutta* (gutta percha tree), *Persea americana* (avocado), *Persea bombycina, Pterocarpus indicus* (red sandalwood), *Saccharum officinarum* (sugarcane), *Tectona grandis* (teak), *Theobroma cacao* (cocoa), *Vernicia montana* (Chinese wood oil tree), *Vigna unguiculata* (cowpea), *Zea mays* (maize)								
Kerria lacca	Lac insect	Polyphagous including lychee, longan, mango, northern black wattle, gum arabic tree, white siris, sickle bush, jujube, pigeon pea, sacred fig tree, golden champa, macassar oil tree	Leaves		Asia (Bangladesh, China, Indonesia, Taiwan)	LOW	LOW	LOW	MEDIUM	VERY LOW
Lymantria xylina (Syn. *Lymantria nigricosta*)	Casuarina moth	Polyphagous including lychee, longan, camellia, casuarina, guava, castor bean, weeping willow, sweet potato, turf grasses	Leaves		Asia (Taiwan)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Maladera insanabilis (Syn. *Maladera matrida*) [68]	White grub	Sweetpotato, apple, pear, peach, loquat, guava, persimmon, cherimoya (*Annona cherimola*), groundnut, papaya, grapefruit, lemon, pomegranate and lychee	Leaves, flowers, roots	Infested plant material, contaminated soil, machinery and tools. Adults capable of flight. Eggs are soilborne.	Asia (Israel, Middle East)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Orgyia turbata (Syn. *Notolophus turbatus*)	Tussock moth	Polyphagous including lychee, groundnut, coconut, durian, tobacco, cocoa, cowpea	Leaves		Asia (Malaysia, Myanmar, Thailand, Vietnam)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Orothalassodes falsaria (Syn: Thalassodes falsaria)	Leaf-eating looper	Lychee, longan, mango, rambutan, shaddock, langsat, lac tree, citrus (pomelo), Ceylon oak	Leaves, flowers		Asia (India, Thailand)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Oxycetonia jucunda	Flower chafer	Lychee, longan, citrus, apple, pear, *Camellia oleifera* (oil seed camellia or tea oil camellia)	Fruit, flowers		China	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Phaedon brassicae	Daikon leaf beetle, Brassica leaf beetle	Polyphagous. Lychee	Leaves		Asia (China, Japan, Republic of Korea, Taiwan, Vietnam, Italy)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Salagena sp.	Bark borer	Lychee	Branches		Asia (India, Philippines, Taiwan,	LOW	LOW	LOW	MEDIUM	VERY LOW

[68] Adults feed on leaves, buds and flowers, larvae feed on the roots

					Thailand) South Africa					
Popillia quadriguttata (Syn. *Trichius biguttatus* Fabricius; *Popillia bogdanowi* Ballion, *Popillia castanoptera* Hope, *Popillia chinensis* Frivaldszky, *Popillia dichroa* Blanchard, *Popillia frivaldszkyi* Kraatz, *Popillia purpurarescens* Kraatz, *Popillia ruficollis* Kraatz, *Popillia sordida* Kraatz, *Popillia straminipennis* Kraatz, *Popillia uchidai* Niijima and Kinoshita)	Scarab beetle	Polyphagous including lychee, longan, peach, pear, corn, Asian hazel, soybean, bush clover, paradise apple, Sargent cherry, Asian raspberry, lyre leaf nightshade, grass	Leaves, flowers, fruit		Asia (Vietnam, China, Taiwan, Korea) Europe (Russia)	LOW	MEDIUM	MEDIUM	LOW - MEDIUM	VERY LOW - LOW
Protaetia nitididorsis (Syn. *Cetonia esquiroli* Pouillaude; *Liocola nitididorsis* Fairmaire; *Liocola speculifera* Schwartz)	Scarab beetle; Chafer; flower beetle; metallic beetle	Lychee, longan	Fruit		Asia (China)	LOW	MEDIUM	MEDIUM	LOW - MEDIUM	VERY LOW - LOW
Lepidiota stigma	Sugarcane white grub	Broad host range including lychee, watermelon, coffee, cassava, grasses, sugarcane, maize, pineapple, agave and rubber	Below ground, seedlings Roots (Pineapple)	Infested soil and plant material. Adults are capable of flight	Widespread throughout Southeast Asia (China, India, Indonesia, Japan, Malaysia, Singapore, Thailand)	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Orgyia postica[69] (Syn. *Lacida postica; Notolophus australis; Notolophus postica; Notolophus posticus; Orgyia australis postica; Orgyia ceylanica; Orgyia ocularis; Orgyia posticus*)	Cocoa tussock moth	Polyphagous including lychee, acerola, mango, rambutan, orchids, poplar, pear, castor bean, roses, black plum, cocoa, mung bean, grapes, common jujube, durian, eucalyptus, mangosteen, table grapes, tea, coffee, soybean, Orchidaeceae, black plum, lilium	Leaves, flower buds		Asia (Bangladesh, Brunei Darussalam, China, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Sri Lanka, Taiwan, Thailand, Vietnam) Oceania (Papua New Guinea)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Anomala cuprea	Cupreous chafer, Oriental beetle, Japanese scarab	Polyphagous including lychee, beans, groundnut, sweetpotato, grape, soybean, sugarcane, peanuts, strawberry	Above ground Sweetpotato: leaves, roots	Infested plant material, contaminated soil, tools and machinery. Eggs are soilborne.	Asia (Japan, Republic of Korea)	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Adoxophyes orana	Apple peel	Highly polyphagous: apple, European	Whole plant	Plant material;	Asia (Armenia, Azerbaijan, China,	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW

[69] This species currently occurs from Japan to southern China (Nasu et al. 2004, Zhu and Zhang 2004). It established in areas with a wide range of climatic conditions and therefore has the potential to establish and spread in Australia.

	tortricid (Syn. Summer fruit tortrix; Smaller tea tortrix, reticulated tortrix)	pear, apricot, quince, blackcurrant, raspberry, peach, roses, short staple cotton, hop, *Medicago* spp., sweet cherry, sour cherry, plum, bird cherry, red currant, gooseberry, blackberry, raspberry, lilac, blueberries, hazelnut, peanut, soybean, chestnut, oak, upland cotton, sour cherry, citrus, lychee, tea, willow, maple, birches, staple cotton, hop, gooseberry, lilac, blueberries	leaves, growing points, flowers, and fruits.	adults capable of flight (Cherry)	Georgia (Republic of), Japan, Republic of Korea), Europe (Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Norway, Poland, Romania, Russian Federation, Serbia, Slovenia, Spain, Sweden, Switzerland, UK, Ukraine)					

Pathogens

Table 18. Lychee pathogen threat summary table.

SCIENTIFIC NAME	COMMON NAME	PRIMARY HOSTS	AFFECTED PLANT PART	MOVEMENT & DISPERSAL	GEOGRAPHIC RANGE	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Fungi										
Phytophthora litchii (Syn. Peronophythora litchii)[70]	Brown blight; downy blossom blight of litchi	Lychee, longan	Fruit, flowers, leaves		Asia (China[48], Taiwan, Thailand, Vietnam) Oceania (Papua New Guinea) Europe (Netherlands)[47]	HIGH	HIGH	HIGH	HIGH	HIGH
Uredo nephelii	Rust	Lychee	Leaves		Asia	MEDIUM - HIGH	HIGH	HIGH	MEDIUM	MEDIUM - HIGH
Pestalotiopsis pauciseta	Leaf blight	Lychee, *Canarium* spp., *Guioa* spp., sycamore, mango, *Neophelium litchi*, Macarthur Palm, *Uvaria* spp., upriva orange mangrove, longan, rubber fig, triangle palm, guava	Leaves, Stems		Asia (China, Philippines, India)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Phaeosaccardinula javanica (Syn. *Chaetothyrium javanicum)*]	Sooty mould	Lychee, grape, sapodilla, mango, Aleurites, shell ginger (dwarf cardamom), bamboo, tea, *Citrus* spp., Cinchona, coffee, persimmon, *Eugenia* spp. (longan), *Ficus* spp., *Gardenia* spp.	Leaves		Asia (China, Taiwan) North America (Caribbean)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Phomopsis longanae	Fruit blotch and leaf blight	Lychee, longan tree	Fruit, leaves		Asia (China) Europe (Italy)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Armillaria tabescens, A. mellea, A. socialis[71]	Armillaria root rot Wood rot (Summerfruit) Clitocye root rot (Tea Tree, Truffles)	Papaya, lychee, Aleurites, *Carya* (hickories), *Casuarina* (beefwood), *Casuarina equisetifolia* (casuarina), mandarin lime, navel orange, *Eucalyptus*, lychee, *Melaleuca quinquenervia* (paperbark tree), oleander, pines, almond, peach, Japanese plum, guava, *Vitis spp. (grape)*, oak, *Acacia* spp., blueberry,	Leaves, fruit, Whole plant Roots and collar region (Truffles)	Infected Plant	Asia (China, India, Japan, Republic of Korea, Malaysia, Nepal, Turkey) Africa (Madagascar, Malawi, Mauritius, Tanzania, Zimbabwe) North America (Mexico, USA) Central America and Caribbean (Panama, Trinidad and Tobago) South America (Brazil)	LOW	MEDIUM	MEDIUM	LOW	NEGLIGIBLE

[70] Present based on regional distribution

[71] Widespread. Similar impact to other Armillaria spp. in Australia. Established Armillaria spp. are not economically significant in tea tree plantations. Unlikely to be a problem on mulch from tea tree as it is heated for oil extraction prior to use.

		common jujube, banana, plantain, coffee, macadamia, pear, apple, apricot, plum, summerfruit, persimmon, loquat, hickories, range of Australian native trees including Rosaceous species, ornamental trees, shrubs and fruit crops.			Europe (Albania, Czech Republic, France, Germany, Greece, Italy, Montenegro, Netherlands, Portugal, Serbia, Slovakia, Slovenia, Spain, UK) Oceania (Fiji)					
Pestalotiopsis mangiferae	Brown spot: mango	Lychee, Eucalyptus, mango, lacebark elm, grapevine, hickory	Leaves		Asia (China, India, Saudi Arabia) North America (USA) Oceania (American Samoa)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Nematodes										
Aorolaimus helicus		Lychee	Roots		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
Aphelenchus maximus		Lychee, mango	Roots		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
Aphelenchus sparsus		Lychee	Roots		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
Clavilenchus similis		Lychee	Roots		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
Criconema hlagum	Spine nematode	Lychee	Roots		South Africa	LOW	LOW	LOW	LOW	NEGLIGIBLE
Criconemoides complexus	Ring nematode	Lychee, pineapple, mango	Roots		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
Helicotylenchus microcephalus	Spiral nematode	Lychee, orchids	Roots		India, South Africa	LOW	LOW	LOW	LOW	NEGLIGIBLE

Hemicriconemoides litchi		Lychee, mango	roots		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
Hemicycliophora typica	Sheath nematode	Lychee, sugarbeet, carrot, apple, applewood, crabapple, rice, kikuyu grass, potato, wheat	Roots		South Africa, Netherlands	LOW	LOW	LOW	LOW	NEGLIGIBLE
Longidorus litchii	Needle nematode	Lychee	Roots		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
Ogma decalineatum	Ogma	Lychee	Roots		South Africa	LOW	LOW	LOW	LOW	NEGLIGIBLE
Scutylenchus quadrifer		Lychee	Roots		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
Trichodorus monhystera	Stubby root nematode	Lychee	Roots		China	LOW	LOW	LOW	LOW	NEGLIGIBLE
*Tylenchorhynchus nudus (*Syn. *Tessellus claytoni)*	Stunt nematode	Lychee, Kentucky bluegrass, bush honeysuckle, red clover, sorghum, creeping bentgrass, chickpea	Roots		USA	LOW	LOW	LOW	LOW	NEGLIGIBLE
Phytoplasmas/Viruses										
Longan witches' broom-associated virus	*Longan witches' broom-associated virus*	Longan	Leaves, branches, shoots	Spread by grafting and by the Litchi stink bug	Asia (Cambodia, China, Taiwan, Vietnam)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

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Biosecurity Plan
for the Papaya Industry

A shared responsibility between government and industry

Version 2.4 November 2024

Plant Health AUSTRALIA

Hort Innovation
Strategic levy investment

PAPAYA FUND

Papaya AUSTRALIA

Location: Level 1
1 Phipps Close
DEAKIN ACT 2600
Phone: +61 2 6215 7700
Email: biosecurity@phau.com.au
Visit our website www.planthealthaustralia.com.au

An electronic copy of this plan is available through the email address listed above.

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Revision history

VERSION NUMBER	DATE	DETAILS
2.0	October 2021	Biosecurity Plan for the Papaya Industry
2.1	July 2022	Biosecurity Plan for the Papaya Industry (updated following BRP meeting #1)
2.2	June 2023	Biosecurity Plan for the Papaya Industry (updated following BRP meeting #2)
2.3	May 2024	Biosecurity Plan for the Papaya Industry (updated following BRP meeting #3)
2.4	November 2024	Biosecurity Plan for the Papaya Industry (updated following BRP meeting #4)

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The *Biosecurity Plan for the Papaya 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 Papaya Industry (Version 2.0)* was formally endorsed by the Papaya industry (through the Papaya Australia in October 2021, and all state and territory governments (through the Plant Health Committee) in November 2021.

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 31 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, Forestry and Fisheries 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.

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LIST OF ACRONYMS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACIAR	Australian Centre for International Agricultural Research
ACPPO	Australian Chief Plant Protection Officer
AgVic	Agriculture Victoria
ALGA	Australian Lychee Growers Association
APC	AUSPest*Check*®
APVMA	Australian Pesticides and Veterinary Medicines Authority
AS/NZS	Australian Standard/New Zealand Standard
BICON	Australian Biosecurity Import Conditions Database
BIRA	Biosecurity Import Risk Analysis
BISOP	Biosecurity Incident Standard Operating Procedure
BRP	Biosecurity Reference Panel
BMP	Best Management Practise
BOLT	Biosecurity On-Line Training
BP	Biosecurity Plan
CABI	Centre for Agriculture and Bioscience International
CCEPP	Consultative Committee on Emergency Plant Pests
CPHM	Chief Plant Health Manager
DAF NT	Department of Agriculture and Fisheries, Northern Territory
DAF Qld	Department of Agriculture and Fisheries, Queensland
DAFF	Department of Agriculture, Fisheries and Forestry
DAWE	Department of Agriculture, Water and the Environment (now DAFF)
DEECA	Department of Energy, Environment and Climate Action, Victoria
DITT NT	Department of Industry, Tourism and Trade, Northern Territory (now DAF NT)
DPI NSW	Department of Primary Industries, New South Wales
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
ILO	Industry Liaison Officer
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
LLC	Local Control Centres
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
NPBS	National Plant Biosecurity Strategy
NPPP	National Priority Plant Pest
NSP	National Surveillance Protocol
NSW	New South Wales
NRE Tas	Department of Natural Resources and Environment, Tasmania
NT	Northern Territory
ORC	Owner Reimbursement Costs
PA	Papaya Australia
PAI	Passionfruit Australia Inc
PaDIL	Pest and Disease Image Library
PBRI	Plant Biosecurity Research Initiative
PHA	Plant Health Australia
PHC	Plant Health Committee
PIC	Property Identification Code
PIRSA	Primary Industries and Regions South Australia
PPIM	Plant Property Identification Model
QA	Quality Assurance
R&D	Research and Development
RDC	Research and Development Corporation
RD&E	Research, Development and Extension
SA	South Australia
SARDI	South Australian Research and Development Institute
SCC	State Coordination Centres
SDQMA	Subcommittee for Domestic Quarantine and Market Access (now SMART)
SMART	Subcommittee on Market Access, Risk and Trade
SNPHS	Subcommittee for Plant Health Surveillance
SPHD	Subcommittee on Plant Health Diagnostics
SPS	Sanitary and Phytosanitary
T2M	Transition to Management
TBA	To be announced
TRP	Technical Review Panel
TST	Threat Summary Table
WA	Western Australia
WTO	World Trade Organization

DEFINITIONS

The definition of a plant pest used in this document includes insects, mites, snails, or diseases (pathogens, including nematodes) 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 that are not native but 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[1], 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 30.

[1] https://www.planthealthaustralia.com.au/response-arrangements/emergency-plant-pest-response-deed-epprd/

EXECUTIVE SUMMARY

To ensure their future viability and sustainability, it is important that the Australian Papaya Industry, represented by the Papaya Australia as the peak industry body, minimise the risks posed by exotic pests and respond effectively to plant pest threats. This biosecurity plan is a framework to coordinate biosecurity activities and investment for the Australian Papaya Industry. It provides a mechanism for industry, Australian Commonwealth, State and Territory governments, and relevant stakeholders (referred to as key stakeholders throughout the remainder of this biosecurity plan) to better prepare for and respond to, incursions of pests that could have significant impacts on these industries. It identifies and prioritises exotic plant pests (not currently present in Australia) and other pests of biosecurity concern and focuses on future biosecurity challenges.

The Biosecurity Plan for the Papaya Industry (this biosecurity plan) was developed in concert with the development of biosecurity plans for the Australian Lychee and Australian Passionfruit Industries. Facilitated by Plant Health Australia (PHA) and involving the collaboration of plant health and biosecurity experts from relevant Commonwealth, State and Territory agriculture agencies, and representatives from the Australian Lychee Growers Association (ALGA), Papaya Australia and Passionfruit Australia. These parties will be referred to as key stakeholders in the remainder of this document.

Key stakeholders were represented in the Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG) and these groups provided advice in the development of the three Biosecurity Plans (Lychee Biosecurity Plan, Papaya Biosecurity Plan, Passionfruit Biosecurity Plan).

A key part of the biosecurity planning process was the development of combined Threat Summary Tables (TST) for all three industries (Table *1*). Containing over 120 exotic plant pests, these tables demonstrate the potential biosecurity threats faced by these industries. Each pest on the list was given an overall risk rating based on four criteria; entry potential, establishment potential, spread potential, and potential for economic impact. In this biosecurity plan, other pests of biosecurity significance for the papaya industry were also identified as good biosecurity practices benefit the ongoing management of and surveillance for these pests.

The Biosecurity Plan 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 papaya industry. This enables identification of gaps and prioritisation of specific actions, as listed in the Biosecurity Implementation Table (Table 3; Table 4). The development of this table will increase the industry's biosecurity preparedness and response capability by outlining specific areas of action which could be undertaken through a government and industry partnership.

The Biosecurity Plan is principally designed for use by decision makers. It provides industry and government with a mechanism to identify exotic plant pests as well as to address the specific strengths and weaknesses of the Australian Papaya Industry's current biosecurity position. It is envisaged that annual reviews of this biosecurity plan will be undertaken to assess progress against agreed activities, with another formal review conducted after five years.

The Biosecurity Plan is a document outlining the commitment to the partnership between the key stakeholders to improve biosecurity.

SIGNIFICANT BIOSECURITY THREATS

Document overview

The Biosecurity Plan for the Australian Papaya Industry focuses on the following five key areas over the years 2021-2026 (i.e. the life of this Biosecurity Plan).

High priority exotic pests and other pests of biosecurity significance

A key outcome of this biosecurity plan is the identification of the exotic high priority pests, and other pests of biosecurity significance for the Australian Papaya industry. This section includes:

- the High Priority Pests (HPP), which are the most significant exotic threats affecting the Australian Papaya industry as identified through a prioritisation process; and
- the other pests of biosecurity significance, identified in consultation with the Australian Papaya industry.

The exotic HPP list and other 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.

Implementing biosecurity for the Australian Papaya Industry 2021-2026

This section includes the biosecurity implementation plan and a gap analysis of the current level of preparedness for HPP of the Australian Papaya 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. The TEG, the BIG and the BRP all contained representatives of the three industries as well as technical experts from Australian commonwealth, state and territory governments.

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 biosecurity threats considered in this 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 rating of high were determined to be HPP (Table 1).

Risk mitigation and preparedness

This section provides a summary of activities to mitigate the impact of pest threats on the Australian Papaya 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 exotic 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 RD&E, such as researching integrated pest management (IPM) strategies, and chemical control are also provided.

Response management

This section provides a summary of the processes in place to respond to emergency plant pest (EPP)[2] incursions that would affect the Australian Papaya Industry. Areas covered in this section include the Emergency Plant Pest Response Deed (EPPRD), PLANTPLAN (outlines the generic approach in response management under the EPPRD), categorisation of pests under the EPPRD and industry specific response procedures and industry communication. Please note that Papaya Australia are not signatories to the EPPRD and therefore Papaya Australia my not have a 'formal' role in a response as outlined in the EPPRD and PLANTPLAN.

PESTS OF BIOSECURITY SIGNIFICANCE OVERVIEW

A key component of this biosecurity plan is to identify the exotic and other pests of biosecurity significance to the Australian Papaya Industry. This section provides information on the High Priority Pest (HPP) list, and the other pests of biosecurity significance for the Australian Papaya industry. These pest lists, provide the Australian Papaya Industry, commonwealth, state and territory governments, and other relevant stakeholders with the information needed to prioritise resources for biosecurity risk management.

The exotic HPP list and other 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 activities.

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

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

Papaya industry high priority exotic pests

Table 1 provides an overview of the top ranked biosecurity pest threats (invertebrates, pathogens and nematodes) for the Australian Papaya Industry. Further details on each pest along with the basis for the likelihood ratings are provided on page 32. 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.

Table 1. Papaya industry High Priority Pest list.

Common name	Scientific name	Host(s)	Affected plant part	Movement and dispersal	Geographic distribution[3]	Entry potential	Est.[4] potential	Spread potential	Economic impact	Overall risk
Invertebrates										
Diptera (flies and midges)										
Carambola fruit fly	*Bactrocera carambolae*	Highly polyphagous (75 hosts from 26 families) including grapefruit, orange, lemon, lime, mandarin, cashew, breadfruit, jackfruit, carambola, capsicum, mango, guava, banana, avocado, tomato, mangrove, passionfruit	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Asia (Brunei, India, Indonesia, Malaysia, Singapore, Thailand) South America (Brazil, French Guiana, Guyana, Suriname)	HIGH	HIGH	HIGH	HIGH	HIGH
Guava fruit fly	*Bactrocera correcta*	Polyphagous, including: cashew, carambola, Citrus spp., longan, mango, melon	Fruit		Asia (Bhutan, China, India, Japan, Myanmar, Nepal, Pakistan, Sri Lanka, Taiwan, Thailand) North America (United States)	HIGH	HIGH	HIGH	HIGH	HIGH
Oriental fruit fly	*Bactrocera dorsalis (Bactrocera invadens; Bactrocera papayae; Bactrocera philippinensis)*	Polyphagous, with wide host range including: cashew, soursop, breadfruit, jackfruit, bell pepper, chilli, citrus, watermelon, coffee, melon, cucumber, longan, persimmon, mangosteen, dragon fruit, mango, apple, banana, avocado, lychee, passionfruit	Fruit	Infested plant material (including fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the soil	Asia, Africa, North America, Europe, Oceania.[5]	HIGH	HIGH	HIGH	HIGH	HIGH

[3] (CABI, 2023).

[4] Establishment potential.

[5] Asia (Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Christmas Island (Indian Ocean), India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, United Arab Emirates, Vietnam). Africa, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Liberia, Madagascar, Mali, Mauritania, Mayotte, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe). North America (USA). Europe (Italy). Oceania (Federated states of Micronesia, French Polynesia, Northern Mariana Islands, Palau, Papua New Guinea)

Common name	Scientific name	Host(s)	Affected plant part	Movement and dispersal	Geographic distribution[3]	Entry potential	Est.[4] potential	Spread potential	Economic impact	Overall risk
Tongan fruit fly, Tropical fruit fly	*Bactrocera facialis*	*Citrus spp*., mango, avocado, peach, guava, cashew, capsicum, tomato, breadfruit, longan	Fruit	Infested plant material (including fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the soil.	Oceania (Tonga)	HIGH	HIGH	HIGH	HIGH	HIGH
Fijian fruit fly	*Bactrocera passiflorae*	Polyphagous (49 hosts in 28 families) including cashew, breadfruit, lime, mandarin, mango, avocado, guava, eggplant, cocoa, passionfruit	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Oceania (Fiji, Niue, Tonga, Tuvalu, Wallis & Futuna)	HIGH	HIGH	HIGH	HIGH	HIGH
	Bactrocera tuberculata	Mango, *Syzygium* spp., peach, sapodilla	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Asia (Bangladesh, Bhutan, China, Myanmar, Thailand, Vietnam)	MEDIUM	HIGH	HIGH	HIGH	HIGH
Melon fruit fly	*Zeugodacus cucurbitae*	Watermelon, rockmelon, cucumber, pumpkin, tomato	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.		HIGH	HIGH	HIGH	HIGH	HIGH
Hemiptera (stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)										
Coconut bug	*Amblypelta cocophaga*	Navel orange, coconut, melon, mango, cassava, peach, sugarcane, cocoa, kapok, *Eucalyptus deglupta*, *E. terecornis*, *E. urophylla*	Stems, growing points, fruit	Infested plant material and machinery. Adult females capable of flight. Nymphs are active crawlers.	Asia (Singapore) Oceania (Fiji, Papua New Guinea, Solomon Islands)	HIGH	HIGH	HIGH	HIGH	HIGH
Mealybug	*Dysmicoccus nesophilus*	Polyphagous including sweet orange, grapefruit, lemon, mango, avocado, pines, taro, ginger, tamarillo, figs, coffee	Leaves, flowers, fruit	Infested plant material. Adult males capable of flight over short distances.	Oceania (Cook Islands, Fiji, Kiribati, Papua New Guinea, Tonga, Tuvalu, Western Samoa)	HIGH	HIGH	HIGH	HIGH	HIGH
Coconut mealybug	*Nipaecoccus nipae*	Polyphagous including breadfruit, pigeon pea, citrus,	Fruit, leaves, stems,	Infested plant material and	Africa, Asia, North America, Oceania. [6]	HIGH	HIGH	HIGH	HIGH	HIGH

[6] Africa, Zimbabwe). Asia (Bangladesh, China, Georgia, India, Indonesia, Pakistan, Philippines, South Korea, Thailand, Turkey, Vietnam). Europe (Austria, Belgium, Czechoslovakia, France, Hungary, Italy, Poland, Portugal, , Russia, Spain, United Kingdom). North America (Antigua and Barbuda, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Jamaica, Mexico, Nicaragua, Panama, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, U.S. Virgin Islands, United States). Oceania (Federated States of Micronesia, Fiji, Guam, Samoa, Solomon Islands). South America (Argentina, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Venezuela).

Common name	Scientific name	Host(s)	Affected plant part	Movement and dispersal	Geographic distribution[3]	Entry potential	Est.[4] potential	Spread potential	Economic impact	Overall risk
		coconut, fig, breadfruit, pigeon pea, sweet potato, mango, cassava, banana, olive, orchids, avocado, guava, potato, cocoa, grape, ginger	growing point	machinery, adult males capable of flight.						
Fruit tree mealybug	*Rastrococcus invadens*	Breadfruit, citrus, figs, mango, banana, guava	Fruit, inflorescence, leaves, stems		Africa (Benin, Burkina Faso, Congo, Democratic Republic of the, Congo, Republic of the, Côte d'Ivoire, Gabon, Ghana, Nigeria, Senegal, Sierra Leone, Togo), Asia (Bangladesh, Bhutan, China, Hong Kong, India, Indonesia, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam), South America (French Guiana)	HIGH	HIGH	HIGH	HIGH	HIGH
Pathogens										
Bacteria										
Bacterial crown rot **Papaya bacterial canker**	*Erwinia mallotivora*[7]	Known to survive on the leaves of cowpea, tomato and rockmelon for at least 14 days.	Leaves, fruit, stems		DAFF lists as: Anguilla; Antigua and Barbuda; Barbados; Dominica; Grenada; Guadeloupe; Indonesia; Japan; Malaysia; Martinique; Montserrat; Northern Mariana Islands; Philippines; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Tonga; Trinidad and Tobago; Venezuela, Bolivarian Republic of; and Virgin Islands, United States of America.	MEDIUM	HIGH	HIGH	HIGH	HIGH
Viruses and viroids										
Cotton leaf curl Alabad virus	*Cotton leafcurl virus complex* (*Begomovirus*)	Cotton. Additional hosts include hibiscus, okra, tobacco, radish, tomato, French bean, chilli and many weeds	Leaves symptomatic, whole plant affected		Asia (Oman)	MEDIUM	HIGH	HIGH	HIGH	HIGH

[7] In the Biosecurity Reference Panel meeting #4 the scientific name of Bacterial crown rot was updated from *Erwinia papaya*.

Other pests of biosecurity significance

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 in Australia. Pollination services of the European honey bee are provided by beekeepers to growers of pollinator-reliant crops.

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

Established and exotic pests of European honey bees as well as exotic pest bees can have a major impact on crop pollination services. Honey bee pests and pest bees can also impact unmanaged colonies which also provide pollination.

Papaya rely on a range of native and established insect species for pollination, including European honey bees. A list of the high priority bee pests and pest bees which could impact the papaya industry can be located on the PHA website planthealthaustralia.com.au/industries/honey-bees/ and the BeeAware website beeaware.org.au/pests/

Introduction

This section identifies other pests of biosecurity significance for the Australian papaya industry. By identifying pests which are either currently under quarantine arrangements or which papaya producers already 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 industry.

Identification of other 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

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

- currently under quarantine arrangements or 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. Other pests of biosecurity significance.

Common name (Scientific name)	Hosts	Affected plant part	Distribution in Australia	State movement controls or market impact by pests	Factsheets	Comments
Invertebrates						
Acari (mites and ticks)						
Varroa mite *Varroa destructor*	*Apis cerana, A. mellifera*.	Brood and adults (honey bee life stage)	NSW and Vic[8].	Movement restrictions of hives and other equipment apply for Qld[9], SA[10], NT[11], WA[12], Vic[13], ACT[14], Tas[15]	PHA[16], BeeAware[17], NSWDPI[18]	A 2-year transition to management (T2M) plan was approved in February 2024.[19]
Diptera (flies and midges)						
Queensland fruit fly *Bactrocera tryoni*	Polyphagous including papaya	Fruit	NSW, NT, Qld, Vic	Movement restrictions in the Greater Sunraysia Pest Free Area	NSW DPI[20], PHA[21], QDAF[22], AgVic[23]	https://www.fruitflyidentification.org.au/species/bactrocera-tryoni/
Mediterranean fruit fly *Ceratitis capitata*	Polyphagous including papaya	Fruit	WA (except Ord River Irrigation Area - ORIA)	Movement controls of fruit	PHA[21], NSW DPI[24], DPIRD[25], AgVic[26] QDAF[27]	https://www.fruitflyidentification.org.au/species/ceratitis-capitata/
Hemiptera (stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)						
Papaya mealybug	Polyphagous	Fruit, growing point, inflorescence, leaves,	NT (Darwin, Palmerston and	Queensland has movement controls on soil, plant movement and related	Yes –NT[30], QLD[31]	

[8] https://www.dpi.nsw.gov.au/emergencies/biosecurity/current-situation/varroa-mite-emergency-response
[9] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/animal/industries/bees/move
[10] https://pir.sa.gov.au/biosecurity/animal_health/animal_species/bees/moving_bees_and_bee_products
[11] https://nt.gov.au/industry/agriculture/livestock-and-animals/honey-bees-and-beekeeping
[12] https://www.agric.wa.gov.au/livestock-animals/livestock-species/bees
[13] https://agriculture.vic.gov.au/biosecurity/moving-livestock-and-animals/moving-bees-interstate
[14] https://www.environment.act.gov.au/parks-conservation/plants-and-animals/biosecurity/biosecurity-alerts/varroa-destructor-mite
[15] https://nre.tas.gov.au/biosecurity-tasmania/animal-biosecurity/bees/bee-pests-diseases-and-welfare/varroa-mite
[16] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Varroa-mites-FS.pdf
[17] https://beeaware.org.au/archive-pest/varroa-mites/#ad-image-0
[18] https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/268026/DPI-Primefact-Varroa-Mites-13062024.pdf
[19] https://www.varroa.org.au/nvmmp
[20] https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/1482740/Queensland-fruit-fly.pdf
[21] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/QFly-and-Medfly-FS-1.pdf
[22] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/insects/horticultural/queensland-fruit-fly
[23] https://fruitflycontrol.com.au/wp-content/uploads/2024/05/Managing-QFF-in-your-garden-English.pdf
[24] https://www.dpi.nsw.gov.au/biosecurity/insect-pests/medfly
[25] https://www.agric.wa.gov.au/medfly/mediterranean-fruit-fly-life-cycle-biology
[26] https://agriculture.vic.gov.au/biosecurity/pest-insects-and-mites/priority-pest-insects-and-mites/mediterranean-fruit-fly
[27] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/priority-pest-disease/mediterranean-fruit-fly
[30] https://nt.gov.au/industry/agriculture/food-crops-plants-and-quarantine/papaya-mealybug
[31] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/priority-pest-disease/papaya-mealybug

Paracoccus marginatus	including papaya[28]	stems, whole plant	Howard Springs), Qld (South east Qld and Townsville).	equipment[29].		
Pathogens						
Viruses						
Papaya ringspot disease Papaya ringspot virus type P (PRSV-P) *(Potyvirus)*	Papaya, cucurbits	Fruit, leaves, stems, and trunk	Southeast Queensland	Two biosecurity zones in southeast Queensland[32]	QLD[33]	
Papaya sticky disease Combined infection with *Papaya meleira virus* (PMeV) and *Papaya meleira virus 2* (PMeV2) (Unassigned, Totiviridae)	Papaya	Fruit, leaves	Qld, NT.		DPIRD[34]	An article published on DPIRD's website in 2022 reported that the disease has been detected in the NT.[35]

[28] Polyphagous (over 55 plants from 25 genera) including Citrus spp., papaya, avocado, mango, cherry, pineapple, pomegranate, hibiscus, cotton, tomato, eggplant, capsicum, bean, pea, sweet potato, coffee, acacia, cassava, guava, cocoa.

[29] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/priority-pest-disease/papaya-mealybug

[32] https://www.daf.qld.gov.au/__data/assets/pdf_file/0011/377606/Papaya-Ringspot-Biosecurity-Zones-1-And-2.pdf

[33] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/weeds-diseases/surveillance/papaya-ringspot

[34] https://www.agric.wa.gov.au/sites/gateway/files/PF025-22%20Papaya%20sticky%20disease%20factsheet%20PRINT.pdf

[35] https://www.agric.wa.gov.au/plant-biosecurity/papaya-sticky-disease-declared-pest

Implementing biosecurity for the Australian Papaya Industry 2021-2026

This section includes the biosecurity implementation plan and a gap analysis of the current level of preparedness for HPP of the Australian Papaya Industry. The Biosecurity Implementation Group (BIG), comprising of representatives of key stakeholders and other relevant experts, developed the implementation plan that sets out the Biosecurity Plans shared goals and objectives. It is intended that the implementation plan is revisited by the BRP regularly over the next five years to maintain its relevance. The TEG, the BIG and the BRP contain representatives of the three industries as well as scientific and technical experts from Australian commonwealth, state and territory governments, and other relevant organisations.

Biosecurity Implementation Table

The Biosecurity Implementation Table aims to build upon the themes outlined in the Intergovernmental Agreement on Biosecurity (IGAB)[36] and the National Plant Biosecurity Strategy (NPBS)[37] by providing a clear line of sight between the development of this Biosecurity Plan and broader plant health policy and legislation.

This table also aims to provide focus and strategic direction for plant biosecurity activities relating to the Australian Papaya Industry over the next five years (i.e. the life of this Biosecurity Plan). The Biosecurity Implementation Table provides specific recommendations for potential biosecurity activities identified by key stakeholders to improve biosecurity preparedness for pest threats.

Biosecurity is a shared responsibility between the key stakeholders and other stakeholders. The Biosecurity Implementation Table has been produced to help coordinate actions and resources in the Australian biosecurity system. Activities may require additional funding to be sourced prior to commencement. Implementing the specific actions listed in the Biosecurity Implementation Table, will not only strengthen Australian Papaya Industry biosecurity systems, but also the broader Australian plant biosecurity systems. Future versions of this table will also track progress on the activities described.

The Biosecurity Implementation Table previously outlined eight strategy areas where industry and government should align their biosecurity efforts. The eight strategy areas were:

- Capacity and Capability
- Education and Awareness
- Preparedness and Response
- Surveillance
- Diagnostics
- Established Pests of Biosecurity Concern
- Research, Development & Extension
- Legislation and Regulatory Issues of Importance

During the life of the Biosecurity Plan, changes have been made to the structure of the Implementation Table to better align with the structure of the IGAB and the NPBS. The Implementation Table has been updated to reflect this new structure below.

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

Table 3. The Biosecurity Implementation Plan for the Australian Papaya industry 2021 - 2026.

Biosecurity Plan Strategy	Action	Output	Outcome	Potential Partners	Current Activities	Timeframe
1. Preparedness and Response	1.1 Describe and evaluate current biosecurity risk pathways into Australia and determine appropriate mitigation measures.	Papaya biosecurity pathway risk analysis.	Greater understanding of the biosecurity risks associated with pathways will provide the opportunity to develop pre-emptive mitigation measures.	Papaya Australia, Department of Agriculture, Fisheries and Forestry (DAFF), State and Territory Governments (where appropriate).		
	1.2 Understand current surveillance programs undertaken by industry and government.	Surveillance analysis and a Papaya industry surveillance program.	Early detection of key exotic pests and an improved knowledge of geographic spread of established pests.	Papaya Australia, Commonwealth, State and Territory Governments, Subcommittee on National Plant Health Surveillance (SNPHS), PHA.		Ongoing
	1.3 Participate in future simulation exercises that test the preparedness and response of the biosecurity system to exotic pest and/or pathogen incursions.	Simulation exercises.	Participating industries and governments are better prepared to respond to a pest incursion.	Papaya Australia, Commonwealth, State and Territory Governments, Hort Innovation, PHA.		Ongoing
	1.4 Review the availability of crop protection products available to manage exotic pests and pathogens and identify gaps in control options.	A list of important pests and control options are available with gaps identified.	Industry will have a list of identified gaps in control options for important pests and pathogens.	Papaya Australia, State and Territory Governments (where appropriate), Australian Pesticides and Veterinary Medicines Authority (APVMA), collaborating industries.		
	1.5 Prioritise identified gaps in pest control options and develop options to address gaps.	A plan to address crop protection gaps.	A prioritised list of pests and control options with strategies developed to gain access.	Papaya Australia, APVMA, collaborating industries, crop protection companies.		
	1.6 Review availability of diagnostics for the high priority pests and assess the capability to perform diagnostics (normal capacity and surge capacity).	Diagnostic tools and methods that provide accurate and timely identification of pests and pathogens.	Increased accuracy and rapid diagnosis of pests/pathogens will provide greater opportunity for eradication and/ or management.	Papaya Australia, State and Territory Governments (where appropriate), collaborating industries, Subcommittee on Plant Health Diagnostics (SPHD).		Ongoing
	1.7 Maintain an understanding of relevant biosecurity legislation and regulations in all states/territories.	Regular legislation and regulation update.	Any specific state/ territory or discordant requirements identified. Increase industry awareness of legislation and regulations impacting their businesses.	Papaya Australia.		Ongoing

2. Capacity & Capability	2.1 In collaboration with industry and governments, gain an understanding of diagnostic capacity within both government and private providers and assess methods to address capacity and capability gaps.	Diagnostic capacity analysis.	Increased diagnostic capacity or a greater understanding of gaps and methods to address these gaps.	Papaya Australia, Hort Innovation, collaborating industries, State and Territory Governments.		
	2.2 Build and maintain international networks of production and biosecurity specialists who can contribute to growth of knowledge and skills within the Australian Papaya industry.	International Biosecurity Network.	Improved preparedness to manage both established and exotic pests.	Papaya Australia, Hort Innovation.		Ongoing
	2.3 Development and implementation of a biosecurity training framework for the Papaya industry.	Biosecurity training framework.	Papaya framework with training modules will assist develop a skilled biosecurity focussed workforce.	Papaya Australia, Hort Innovation, PHA.		
3. Communication and Engagement	3.1 Papaya Australia maintains an industry database which holds current contact information for Papaya growers and key industry stakeholders.	Industry database.	Critical information on biosecurity can be delivered rapidly to the industry.	Papaya Australia, other authorised buyers.		Ongoing
	3.2 Papaya Australia delivers an effective industry communications program with multiple delivery methods which has the capacity to deliver relevant biosecurity information, including Beeaware and the National Fruit Fly Council (NFFC).	Papaya communications program.	The Papaya industry is well informed on the range of issues impacting on industry and business.	Papaya Australia.		Ongoing
	3.3 Promote, disseminate, and demonstrate benefits of biosecurity to industry within and across each component of the supply chain.	BOLT courses.	Improved knowledge of biosecurity and process and systems supporting biosecurity.	Papaya Australia, State and Territory Governments, PHA.		Ongoing
	3.4 Prepare articles (including fact sheets) on biosecurity and key pests (exotic and established) for publication in industry journals and website.	Articles, fact sheets, other information.	Industry stakeholders are informed on pests, current management practices and research activities.	Papaya Australia, State and Territory Governments, PHA.		2021-2022
4. Innovation, Research, Development and Extension	4.1 Review and prioritise Papaya biosecurity Research, Development and Extension (RD&E) annually and identify opportunities for collaboration and cross-sectoral investment.	Papaya biosecurity RD&E plan.	A Papaya innovation and RD&E program that addresses key issues challenging the Papaya industry.	Papaya Australia, Biosecurity Reference Panel (BRP), State and Territory Governments (where appropriate), PHA.		Ongoing
	4.2 Keep informed of activities with SPHD through the national Diagnostic and Surveillance Network Coordinator.	Rapid field diagnostic tools.	More rapid diagnosis of pathogens will asset growers implement the most suitable eradication or management program.	Papaya Australia, State and Territory Governments.		Ongoing
5. Collaboration and partnerships	5.1 Build strong networks among both researchers and regulators in Commonwealth and State/Territory governments.	A robust and collaborative research and regulatory network.	Greater input into future decisions making that may impact on the industry.	Papaya Australia, State and Territory Governments, Universities.		

	5.2 Maintain collaborative arrangements with universities and other research and education providers so opportunities for Papaya research and development activities can be addressed.	Collaborative biosecurity programs.	The Papaya industry maintains access to innovative solutions and products.	Papaya Australia, State and Territory Governments (where appropriate), Universities.		
	5.3 Support addressing gaps in biosecurity preparedness by collaborating with other industries, governments, and other stakeholders.	Collaborative biosecurity programs.	Improved biosecurity preparedness by industry and government.	Papaya Australia, other industries, State and Territory Governments.		
	5.4 Facilitate and maintain an international network of Papaya technical specialists who can contribute to growth of knowledge and skills within the Australian Papaya industry.	Papaya pest and disease network.	Improved capability and capacity to manage both established and exotic pests.	Papaya Australia.		Ongoing
	5.5. Engage in initiatives to improve preparedness and response to cross sectoral pests and or diseases.	Improved preparedness for pests and diseases.	Shared investment into RD&E.	Papaya Australia, Plant Biosecurity Research Initiative (PBRI), PHA.		Ongoing

Australian Papaya industry - biosecurity preparedness

The following table documents the current preparedness documents and activities relating to the Australian Papaya Industry HPP. 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 Papaya industry.

Common name (Scientific name)	National Diagnostic Protocol[38]	Surveillance programs[39]	Fact sheets	Contingency plan	EPPRD category[40]	National Priority Plant Pest[41]	Potential Collaborators[42]
Invertebrates							
Diptera (flies and midges)							
Carambola fruit fly *Bactrocera carambolae*	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[43]	Australian Government & all states (excl. ACT), NAQS[44]	Not developed	Not developed	Not categorised	No. 4	Avocado, Citrus, Mango, Tomato, Vegetable
Guava fruit fly *Bactrocera correcta*	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[43]	Australian Government & all states (excl. ACT), NAQS[44]	Not developed	Not developed	Not categorised	No. 4	Mango
Oriental fruit fly *Bactrocera dorsalis*	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[43]	Australian Government & all states (excl. ACT), NAQS[44]	PHA[45], QDAF[46], NSW DPI[47], NFFC[48]	Not developed	2	No. 4	Avocado, Mango, Summerfruit, Apple and Pear, Citrus, Viticulture, Banana, Coffee, Cherry, Tomato, Vegetable

[38] https://www.plantbiosecuritydiagnostics.net.au/resources/?category=national-diagnostic-protocols

[39] Information presented has been taken from National Plant Biosecurity Status Report 2020, National Plant Health Surveillance Program and the Northern Australian Quarantine Strategy and confirmed through the Plant Health Committee.

[40] https://www.planthealthaustralia.com.au/response-arrangements/emergency-plant-pest-response-deed-epprd/

[41] https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/plant/national-priority-plant-pests-2019

[42] Industries listed in this column identify these pests within their biosecurity plans. Pests listed as a High Priority Pest are indicated by HPP.

[43] https://www.fruitflyidentification.org.au/wp-content/uploads/2018/10/The-Australian-Handbook-for-the-Identification-of-Fruit-Flies-v3.1.pdf

[44] Australian Gov.: Northern Australian Quarantine Survey exotic fruit fly trapping, NSW: Exotic Fruit Flies-Ports & Riverina (protocol based on pheromone traps), Tas.: Fruit Fly Trapping program (area freedom & export protocol), VIC: National Plant Health Surveillance Project (protocol developed), SA: Ports of Entry Trapping Program (protocol developed), WA: Port of Entry Fruit Fly Trapping (Fruit fly Codes of Practice protocol), QLD: Exotic fruit fly trapping (protocol developed), NT: Fruit Fly monitoring and surveillance

[45] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/02/Exotic-fruit-flies-FS.pdf

[46] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease/oriental-fruit-fly

[47] https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/orientalff

[48] https://www.preventfruitfly.com.au/about-the-oriental-fruit-fly/

Common name (Scientific name)	National Diagnostic Protocol[38]	Surveillance programs[39]	Fact sheets	Contingency plan	EPPRD category[40]	National Priority Plant Pest[41]	Potential Collaborators[42]
Tongan fruit fly, Tropical fruit fly *Bactrocera facialis*	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[43]	Australian Government & all states (excl. ACT), NAQS[44]	Not developed	Not developed	Not categorised	Not listed	Mango, Avocado, Tomato
Fijian fruit fly *Bactrocera passiflorae*	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[43]	Australian Government & all states (excl. ACT), NAQS[44]	PHA[49]	Not developed	Not categorised	Not listed	Mango, Avocado, Vegetable
Bactrocera tuberculata	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[43]	Australian Government & all states (excl. ACT), NAQS[44]	Not developed	Not developed	Not categorised	Not listed	Mango
Melon fruit fly *Zeugodacus cucurbitae*	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[43]	Australian Government & all states (excl. ACT), NAQS[44]	PHA[50], QDAF[51], NPBDN/Cesar[52]	Not developed	Not categorised	No. 4	Tomato, Melon, Mango
Hemiptera (Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)							
Coconut bug *Amblypelta cocophaga*	Not developed	Not covered by a pest specific surveillance program	PHA[53]	Not developed	Not categorised	Not listed	
Mealybug *Dysmicoccus grassii* (Syn. *Pseudococcus grassi*)	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	
Mealybug *Dysmicoccus nesophilus*	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	
Coconut mealybug *Nipaecoccus nipae*	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	
Fruit tree mealybug *Rastrococcus invadens*	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	Mango

[49] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/02/Fijian-fruit-fly-FS.pdf
[50] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Melon-fruit-fly-FS.pdf
[51] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/priority-pest-disease/melon-fly
[52] https://www.plantbiosecuritydiagnostics.net.au/resources/melon-fruit-fly-fact-sheet/
[53] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Coconut-bug-FS.pdf

Common name (Scientific name)	National Diagnostic Protocol[38]	Surveillance programs[39]	Fact sheets	Contingency plan	EPPRD category[40]	National Priority Plant Pest[41]	Potential Collaborators[42]
Pathogens							
Bacteria							
Bacterial crown rot, Papaya bacterial canker *Erwinia mallotivora*[54]	Not developed	Not covered by a pest specific surveillance program	PHA[55]	Developed 2011[56]	Not categorised	Not listed	
Viruses and viroids							
Cotton leaf curl Alabad virus *Cotton leaf curl virus (Begomovirus)*	Draft under review (for cotton)	Not covered by a pest specific surveillance program	PHA[57]	Draft submitted for assessment	3 (for cotton)	Not listed	Cotton

[54] In the Biosecurity Reference Panel meeting #4 the scientific name of Bacterial crown rot was updated from *Erwinia papaya*.
[55] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Bacterial-crown-rot-FS.pdf
[56] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Bacterial-crown-rot-CP.pdf
[57] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Apple-maggot-Cotton-leaf-curl-disease-FS.pdf , https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Tarnished-plant-bug-Cotton-leaf-curl-disease-Technical-FS.pdf

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 exotic 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 our way of life.

Plant pests include (but are not limited to) insects, mites, snails or diseases (pathogens, including nematodes) that have the potential to adversely affect fresh food, fibre, ornamental crops, honey bees and stored products, as well as environmental flora and fauna. For agricultural systems, if exotic plant 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 plant 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 focus on continuous improvement from industry and governments to keep Australia's plant biosecurity system effective, 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.

Papaya peak industry body

Papaya Australia is the peak industry body for the papaya industry. Currently Papaya Australia is not a signatory to the EPPRD.

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. The main activities of PHA are funded from annual subscriptions paid by members. The Australian Government, state and territory governments and 38 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 PHA.

Plant Health Australia 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 Australia's plant industries. Through PHA, current and future needs of the plant biosecurity system can be mutually agreed, issues identified, and solutions to problems found. The independence and impartiality of PHA, allows the organisation 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 Australian Papaya Industry was developed in consultation with the Technical Expert Group and Biosecurity Implementation Group. These groups were comprised of plant health and biosecurity experts and industry representatives from key stakeholders.

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

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

Biosecurity planning

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

Ensuring the Papaya 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 economic and social costs of pest incursions on both growers and the wider community. The information gathered during these processes provides additional assurance that the Australian Papaya 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.

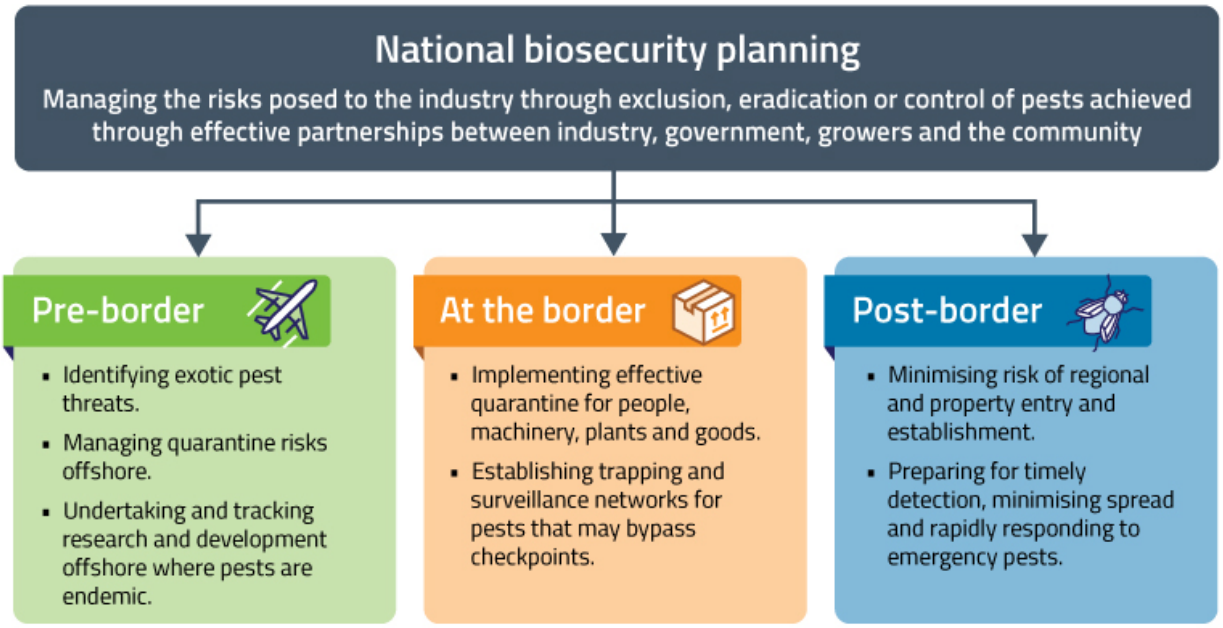

Figure 1. Industry biosecurity: a shared responsibility.

Biosecurity Plan development

With the assistance of Passionfruit Australia, Australian Lychee Growers Association and Papaya Australia, a Tropical Fruits Technical Expert Group (TEG) and a Tropical Fruits Biosecurity Implementation Group (BIG) were formed to work on the review of the Biosecurity Plan for the Papaya industry. These groups were coordinated by Plant Health Australia (PHA) and included representatives from the three industries, relevant Commonwealth, state, and territory agriculture agencies.

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

- identifying and documenting key threats to the Passionfruit 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 Tropical Fruit Technical Expert Group (TEG) and/or the Tropical Fruit Biosecurity Implementation Group (BIG).

NAME	ORGANISATION	AREA OF EXPERTISE	MEMBER OF TEG	MEMBER OF BIG
Jill Houser	ALGA	Industry	✓	✓
Gerard Kath	Papaya Australia	Industry	✓	✓
Joe Zappala	Papaya Australia	Industry		✓
Dennis Chant	Passionfruit Australia	Industry	✓	✓
Jane Richter	Passionfruit Australia	Industry	✓	

Greg Chandler	Hort Innovation	Biosecurity, Research & Development	✓	
Matt Adkins	NSW DPI	Research & Development	✓	
Ruth Huwer	NSW DPI	Entomology	✓	✓
Fucheng Shan	WADPIRD	Research	✓	✓
Touhidur Rahman	WADPIRD	Entomology	✓	
Alison Mackie	WA DPIRD	Pathology, Research		✓
Ceri Pearce	DAF QLD	Pathology	✓	✓
Fiona Giblin	DAF QLD	Pathology	✓	✓
Lindy Coates	DAF QLD	Pathology	✓	
Christine Horlock	DAF QLD	Pathology	✓	
Ian Newton	DAF QLD	Entomology	✓	✓
Jose Liberato	NTDITT	Pathology	✓	✓
Stuart Kearns	PHA	Biosecurity	✓	
Victoria Ludowici	PHA	Biosecurity	✓	
Bosibori Bett	PHA	Biosecurity	✓	
Trevor Dunmall	PHA	Biosecurity	✓	✓
Stephen Quarrell	PHA	Biosecurity		✓
Rebecca Powderly	PHA	Biosecurity		✓

Table 6. Scientists and others who contributed information for the review of the biosecurity plan. [58]

NAME	ORGANISATION	AREA OF EXPERTISE
Cherie Gambley	DAF QLD	Virology
Danuta Knihinicki	DPI NSW	Entomology
Denis Persley	DAF QLD	Virology
Jennifer Cobon	DAF QLD	Nematology
Marc Poole	WA DPIRD	Entomology
Nanditha Panthania	DAF QLD	Pathology
Peter Gillespie	DPI NSW	Entomology
Tony Pattison	DAF QLD	Pathology
Sharl Mintoff	NT DITT	Pathology
Merran Neilsen	NT DITT	Pathology
Brian Thistleton	NT DITT	Entomology

[58] 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 are documented, and
- contact details and references to available resources are accurate.

In addition to the formal review process above, the document should be revisited annually by a Biosecurity Reference Panel comprised of representatives of relevant industry, government and other stakeholder groups as well as PHA, to ensure currency and relevance of information and to monitor progress with implementation. As an example, the industry biosecurity priorities identified within the biosecurity plan could feed directly into industry RD&E priority setting activities on an annual basis.

Opportunities to make out-of-session changes to the biosecurity plan, including the addition/subtraction of HPP or changes to legislation are currently being investigated. Such changes would need to include consultation with and agreement of relevant industry groups and governments. This flexibility enhances the plan's currency and relevance.

THREAT IDENTIFICATION AND PEST RISK ASSESSMENTS

Introduction

This section identifies high-risk exotic plant pest threats to the Australian Papaya 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 Australian Papaya 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 when pest incursions occur. One such mechanism is the EPPRD that has been negotiated between PHA government and industry members. The EPPRD ensures reliable and agreed funding arrangements are in place in advance of EPP incursions and can assist in responses to EPP incursions, particularly for those EPP identified as key threats.

Identification of high-risk exotic plant 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.

Other pests of biosecurity significance are also considered in this biosecurity plan. It has been demonstrated that good biosecurity practice is beneficial for the ongoing management of other pests, as well as for surveillance and early detection of exotic plant pests. Other plant pests cause ongoing hardships for growers and these plant 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 plant pests for the benefit of the Australian Papaya industry.

Exotic plant pests of the Papaya industry

Threat identification

Information on exotic plant pest threats to the Australian Papaya Industry described in this document came from a combination of:

- past records,
- industry practice and experience,
- relevant published literature,
- local industry and overseas research, and
- specialist and expert judgment.

At this time, only invertebrate pests (insects, mites, and molluscs) and diseases (pathogens, including nematodes) of plants have been identified for risk assessment in this biosecurity plan, as these organisms dealt with under the nationally agreed EPPRD. At this time, pest plants (weeds) are dealt with under the National Environmental Biosecurity Response Agreement (NEBRA). If exotic pest plants (weeds) of commercial crops were included in the EPPRD in the future, then the inclusion of pest plants (weeds) of papaya crops would be considered at that time.

Pest risk assessments

The assessment process used in this biosecurity plan was developed in accordance with the International Standards for Phytosanitary Measures (ISPM) No. 2[59] and 11 [Food and Agriculture Organization of the United Nations.[60] A summary of the pest risk analysis protocol followed in this biosecurity plan is shown in Table *7*.

While there are similarities in the ranking system used in this document and the Biosecurity Import Risk Analysis (BIRA)[61] process followed by the Department of Agriculture, Fisheries and Forestry (DAFF), 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.

Modifications of the DAWR[62] (Department of Agriculture and Water Resources, 2016) protocol have been made to suit the analysis required in the biosecurity plan development process, including, but not limited to:

- Entry potential: The determination of entry potential in this biosecurity plan considers 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 in the BIRA process, which only considers legal importation of plants or plant commodities.
- Potential economic impact of pest establishment in this document only considers the impacts on the Australian papaya industry. The BIRA process has a wider scope, including the impacts on all of Australia's plant industries, trade, the environment, social amenity and public health.
- Risk potential and impacts: The categories used in this biosecurity plan for describing the entry, establishment, spread, and potential economic impacts (see page 32) differs in comparison to that used in the 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

[59] FAO (2007).
[60] FAO (2004).
[61] https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/bira-guidelines-2016.pdf
[62] Now the Department of Agriculture, Fisheries and Forestry (DAFF).

The objective of risk assessment is to clearly identify and classify biosecurity risks and to provide data to assist in the evaluation and mitigation 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 Threat Summary Tables (page 61) present a list of potential plant pest threats to the Australian Papaya 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 TST 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 human-assisted spread (including illegal means such as smuggling). This is a broader view of potential risk than the BIRA process conducted by Department of Agriculture, Fisheries and Forestry which focuses 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 biosecurity plans, sharing similar pest ratings. However, the economic impact of a pest is considered at an industry specific level (i.e., only for the Australian Papaya Industry in this biosecurity plan), and therefore this rating may differ between biosecurity plans.

Description of terms used in pest risk tables

The descriptions below relate to terms used in Table 1 and provides an overview of the top ranked biosecurity pest threats (invertebrates, pathogens and nematodes) for the Australian Papaya Industry. Further details on each pest along with the basis for the likelihood ratings are provided in the TST. 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.

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

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

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.

Department of Agriculture and Water Resources 2019b, *Final group pest risk analysis for mealybugs and the viruses they transmit 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/mealybugs/final-report

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[63] and Commonwealth and state/territory legislation.

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the Australian Papaya Industry (Figure 2). Such risk mitigation and preparedness practices are the joint 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 commonwealth, state and territory governments, and Australian Papaya 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 individual situation.

Figure 2. Examples of biosecurity risk mitigation activities.

[63] https://www.ippc.int/en/core-activities/standards-setting/ispms/

Barrier quarantine

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

National level – importation restrictions

The Department of Agriculture, Fisheries and Forestry (DAFF) is the Australian Government department responsible for maintaining and improving international trade and market access opportunities for agriculture, fisheries, forestry, and food industries. DAFF 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.

DAFF is responsible for developing biosecurity (i.e. SPS) risk management policy and reviewing existing quarantine measures for the importation of live animals and plants, and animal and plant products. In particular, DAFF undertakes import risk analyses to determine which products may enter Australia, and under what quarantine conditions. DAFF 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, DAFF 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 DAFF under the Australian Government *Biosecurity Act 2015*. Quarantine policies are developed through the Biosecurity Import Risk Analysis (BIRA) process. This process is outlined in the BIRA Guidelines 2016 (Department of Agriculture and Water Resources, 2016). DAFF maintains barrier quarantine services at all Australian international sea and airports, 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 DAFF.

The Australian Biosecurity Import Conditions Database (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. BICON can be accessed at agriculture.gov.au/import/bicon. For export conditions see the Manual of Importing Country Requirements (MICoR) database at https://micor.agriculture.gov.au/Pages/default.aspx.

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 DAFF on 1800 900 090, or visit the website at awe.gov.au/biosecurity-trade/import/online-services/bicon.

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.

State and regional level – movement restrictions

The ability to control movement of materials that can carry and spread papaya pests is of high importance. Each state/territory may have quarantine legislation in place to control the importation of papaya fruit and or papaya pest carriers interstate and intrastate, and to manage agreed pests if an incursion occurs (contact details in Table 8). 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 Subcommittee on Market Access, Risk and Trade (SMART; previously the Subcommittee 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 papaya can be obtained by contacting your local state or territory agriculture department directly (contact details in Table 8), or through the SMART website[64] 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 and weed seed. 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 agriculture department (contact details in Table 8).

[64] https://interstatequarantine.org.au/

Table 8. 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*	https://www.environment.act.gov.au/__data/assets/pdf_file/0007/902293/act-biosecurity-strategy-2016-2026.pdf	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	https://www.dpi.nsw.gov.au/biosecurity/managing-biosecurity/legislation	(02) 6391 3384
NT	Department of Agriculture and Fisheries, Northern Territory https://daf.nt.gov.au/biosecurity	*Plant Health Act 2008* *Plant Health Regulations 2011*	https://industry.nt.gov.au/__data/assets/pdf_file/0011/396587/Plant-Quarantine-Manual.pdf	(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*	https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/379138/qld-biosecurity-manual.pdf	132 523
SA	Primary Industries and Regions SA pir.sa.gov.au	Plant Health Act 2009 Plant Health Regulations 2022	pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia	(08) 8207 7820
TAS	Biosecurity Tasmania, a part of the Department of Natural Resources and the Environment Tasmania https://nre.tas.gov.au/biosecurity-tasmania	Biosecurity Act 2019 Plant Quarantine Act 1997 Weed Management Act 1999	https://nre.tas.gov.au/documents/Plant%20Biosecurity%20Manual%20Tasmania.pdf	1300 368 550
VIC	Agriculture Victoria, a part of the Department of Energy, Environment and Climate Action https://agriculture.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 Agriculture Management Act 2007	https://www.agric.wa.gov.au/qtine/default.asp	(08) 9368 3333

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 QLD website (Restrictions on moving plant material, soil and related equipment into Queensland | Business Queensland).

Further details can be obtained from the DAF Queensland Customer Service Centre by phoning 13 25 23 or by fax 07 3404 6900.

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 8). 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) 9368 3333.

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 pest entry 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). The Australian Papaya 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, minimises costs associated with eradication and are necessary to meet the treaty obligations of the WTO SPS Agreement with respect to the area freedom status of Australia, Australian states and territories and intra state/territory 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 SPS 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 No. 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, detection techniques available and the potential impact of the pest.

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 to determine the presence or absence in each area (state/territory or region.

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, Fisheries and Forestry (DAFF) maintains barrier quarantine services at all international ports and in the Torres Strait region. DAFF 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).[65] NAQS surveillance programs relevant to the Australian Papaya Industry are listed in Table *9*.

State surveillance programs

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

[65] https://www.agriculture.gov.au/biosecurity-trade/policy/australia/naqs

- communication, training and extension strategies with industry,
- biosecurity training, and
- reporting services to all interested parties (DAFF, national bodies, trading partners and industry).

Various pest surveillance programs are managed by the DAFF and the state/territory agriculture departments. Many state/territory agriculture agencies run diagnostic programs whereby samples of pests suspected to be EPP or HPP can be forwarded to the local agency and diagnosed for the presence of exotic pests free of charge. Official surveillance programs that target pests of the Australian Papaya Industry (exotic or those under official control in a region or state/territory) are shown in Table *9*.

Table 9. Official surveillance programs that target pests of the Passionfruit industry (as of July 2020). [66]

SURVEILLANCE PROGRAM	TARGET PEST(S)	TARGET HOST(S)
Australian Government		
External Territories Surveillance Program	High priority exotic pests	Various environmental, production and ornamental plants
International Plant Health Surveillance Program	High priority exotic pests	Tropical horticultural, environmental and agricultural species
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Bee swarms at first points of entry
National Border Surveillance Program	Specific high priority exotic pests and any pest belonging to key taxonomic groups	Plant families of high economic importance and known or potential key hosts of specific exotic pests, focusing on regulatory import pathway risks
National Plant Health Surveillance Program (delivered through states and territories)	High priority exotic pests including exotic gypsy moth and fruit fly species	Various, based on the species surveyed
Northern Australia Quarantine Strategy – exotic fruit fly trapping	Exotic fruit flies including *Bactrocera dorsalis, B. latifrons, B. trivialis, B. umbrosa, Zeugodacus atrisetosa, Z. cucurbitae, Z. decipiens*	Various
Northern Australia Quarantine Strategy – pest and disease surveys	123 high priority exotic pests, diseases and weeds	Tropical horticultural, environmental and agricultural species
Within New South Wales		
Exotic fruit flies – Riverina	Mediterranean fruit fly (*Ceratitis capitata*), other tri lure responsive exotic fruit flies	Various horticultural crops (citrus, stone fruit)
Exotic longhorn beetle trapping	Asian longhorn beetle (*Anoplophora glabripennis*), Japanese pine sawyer beetle (*Monochamus alternatus*), brown mulberry longhorn beetle (*Apriona germari*)	Various hosts around ports
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment

[66] Information presented has been taken from the National Plant Biosecurity Status Report 2020 and confirmed by the Sub-committee on National Plant Health Surveillance (sub-committee of the Plant Health Committee) and NAQS

National Plant Health Surveillance Program – multi pest surveillance	Multiple including *Bactrocera albistrigata, B. carambolae, B. caryae, B. correcta, B. curvipennis, B. dorsalis, B. facialis, B. kandiensis, B. kirki, B. melanotus, B. occipitalis, B. passiflorae, B. psidii, B. trilineola, B. trivialis, B. umbrosa, B. xanthodes, B. zonata, Ceratitis capitata, Zeugodacus cucurbitae, Z. tau,* gypsy moth (*Lymantria* spp.), 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
Serpentine leafminer	Serpentine leafminer (*Liriomyza huidobrensis*)	Multiple horticultural and ornamental hosts
Within the Northern Territory		
Area Freedom Surveillance Program	Queensland fruit fly (*Bactrocera tryoni*)	Horticultural crops
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca, Aethina tumida,* acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris,* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including citrus canker (*Xanthomonas axonopodis* pv. *citri*), huanglongbing (*Candidatus* Liberibacter spp.), Asiatic citrus psyllid (*Diaphorina citri*), giant African snail (*Achatina fulica*), glassy winged sharpshooter (*Homalodisca vitripennis*), Pierce's disease (*Xylella fastidiosa*), banana black sigatoka (*Mycosphaerella fijiensis*), red imported fire ant (*Solenopsis invicta*), electric ant (*Wasmannia auropunctata*), yellow crazy ant (*Anoplolepis gracilipes*), *Bactericera cockerelli*, *Candidatus* Liberibacter solanacearum, potato leafminer, pea leafminer, serpentine leafminer (*Liriomyza huidobrensis*), American leafminer (*Liriomyza trifolii*), vegetable leafminer (*Liriomyza sativae*), exotic fruit flies (*Bactrocera* spp. and *Ceratitis* spp.)	Multiple
Plant Pest Diagnostic Service – horticulture	All pests and pathogens that can affect horticultural crops (mango, chilli, watermelon, Cucurbitaceae)	Horticultural crops
Regional Fruit Fly Monitoring and Surveillance	Exotic fruit flies (*Bactrocera* spp. and *Ceratitis* spp.)	Horticultural crops
Within Queensland		
Area freedom surveys	Multiple pests	Multiple
Exotic Fruit Fly in the Torres Strait Program	Exotic fruit fly including *Bactrocera* and *Zeugodacus* spp.	Multiple
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
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca, Aethina tumida,* acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris,* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program	Multiple, including exotic fruit flies and Mediterranean fruit fly (*Ceratitis capitata*), exotic gypsy moths, Pierce's disease (*Xylella fastidiosa*) and	Multiple

– multi pest surveillance	glassy winged sharpshooter (*Homalodisca vitripennis*), and brown marmorated stink bug (*Halyomorpha halys*).	
Bee pest and pest bee diagnostic service	Multiple pests	European honey bee
Within South Australia		
Area freedom surveys	Multiple pests	Multiple
Bee surveillance – endemic disease	American foulbrood (*Paenibacillus* spp.)	European honey bees
Mediterranean fruit fly	Mediterranean fruit fly (*Ceratitus capitata*)	Horticultural crops
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple, including exotic invasive ants (tramp ants), Asian and African citrus psyllids (*Diaphorina citri*, *Candidatus* Liberibacter africanus), huanglongbing (*Candidatus* Liberibacter asiaticus), citrus canker (*Xanthomonas axonopodis* pv. *citri*), glassy winged sharpshooters (*Homalodisca vitripennis* and *H. coagulata*), brown mamorated stink bug (*Halyomorpha halys*), xylella (*Xylella fastidiosa*)	Multiple
Ports of Entry Trapping Program	Multiple – *Bactrocera albistrigata, B. carambolae, B. caryae, B. correcta, B. curvipennis, B. dorsalis, B. facialis, B. kandiensis, B. kirki, B. melanotus, B. occipitalis, B. passiflorae, B. psidii, B. trilineola, B, trivialis, B. tryoni, B. umbrosa, B. xanthodes, B. zonata, Ceratitis capitata, C. rosa, Zeugodacus cucurbitae, Z. tau*	Various fruit fly hosts
Mediterranean fruit fly	Mediterranean fruit fly (*Ceratitis capitata*)	Horticultural crops
Queensland fruit fly	Queensland fruit fly (*Bactrocera tryoni*)	Horticultural crops
Within Tasmania		
Bee surveillance – endemic disease and pests	American foulbrood (*Paenibacillus* spp.), European foulbrood (*Melissococcus pluton*), chalkbrood (*Ascophera apis),* sacbrood (*Nosema apis, N. ceranae),* sacbrood virus (*Morator aetatulas*), greater wax moth *(Galleria mellonella)*, lesser wax moth (*G. achroia grisella)*, European wasps (*Vespula germanica*), *Braula coeca,* bumble bee *(Bombus terestris)*	European honey bees
Fruit fly trapping surveillance	*Bactrocera dorsalis, B. tryoni, Ceratitis capitata* and exotic fruit flies	Host fruit trees, fruit and vegetables
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Aethina tumida*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Brown marmorated stink bug (*Halyomorpha halys*), citrus canker (*Xanthomonas citri* subsp. *citri*), gypsy moths (including *Lymantria albescens, L. atameles, L. concolor, L. dispar asiatica, L. dispar dispar, L. dispar japonica, L. dissoluta, L. fumida, L. marginata, L. minomonis, L. monacha, L. postalba, L. pulverea, L. sinica, L. umbrosa, L. xylina*), huanglongbing (*Candidatus* Liberibacter asiaticus), *Bactericera cockerelli*, *Diaphorina citri*, *Trioza erytreae*, *B. trigonica*, *Trioza apicallis*, Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*), *Bactrocera, Zeugodacus* and *Ceratitis spp.* (exotic fruit fly species)	Multiple

Within Victoria		
Alert contacts	All plant pests	All hosts, general surveillance
Exotic fruit flies – Sunraysia	Mediterranean fruit fly (*Ceratitis capitata*)	Various horticultural crops (citrus, stone fruit)
MyPestGuide e-surveillance	All plant pests	All hosts, general surveillance
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including citrus canker (*Xanthomonas axonopodis* pv. *citri*), exotic fruit flies (*Bactrocera* spp., *Ceratitis captitata*), Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*), plum pox virus, Asian gypsy moth (*Lymantria dispar* and other *Lymantria* spp.), brown marmorated stink bug (*Halyomorpha halys*), Asian citrus psyllid (*Diaphorina citri*), African citrus psyllid (*Trioza erytreae*) and spotted wing drosophila (*drosophila suzukii*)	Multiple
Passive MedFly Program	Mediteranean fruit fly (*Ceratitis capitata*)	Fruit trees in backyards
Urban Plant Health Network	Various, including brown marmorated stink bug (*Halyomorpha halys*), Asian citrus psyllid (*Diaphorina citri*), African citrus psyllid (*Trioza erytreae*), Asian honeybee, red imported fire ant (*Solenopsis invicta*), spotted wing drosphila (drosophila suzukii) and glassy winged sharpshooter (*Homalodisca vitripennis*)	Multiple plant hosts in periurban landscape, including community gardens
Within Western Australia		
Ant Blitz	Browsing ant (*Lepisiota frauenfeldi*), Red Imported Fire Ant (*Solenopsis invicta*), Small black sugar ant (*Lepisiota capensis*)	Urban areas
Biosecurity Blitz	All plant pests	General surveillance, all hosts
Medfly Area Freedom (Ord River Irrigation Area)	Mediterranean fruit fly (*Ceratitis capitata*)	Many horticultural hosts
MyPestGuide e-surveillance	All plant pests	All hosts, general surveillance
National Bee Pest Surveillance Program	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including Asian citrus psyllid (*Diaphorina citri*), citrus canker (*Xanthomonas axonopodis* pv. *citri*), citrus longicorn beetle (*Anoplophora chinensis*), glassy winged sharpshooter (*Homalodisca vitripennis*), xylella (*Xylella fastidiosa*), brown marmorated stink bug (*Halyomorpha halys*)	Pome and citrus crops
Port of Entry – Asian gypsy moth trapping	Asian gypsy moth (*Lymantria dispar*)	More than 600 forest, orchard, ornamental and native species
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

Farm level pest monitoring

Farm level monitoring involves the participation and interaction of growers, agribusinesses 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 plant pests early and implementing eradication or management responses.

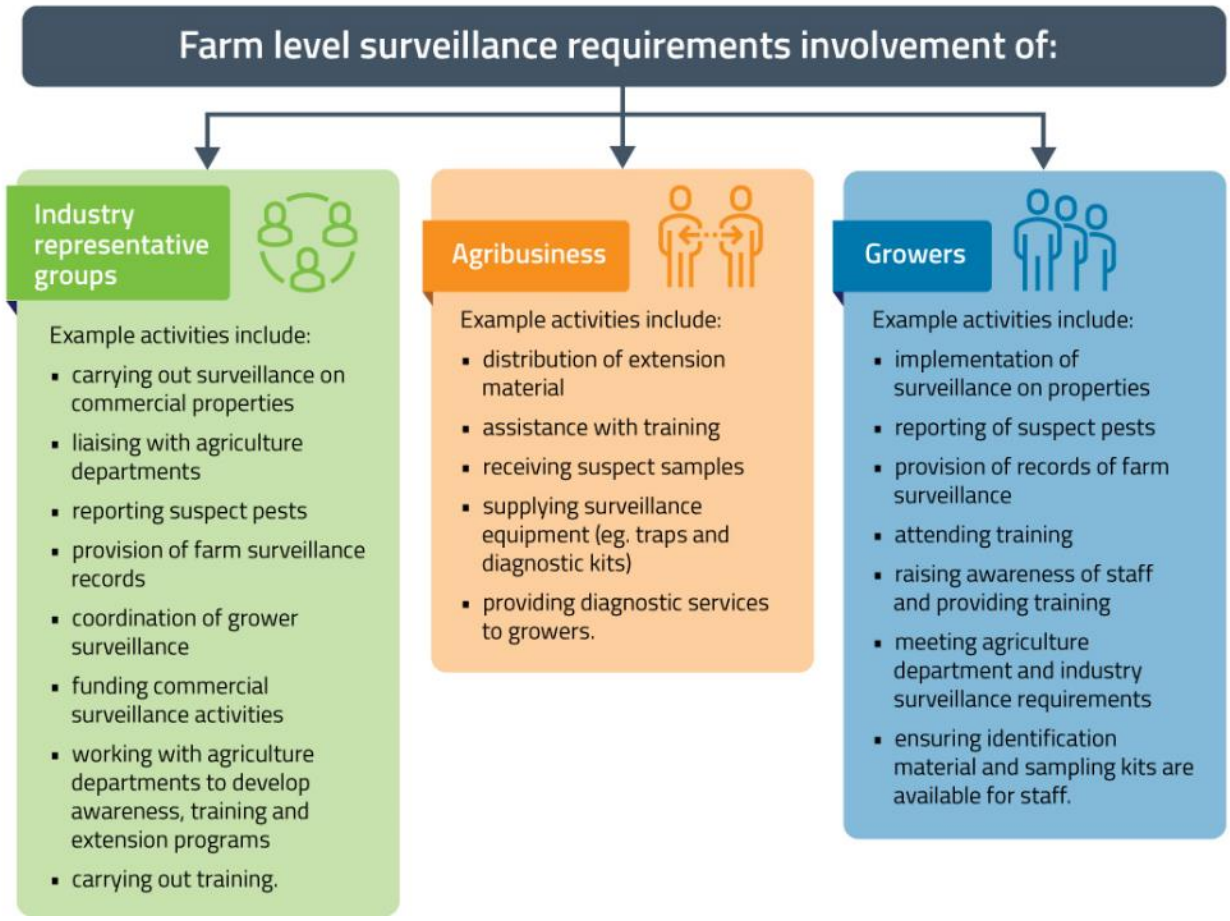

Figure 3. Examples of farm level surveillance activities.

Training

A key component of biosecurity preparedness is ensuring personnel engaged are 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 relevant governments and peak industry bodies who will be involved in responding to exotic plant pest incursions 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 Australian Papaya 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).

Pests contained in Table 1 have been identified as high priority plant pest threats to the Australian Papaya 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 contain information on pests across most plant industries, including the Papaya industry.

Table 10. Sources of information on high priority pest threats for the Papaya industry.

SOURCE	WEBSITE
CABI – Crop Protection Compendium	cabi.org/cpc/
DAF QLD Priority plant pests and diseases	https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease
Department of Agriculture, Water and the Environment	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 Papaya industry biosecurity (Table 11).

Table 11. Industry and government contact details.

AGENCY	WEBSITE/EMAIL	PHONE	ADDRESS
National			
Papaya Australia	australianpapaya.com.au/	0488 932 123	
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 info@daf.qld.gov.au	13 25 23	41 George Street Brisbane, QLD 4000
Northern Territory			
Department of Industry, Tourism and Trade	industry.nt.gov.au/	(08) 8999 5511	Berrimah Farm, Science Precinct 29, Makagon Road Berrimah, NT 0828
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	DPIRD, 1 Nash Street, Perth, WA 6000 DPIRD, Locked Bag 4, Bentley Delivery Centre, WA 6983

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 papaya that are not currently known to be present in Australia.

Farm biosecurity measures can be used to minimise the impacts of both exotic and established plant pests The farm biosecurity and hygiene measures outlined in this section, can be considered as options for each farm's risk management. Many of these measures can be implemented in a range of different ways, so that the individual needs of any given farm can be addressed, and each farm can have an appropriate level of biosecurity.

Farm biosecurity measures, reporting procedures and hygiene strategies that reduce the impact of plant pest threats covered in this document are:

- selection and preparation of appropriate planting material,
- appropriate use of chemical and other plant pest control measures,
- control of vectors,
- control of alternative hosts,
- management of 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,
- managing the movement of people,
- how to safely visit other farms/orchards (including interstate and international trips) – what to watch out for when you return,
- including farm biosecurity in industry best management practice and quality assurance schemes, and
- an example farm biosecurity checklist.

Development of an specific farm biosecurity plan tailored to the needs of an individual business or farm is a good way to integrate best practice biosecurity into day-to-day operations (farmbiosecurity.com.au/planner/).

Further information on farm biosecurity can be found at farmbiosecurity.com.au.

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 *12***.** 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 12. 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 https://www.daf.qld.gov.au/contact/report-a-biosecurity-pest-or-disease
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 state or territory.

Some papaya 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 agriculture agency of the presence of those pests within a defined timeframe.

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**.** Over time, as more resources are produced for pests of the Australian Papaya 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 HPP (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 TST.

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 4 for a list of current fact sheets available for papaya 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. 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 how to diagnose or identify a specific plant pest, or related group of pests. National Diagnostic Protocols (NDP) are nationally agreed diagnostic protocols for the unambiguous taxonomic identification of a pest in a manner consistent with ISPM No. 27 – Diagnostic Protocols for Regulated Pests. NDP include diagnostic procedures and data on the pest, its hosts, taxonomic information, and detection and identification.

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

Endorsed NDP 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 papaya pests 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. The Handbook is endorsed by the Subcommittee on Plant Health Diagnostics (SPHD).

Research, Development and Extension

Research, Development and Extension – Linking Biosecurity Outcomes to Priorities

Through the biosecurity planning process, gaps in knowledge or the extension of knowledge will have been identified and 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 goals 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 papaya industry

Export is currently not a major focus for the papaya industry. There is limited data to support evidence of substantial export volumes.

Implementation actions

To help maintain or facilitate domestic market access, in the event of an incursion, the papaya industry in partnership with the DAFF and the relevant state and territory governments should develop the following, for the HPP pests:

- 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. 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 incident response 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 the detection of an Emergency Plant Pest (EPP) within Australia.

Currently Papaya Australia is not a member of PHA nor a EPPRD signatory. As such in the event of an incursion and response to an exotic pest, Papaya Australia may not have a formal role in the decision-making processes involved in the response. The following sections would be applicable in the event Papaya Australia becomes a PHA member and EPPRD signatory.

The following section includes key contact details and communication procedures that should be used in the event of an incursion. 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 Papaya 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 commonwealth, state and territory governments, 38 plant industries (including ALGA) and PHA (collectively known as the signatories), that facilitates the rapid and efficient responses EPP incursions. The EPPRD is a legally binding document that outlines the basic operating principles and guidelines for EPP eradication responses.

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 associated with eradication activities undertaken in response to the detection of EPP 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 suspected 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.
- Mechanisms to support early detection and response to EPP.
- Rapid responses to EPPs (excluding weeds).
- A framework to ensure that 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.
- 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 *13*). 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 13. 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*.

EPPs that are relevant to papaya categorised to date

EPPs relevant to the Papaya industry that are categorised and listed within Schedule 13 of the EPPRD.

Table 14. Formal categories for pests of the Papaya industry listed in Schedule 13 of the EPPRD (as of July 2021).

FORMAL CATEGORY	SCIENTIFIC NAME	COMMON NAME
2	*Bactrocera dorsalis* (syn. *B. invadens, B. papayae, B. philippiensis*)	Oriental fruit fly

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 incursion is confirmed to be an EPP, and the formal notification processes are complete, all signatories affected by the EPP participate in the national management of the EPP. Formal activities undertaken by signatories to respond to an EPP incursion are documented in a Response Plan. This is primarily through the two national decision-making committees:

- The Consultative Committee on Emergency Plant Pests (CCEPP) which provide scientific and technical expertise on the pest, mitigating measures and response activities, and
- The National Management Group (NMG) which acts on recommendations from the CCEPP and make the final decisions about EPP responses (such as approving formal response plans) and funding.

Technical and economic considerations are reviewed by the CCEPP, 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 to accept the presence of the pest and transition to long term management).

The relevant state/territory agriculture department is responsible for the on-ground activities stipulated by the Response Plan, 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, and
- control or containment measures.

Each response to an EPP is different 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 (ORC) 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.

ORC were developed to encourage early reporting and increase the chance of successful eradication. ORC 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.

ORC are only available when there is an approved Response Plan under the EPPRD, and only to industries that are signatories to the EPPRD.

The value of ORC 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

Papaya Australia is the peak industry body for the Papaya industry. Although not currently a member of PHA nor a signatory to the EPPRD, it is likely that Papaya Australia will be an industry contact point if a plant pest affecting the Papaya industry is detected.

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 15. Contact details for Papaya Australia.

Website	australianpapaya.com.au
Email	admin@australianpapaya.com.au

References

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

APPENDIX 1: PROFILE OF THE AUSTRALIAN PAPAYA INDUSTRY

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

Papaya Australia

Papaya Australia is the recognised body representing the Australian Papaya industry along with its growers, industry people, associated businesses and its members. It was formed in 2002 to represent the interests of Australian papaya/papaw growers and foster the growth of the industry.

All commercial Papaya growers in Australia pay statutory national levies which are used for research and development (R&D) and marketing. These levies are collected by the Australian Government. Papaya Australia works closely with Hort Innovation through the Papaya Strategic Industry Advisory Panel (SIAP) to ensure that the R&D and marketing levies are well directed to the needs of the industry The Papaya Strategic Investment Plan 2017-2021 provides guidance in the investment of Papaya marketing and R&D levies.

Papaya	Marketing	R&D	TOTAL
Fresh - domestic and export	1 cent per kilogram	1 cent per kilogram	**2 cents per kilogram**
Processing	-	0.25 cents per kilogram	**0.25 cents per kilogram**

Figure 5. Papaya levy and charge rates as of November 2024.[67]

[67] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/levies/rates/papaya

Industry profile

The Australian papaya industry has growers across Northern Australia from Queensland to Western Australian with production of 21,760 tonnes in 2022/23 for a farm gate value of $39.0 million (Australian Horticulture Statistics Handbook 2022/23). Over 85% of production comes from Queensland with growers spread between Bundaberg (South east Queensland) and Lakeland (Far North Queensland). Product is either yellow, referred to as papaw, or red fleshed, known as papaya[68]. In northern Australia, papaya grows all year round and because of this the industry has the capacity to provide consistent supply of fruit to consumers and year-round income to growers. There are over 130 growers in Australia, but production is dominated by several large producers.

Growers produce different varieties that include hybrids of both yellow and red breeds. Understanding consumer taste provides the best basis for determining how varieties should be developed through additional research such as the papaya breeding program. Commercial lines and breeding lines will conduct taste trials to incorporate consumer preferences with the breeding project. Production occurs in tropical and sub-tropical areas and the crops are susceptible to a variety of pests and fungal disease. Some of these pests and diseases also affect other fruit varieties and there is opportunity for collaboration on research in these areas.

Specific research in papaya to address ongoing improvements in production and development of varieties that are resistant to some of the pests and diseases will provide benefits across the industry. Papaya is viewed as a fruit that has good opportunities to significantly expand within the domestic market but to do this the industry needs to develop a more consistent product, so the retailers and consumers have confidence in the ongoing quality and supply.

Red papaya and yellow papaws are predominately grown in the warmer tropical climate areas of Tully, Mareeba, and Innisfail to Mossman in Far North Queensland. There are also plantings in Lakeland, Far North Queensland as well as in Darwin, Northern Territory and Kununurra, Western Australia. Both are available all year round with increased supply during spring and autumn. Currently papaw and papaya varieties are based on a range of commercially available Australian-produced hybrid varieties[69], imported seed and grower-bred seed stock. Red-fleshed Hybrid RB1, Sunrise Solo, Linda Solo and Sunset Solo are the most popular papaya varieties grown in Far North Queensland.

Papaya grown in Queensland can be transported to all Australian states and territories except Western Australia. Queensland grown papaya is unable to be transported to Western Australia due to import requirements related to pests and diseases of biosecurity concern to Western Australia.

Fruit consigned to Tasmania, Victoria, South Australia and certain areas within New South Wales must be produced and treated under specific Interstate Certification Assurance (ICA) schemes (Papaya Industry Strategic Plan 2022-2026).

References

Hort Innovation (2024). *Australian Horticulture Statistics Handbook (AHSH) 2022/23*. Horticulture Innovation Australia Limited, Sydney NSW. Available online at: https://public.tableau.com/app/profile/flopenanalytics/viz/HortStatsOnlinev1_1FY23-HIADRAFTMain/MainPage

Papaya industry Strategic Plan 2022-2026. Horticulture Innovation Australia Limited, Sydney NSW. Available online at: https://www.australianpapaya.com.au/wp-content/uploads/bsk-pdf-manager/2024/04/PapayaSIP-2022-26.pdf

[68] The terms papaya and papaw are referred to differentiate the product in the papaya industry

[69] (papaw – 1B and 13, papaya – RB1, RB2, RB4),

APPENDIX 2: THREAT SUMMARY TABLES

The information provided in the threat summary tables is an overview of exotic plant pest threats to the Papaya Industry. More than 120 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[70] or eradication may be included in these tables where appropriate. However, 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 32. Additional information on a number of the pests listed in the TSTs can be found in Table 4.

Invertebrates

Table 16. Papaya invertebrate threat summary table.

SCIENTIFIC NAME	COMMON NAME	PRIMARY HOSTS	AFFECTED PLANT PART	MOVEMENT & DISPERSAL	GEOGRAPHIC RANGE	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Amblypelta cocophaga[71]	Coconut bug	Papaya, navel orange, coconut, melon, mango, cassava, peach, sugarcane, cocoa, kapok, *Passiflora quadrangularis*, winged bean, *Eucalyptus deglupta*, *E. terecornis*, *E. urophylla*	Stems, growing points, fruit	Infested plant material and machinery. Adult females capable of flight. Nymphs are active crawlers.	Asia (Singapore) Oceania (Fiji, Papua New Guinea, Solomon Islands)	HIGH	HIGH	HIGH	HIGH	HIGH
Dysmicoccus nesophilus[72]	Mealybug	Polyphagous including sweet orange, grapefruit, lemon, papaya, mango, avocado, pines, taro, ginger, tamarillo, figs, coffee.	Leaves, flowers, fruit	Infested plant material. Adult males capable of flight over short distances.	Oceania (Cook Islands, Fiji, Kiribati, Papua New Guinea, Tonga, Tuvalu, Western Samoa)	HIGH	HIGH	HIGH	HIGH	HIGH
Helopeltis clavifer	Cocoa mirids	Passionfruit, tea, cocoa; cashew, sweet potato and other host plants reported from New Guinea include *Acalypha caturus, Annona* spp., *Bixa orellana, Camellia sinensis,* *Cassia fistula, Centrosema pubescens, Eucalyptus deglupta, Flemingia strobilifera, Glincidia sepium, Ixora* sp.,	Pods	Infested plant materials	Asia (Indonesia, Malaysia) Oceania (Papua New Guinea); New Britain and New Ireland	HIGH	HIGH	HIGH	HIGH	HIGH

[70] 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.

[71] Numerous *Amblypelta* species are established in Australia making diagnostics difficult. This pest can fly but only over short distances making natural dispersal into new areas unlikely (CABI). Causes reduced fruit set and fruit damage. Eggs are not ususally laid on fruit making it unlikely that this pest would enter Australia through infested fruit. Long range dispersal is generally through infested planting material.

[72] http://scalenet.info/catalogue/Dysmicoccus%20nesophilus/

		Leucaena leucocephala, Mangifera indica, Mimosa invisa, Passiflora edulis, Persea americana, Polyscias sp., *Psidium guajava* and *Pueraria phaseoloides*.								
Nipaecoccus nipae[73]	Coconut mealybug, spiked mealybug, nipa mealybug, avocado mealybug, sugar apple mealybug, Kentia mealybug	Polyphagous including breadfruit, pigeon pea, papaya, citrus, coconut, fig, rubber plant, soursop, sugar apple, breadfruit, pigeon pea, sweet potato, mango, cassava, mulberry, banana, olive, orchids, avocado, guava, potato, cocoa, grape, ginger	Fruit, leaves, stems, growing point	Infested plant material and machinery, adult males capable of flight.	Africa (Algeria, Madagascar, Morocco, South Africa, Zimbabwe) Asia (Bangladesh, China, Georgia, India, Indonesia, Pakistan, Philippines, South Korea, Thailand, Turkey, Vietnam) Europe (Austria, Belgium, Czechoslovakia, France, Hungary, Italy, Poland, Portugal, , Russia, Spain, United Kingdom) North America (Antigua and Barbuda, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Jamaica, Mexico, Nicaragua, Panama, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, U.S. Virgin Islands, United States) Oceania (Federated States of Micronesia, Fiji, Guam, Samoa, Solomon Islands) South America (Argentina, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Venezuela)	HIGH	HIGH	HIGH	HIGH	HIGH
Rastrococcus invadens	Fruit tree mealybug	Breadfruit, papaya, Citrus, figs, mango, banana, passionflower, frangipani, guava	Fruit, inflorescence, leaves, stems		Africa (Benin, Burkina Faso, Congo, Democratic Republic of the, Congo, Republic of the, Côte d'Ivoire, Gabon, Ghana, Nigeria, Senegal, Sierra Leone, Togo) Asia (Bangladesh, Bhutan, China, Hong Kong, India, Indonesia, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam) South America (French Guiana)	HIGH	HIGH	HIGH	HIGH	HIGH

[73] http://www.cabi.org/cpc/datasheet/36334
http://entnemdept.ufl.edu/creatures/orn/mealybug/coconut_mealybug.htm
N. nipae is polyphagous and attacks 80 genera of plants belonging to 43 families.

Tetranychus piercei[74] (Syn. *T. manihotis*)	Pierce's spider mite; Red spider mite	Highly polyphagous including peanut, papaya, butterfly-pea, sweet potato, banana, bean, castor bean, *Ageratum spp*., cucurbits, maize, rose, banana, grapevine, cassava, eggplant, mulberry, passionfruit, peach, oil palm, lab lab, soybean, maize, turmeric, grape, capsicum, jasmine, rose, frangipani, taro, wild ginger, cowpea, mungbean	Above ground plant parts (Leaves, fruits)	Infested plant material and machinery, natural dispersal from PNG (wind dispersal for localised spread)	Asia (Bangladesh, China, Indonesia, Malaysia, Japan, Philippines, Taiwan, Thailand, South Korea, Vietnam) North America (Suriname) Oceania (Papua New Guinea)	MEDIUM Papaya	HIGH Papaya	HIGH Papaya	MEDIUM - HIGH Papaya	MEDIUM – HIGH Papaya
Anastrepha ludens	Mexican fruit fly	Cashew nut, cherimoya, hardshell custard-apple, soursop, sugar apple, papaya, *Citrus* spp., coffee, persimmon, apple, mango, passionfruit, avocado, peach, strawberry guava, guava, pomegranate, European pear, rose apple	Fruit	Infested plant material, machinery and soil. Adults are capable of flight over long distances [209]. Transmitted via infested plant material (fruit and puparia in soil or packaging with plants that have already fruited).	North America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, United States)	LOW Papaya Passionfruit,	HIGH Papaya LOW Passionfruit	HIGH Papaya LOW Passionfruit	HIGH Papaya MEDIUM Passionfruit	MEDIUM Papaya LOW Passionfruit
Anastrepha spp, *Inc.* *A. distincta* *A .fraterculus* *A. pseudoparallela* *A. serpentina*		Polyphagous, wide variety of hosts including Papaya, mango, citrus, guava, caimito, kiwifruit, cherimoya, soursop, sugar apple, carambola, coffee, quince, persimmon, loquat, common fig, round kumquat, walnut…	Fruit	Infested plant material (including fruit), soil and machinery. Adults capable of flight over long distances. Pupariation is in the soil	North, central and South America (Species have different geographical ranges	LOW Papaya Passionfruit	MEDIUM Papaya Passionfruit	MEDIUM Papaya Passionfruit	MEDIUM Papaya Passionfruit	LOW Papaya Passionfruit
Bactrocera carambolae	Carambola fruit fly	Highly polyphagous (75 hosts from 26 families) including grapefruit, orange, lemon, lime, mandarin, cashew, breadfruit, jackfruit, soursop, carambola, capsicum, mango, guava, passionfruit, papaya, banana, avocado, tomato, bell pepper, coco plum, navel orange, pomegranate, mangrove, common jujube	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Asia (Brunei, India, Indonesia, Malaysia, Singapore, Thailand) South America (Brazil, French Guiana, Guyana, Suriname)	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit

[74] Present in the Philippines. Modelling of potential distribution does not put Australia as an area the mite may expand to
After spraying to control banana weevil, mites become more abundant and are currently causing damage in the Australian banana industry. This mite species could cause significant issues if it becomes established in Australian banana growing regions. *T. piercei* is found in the Far northern biosecurity zone.

Bactrocera correcta	Guava fruit fly	Cashew nut, carambola, papaya, *Citrus* spp., melon, longan tree, mango, sapodilla, Spanish cherry, plantain, cherry, peach, guava, black plum, rose apple, Malay apple, water apple, Singapore almond, common jujube	Fruit		Asia (Bhutan, China, India, Japan, Myanmar, Nepal, Pakistan, Sri Lanka, Taiwan, Thailand) North America (United States)	HIGH Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya
Bactrocera curvipennis (Syn. *Chaetodacus curvipennis; Dacus curvipennis; Strumeta curvipennis*)	Banana fruit fly	Polyphagous (41 hosts from 20 families) including *Citrus spp*., mango, papaya, grape, tomato, bell pepper, capsicum, nectarine, peach, plum, coffee, sweet pepper, strawberry	Fruit	Infested plant material (fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the soil.	New Caledonia, Vanuatu, Fiji	UNKNOWN Papaya	UNKNOWN Papaya	UNKNOWN Papaya	UNKNOWN Papaya	UNKNOWN Papaya
Bactrocera diversa (Syn. Asiadacus diversus; Dacus diversus)	Fruit fly, three striped	*Citrus spp*., papaya, gourd, pumpkin, guava, jamun, marrow	Fruit		Asia (China, India)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Bactrocera dorsalis (Syn. Bactrocera; Bactrocera invadens; Bactrocera papayae; Bactrocera philippinensis;	Oriental fruit fly, Philippine fruit fly, Invasive fruit fly, Asian Papaya fruit fly	Lychee, papaya, passionfruit, red fruit passion flower, giant granadilla, corkystem passionflower, red-bead tree, cashew nut, cherimoya, pond apple, soursop, bullock's heart, wild custard apple, sugar apple, black currant tree, coral berry, sugar palm, breadfruit, jackfruit, champedak, monkey jack, bilimbi, carambola, Akee apple, toddy palm, Alexandrian laurel, perfume tree, Indian caper, bell pepper, chilli, tummy wood, caranda, white sapote, evergreen chinkapin, Chittagong wood, Citrus, watermelon, scarlet-fruited ivy gourd, coffee, melon, cucumber, giant pumpkin, marrow, Burma simpoh, longan tree, persimmon, loquat, weeping fig, Indian laurel tree, cluster tree, sacred fig tree, sycamore fig, governor's plum, rukam, round kumquat, oval kumquat, mangosteen, dragon fruit, wild mango, bottle gourd, langsat, Indian laurel, acerola, apple, mango, sapodilla, Spanish cherry, bitter gourd, black mulberry, banana, plantain, avocado, common bean, cutleaf groundcherry, black pepper, fijian longan, Trifoliate orange, canistel, apricot, sweet cherry, sour cherry, plum, peach, Japanese plum, strawberry guava, guava, pomegranate, European	Fruit	Infested plant material (including fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the soil[33]	Asia (Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Christmas Island (Indian Ocean), India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, United Arab Emirates, Vietnam) Africa, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Liberia, Madagascar, Mali, Mauritania, Mayotte, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe) North America (USA) Europe (Italy) Oceania (Federated states of Micronesia, French Polynesia, Northern Mariana Islands, Palau, Papua New Guinea)	HIGH Lychee, Papaya, Passionfruit	HIGH Lychee, Papaya, Passionfruit	HIGH Lychee, Papaya, Passionfruit	HIGH Papaya, Passionfruit LOW Lychee	HIGH Papaya, Passionfruit, LOW Lychee

		pear, Oriental pear tree, mangrove, Downy rose-myrtle, marula, grey bitter-apple, tomato, aubergine, watery rose-apple, clove, black plum, sea apple, rose apple, Malay apple, water apple, Singapore almond, cocoa, limeberry, christmas palm, shea tree, common jujube, jujube, pomelo, tropical almond, star fruit, sour orange, calamondin orange								
Bactrocera facialis	Tongan fruit fly, tropical fruit fly	*Citrus spp*., mango, papaya, avocado, passionfruit, peach, guava, cashew nut, capsicum, tomato, breadfruit, longan tree	Fruit	Infested plant material (including fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the soil.	Oceania (Tonga)	HIGH Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya
Bactrocera kandiensis	Sri Lankan fruit fly	Cashew nut, jackfruit, carambola, papaya, pummelo, mango, avocado, guava, pomegranate, clove, rose apple, calamandarin	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Asia (Sri Lanka)	UNKNOWN Papaya	UNKNOWN Papaya	UNKNOWN Papaya	UNKNOWN Papaya	UNKNOWN Papaya
Bactrocera melanotus	Asian papaya fruit fly, Cook Islands fruit fly	Papaya, *Citrus spp*., mango, longan, guava	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Oceania (Cook Islands)	MEDIUM Papaya	MEDIUM Papaya	MEDIUM Papaya	HIGH Papaya	MEDIUM Papaya
Bactrocera passiflorae	Fijian fruit fly	Polyphagous (49 hosts in 28 families) including Cashew, breadfruit, papaya, lime, mandarin, mango, passionfruit, giant granadilla, avocado, guava, eggplant, cocoa	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Oceania (Fiji, Niue, Tonga, Tuvalu, Wallis & Futuna)	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit
Bactrocera psidii	South sea guava fruit fly	Candlenut tree, mango, pummelo, mango, fig, cashew, custard apple, granadilla, strawberry guava, guava, rose apple, papaya, carambola, peach, plum, grape	Fruit	Infested plant material (including fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the soil.	Oceania (New Caledonia)	HIGH Papaya	HIGH Papaya	HIGH Papaya	UNKNOWN Papaya	Unknown Papaya
Bactrocera trilineola[75]	Vanuatu fruit fly	Papaya, *Citrus* spp., guava, Malay apple, Suriname cherry, tropical almond,	Fruit	Infested plant material (fruit).	Oceania (New Caledonia, Vanuatu)	MEDIUM Papaya	MEDIUM Papaya	HIGH Papaya	MEDIUM Papaya	LOW Papaya

[75] Leblanc, L., Vueti, E. T., & Allwood, A. J. (2013). Host plant records for fruit flies (Diptera: Tephritidae: Dacini) in the Pacific Islands: 2. Infestation statistics on economic hosts.

		Tahitian chestnut, carambola, avocado, mango, soursop, pineapple, cashew, breadfruit, plantain, guava, kumquat, Pacific lychee, *Syzygium* spp., Indian almond, *Musa* spp.		Adults capable of flight. Pupae are soilborne.						
Bactrocera tuberculata[76]	No common name	Mango, papaya, *Syzygium* spp., peach, sapodilla	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Asia (Bangladesh, Bhutan, China, Myanmar, Thailand, Vietnam)	MEDIUM Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya
Bactrocera xanthodes[77]	Pacific fruit fly	Papaya, passionfruit, breadfruit, mandarin, guava, tomato, soursop, mango, tropical almond, watermelon, avocado, Tahiti chestnut, jackfruit, round kumquat, tangerine, sweet orange, star apple, pomelo, capsicum	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Oceania (American Samoa, Cook Islands, Fiji, Nauru, New Zealand, Niue, Samoa, Tonga, Tuvalu, Vanuatu, Wallis and Futuna)	LOW Papaya Passionfruit	LOW Papaya Passionfruit	LOW Papaya Passionfruit	LOW Papaya UNKNOWN Passionfruit	NEGLIGIBLE Papaya UNKNOWN Passionfruit
Bactrocera zonata	Peach fruit fly/ guava fruit fly	Papaya, golden apple, sugar apple, *Citrus* spp., Quince, fig, apple, mango, bitter gourd, date-palm, peach, guava, pomegranate, potato	Fruit	Infested plant material (fruit), soil and hitchhiking. Adults capable of flight. Pupae are soilborne.	Africa (Egypt, Libya, Mauritius, Réunion, Sudan) Asia (Bangladesh, Bhutan, India, Indonesia, Iran, Iraq, Israel, Laos, Myanmar, Nepal, Oman, Pakistan, Saudi Arabia, Sri Lanka, Thailand, United Arab Emirates, Vietnam, Yemen) North America (United States)	LOW Papaya	LOW Papaya	LOW Papaya	LOW Papaya	NEGLIGIBLE Papaya
Ceratitis rosa	Natal fruit fly	Polyphagous; Lychee, cashew, papaya, citrus, grape, soursop, sugar apple, carambola, chilli, coffee, pumpkin, longan tree, persimmon, loquat, mangosteen, apple, mango, blackberry, *Musa* spp., avocado, prickly pear, apricot, plum, peach, nectarine, guava, European pear, tomato, tobacco, cocoa, grapevine, common jujube	Fruit	Infested plant material, adults capable of flight. Larvae pupate in the soil	Africa (Ethiopia, Kenya, Lesotho, Malawi, Mozambique, South Africa, Swaziland, Tanzania, Zambia)	LOW Lychee, Papaya	HIGH Lychee, Papaya	MEDIUM Lychee, Papaya	MEDIUM Lychee, Papaya	LOW Lychee, Papaya
Lissachatina fulica *(Syn. Achatina fulica)*	Giant African land snail, Giant Ghana snail	Polyphagous: cassava, lettuce, papaya, sweet potato, orange, oil palm, pear, cereals, yam, onion, Oriental garlic, pineapple, cherimoya, soursop, Anthurium, peanut, breadfruit trees, breadfruit, jackfruit, carambola, Bougainvillea, *Brassica* spp., canola, cauliflower, cabbage, pigeon pea, tea, capsicum, chrysanthemum, watermelon,	Whole plant, above ground (Leaves, stems, roots, growing points and fruit)	Infested plant material, contaminated soil, tools and machinery and hitchhiking.	Africa (Central African Republic, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Mauritius, Morocco, Nigeria, Réunion, Seychelles, South Africa, Tanzania, Togo) Asia (Bangladesh, Brunei, Cambodia, China, Hong Kong, India, Indonesia, Israel, Japan, Malaysia, Maldives, Myanmar, Nepal, Philippines,	HIGH Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya

[76] https://fruitflyidentification.org.au/species/bactrocera-tuberculata/#host-range

[77] Leblanc, L., Vueti, E. T., & Allwood, A. J. (2013). Host plant records for fruit flies (Diptera: Tephritidae: Dacini) in the Pacific Islands: 2. Infestation statistics on economic hosts.

		Citrus spp., butterfly-pea, coffee, taro, melon, melo, cucumber, giant pumpkin, marrow, carrot, white yam, oil palm, eucalyptus, soyabean, short staple cotton, sunflower, hyacinth bean, bottle gourd, leucaena, ornamental species apple, cassava, bitter gourd, horse radish tree, banana, wild banana, oleander, tobacco, prickly pear, rice, yam bean, passionflower, beans, gooseberry, pea, radish, castor bean, roses, sage, sesame, tomato, eggplant, potato, sorghum, spinach, teak, cocoa, pointed gourd, vanilla, cowpea, grapevine, maize			Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Europe, Spain, North America, Anguilla, Antigua and Barbuda, Barbados, Cuba, Dominica, Guadeloupe, Martinique, Netherlands Antilles, Saint Lucia, Trinidad and Tobago, United States) Oceania (American Samoa, Christmas Island, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, U.S. Minor Outlying Islands, Vanuatu, Wallis and Futuna) South America (Argentina, Bolivia, Brazil, Colombia, Ecuador, Paraguay, Peru, Venezuela)					
Aleurocanthus woglumi	Citrus black fly	Polyphagous: Citrus, avocado, cashew nut, jackfruit, papaya, coconut, coffee, lychee, mango, sapodilla, banana, passionfruit, quince, guava, frangipani, pomegranate, pears, roses, grapevine, ginger	Leaves, stems	Infested plant material and machinery, adults capable of flight. Natural movement, infested soil and plant material and vectors	Asia (Bangladesh, Bhutan, Cambodia, China, Christmas Island (Indian Ocean), India, Iran, Laos, Malaysia, Maldives, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, United Arab Emirates, Vietnam, Yemen), Africa (Kenya, Seychelles, South Africa, Swaziland, Tanzania, Uganda, Zimbabwe), North America (Bermuda, Mexico, USA), Central America and Caribbean (Antigua and Barbuda, Bahamas, Barbados, Belize, British Virgin Islands, Cayman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Guadeloupe, Guatemala, Haiti, Jamaica, Netherlands Antilles, Nicaragua, Panama, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Trinidad and Tobago), South America (Brazil, Ecuador, French Guiana, Guyana, Suriname, Venezuela), Oceania (Papua New Guinea)	HIGH Papaya Passionfruit	HIGH Papaya Passionfruit	MEDIUM Papaya Passionfruit	LOW Papaya Passionfruit	LOW Papaya Passionfruit
Aonidomytilus albus	Tapioca scale	Papaya, mango, cassava, roses, sage, Solanum (nightshade)	Leaves, stems		Africa (Angola, Cabo Verde, Democratic Republic of the Congo,	MEDIUM	HIGH	HIGH	LOW	LOW

					Côte d'Ivoire, Gambia, Ghana, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mauritius, Mozambique, Nigeria, Senegal, Somalia, Tanzania, Uganda, Zambia) Asia (Bahrain, China, Hong Kong, India, Indonesia, Malaysia, Sri Lanka, Taiwan, Thailand) North America (Antigua and Barbuda, Bahamas, Barbados, British Virgin Islands, Cuba, Dominica, Dominican Republic, Grenada, Guadeloupe, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, U.S. Virgin Islands, United States) South America (Argentina, Brazil, Colombia, French Guiana, Guyana, Peru, Suriname)					
Aphis illinoisensis	Grapevine aphid[78]	Papaya, grapevine, mango	Shoots, leaves and fruit	Infested plant material	Africa (Algeria, Libya, Tunisia, Asia, Israel, Turkey, Europe, Albania, Cyprus, Greece, Italy, Malta, Montenegro, Spain) North America (Belize, Canada, Costa Rica, Cuba, Dominican Republic, El Salvador, Guadeloupe, Haiti, Honduras, Jamaica, Mexico, Panama, Puerto Rico, United States) South America (Argentina, Brazil, Chile, Colombia, Uruguay, Venezuela)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Asterolecanium pustulans (Syn. *Asterolecanium sambuci; Russelaspis pustulans*)[79]	Oleander pit scale, akee fringed scale	Sugar apple (sweet sop), papaya, akee apple, pigeon pea, tea, coconut, coffee, silky oak, leucaena, mango, sapodilla, aubergine, cocoa, oleander, cabbage, broccoli, cauliflower, kale, Brussels sprouts, collard greens, savoy, Australian pine tree, Euphorbia, Acacia, *Bauhinia tomentosa*, pigeon pea, Leucaena, cotton, Hibiscus, fig tree, plantain, Eucalyptus, guava, Syzygium, Bougainvillea, jasmine, passionfruit, olive, Grevillea, Prunus, roses, citrus,	Stems, branches		Africa (Egypt, São Tomé and Príncipe, Mozambique, Tanzania, South Africa, Sierra Leone, Seychelles, Rodrigues Island, Madagascar, Malawi, Kenya, Comoros, Gabon) Asia (China, Cape Verde, India, Indonesia, Iran, Israel, Taiwan, Oman, Pakistan, Yemen, Sri Lanka, Saudi Arabia, Bonin Islands - Ogasawara Islands) Europe (Cyprus, Italy, Malta, United Kingdom)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW

[79] http://scalenet.info/catalogue/Russellaspis%20pustulans/

		chilli pepper, Solanum (nightshade), tea, lantana, grapevine			North America (Agalega Islands, Anguilla, Antigua and Barbuda, Bahamas, Barbados, Bermuda, Costa Rica, Cuba, Curaçao, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Haiti, Hawaiian Islands, Honduras, Jamaica, Martinique, Mexico, Montserrat, Nicaragua, Panama, Panama Canal Zone, Puerto Rico and Vieques Island, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Saint Martin and Saint Barthelemy, Saint Croix, Trinidad and Tobago, U.S. Virgin Islands, USA) Oceania (Fiji, French Polynesia, Guam, Papua New Guinea, Tuvalu, New Caledonia, Kiribati) South America (Brazil, Colombia, Ecuador, Guyana, Peru, Venezuela, Galapagos Islands)					
Brachylybas variegatus[80]	Brown coreid bug, passionvine bug	Polyphagous including giant passionfruit, papaya, taro, pumpkin, tomato, coconut, fig, sugarcane, Eucalyptus, cabbage, banana, ginger	Leaves, stem, fruit	Infested plant material and machinery, adults capable of flight.	Fiji, Tonga	MEDIUM	LOW	HIGH	MEDIUM	LOW
Corynothrips stenopterus	Cassava thrips	Papaya, cassava	Leaves, stems, fruit		North America (Antigua and Barbuda, Barbados, Dominica, Grenada, Guadeloupe, Martinique, Mexico, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago) South America (Guyana, Suriname)	MEDIUM	MEDIUM	MEDIUM	LOW	LOW
Diaprepes abbreviatus	Citrus weevil, West Indian weevil, sugarcane rootstalk borer	Wide host range including citrus, sugarcane, vegetables, potato, papaya, guava, woody field grown ornamentals strawberry, sweetpotato, mahogany, containerized ornamentals, non-cultivated wild plants	Flowers, leaves, roots	Infested plant material, contaminated soil, tools and machinery. Pupation occurs in the soil.	North America (Antigua and Barbuda, Barbados, Costa Rica, Dominica, Dominican Republic, Grenada, Guadeloupe, Haiti, Jamaica, Martinique, Montserrat, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, United States) South America (French Guiana)	MEDIUM	HIGH	HIGH	LOW	LOW
Oligonychus gossypii	Spider mite; cotton red mite	Polyphagous including Papaya, cotton, cassava, beans, peach, citrus, okra, peanut, and a range of ornamentals including rose	Leaves		Africa (Benin, Republic of Congo, Gabon, Nigeria, Angola, Cameroon, Chad, Ivory Coast, Kenya, Madagascar, Senegal, Sierra Leone,	MEDIUM	HIGH	HIGH	LOW	LOW

[80]https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/ba/plant/2013/islandcabbage/Final-PRA-Island-Cabbage.pdf

					Tanzania, Uganda) South America (Brazil, Venezuela, Colombia, Ecuador), Central America (Costa Rica, Honduras)					
Trialeurodes variabilis (Syn. *Aleurochiton variabilis, Aleurodes variabilis, Aleurodicus variabilis, Asterochiton variabilis, Metaleurodicus variabilis, Trialeurodes caricae*)	Papaya whitefly	Polyphagous: Papaya, cassava	Leaves		North America (Cuba, Trinidad and Tobago)South America (Colombia)	LOW	MED	HIGH	MED	LOW
Veneza zonatus (Syn. *Leptoglossus zonatus*)	Western leaf-footed bug; large-legged bug	Passionfruit (*Passiflora spp.*), pecan, lime, navel orange, melon, pumpkin, cotton, jatropha, avocado, guava, pomegranate, tomato, eggplant, sorghum, maize, peach, watermelon	Leaves, fruit		North America (Mexico, United States) Central America (Nicaragua, Honduras, El Salvador) South America (Brazil, Venezuela, Colombia)	LOW	MEDIUM	MEDIUM	MEDIUM - HIGH	LOW - MEDIUM
Oligonychus annonicus	Spider mite	Papaya, *Annona* spp., *Erythrina* spp., coffee	Leaves	Infested plant material and soil	South America (Ecuador)	MEDIUM Papaya	HIGH Papaya	HIGH Papaya	LOW Papaya	LOW Papaya
Frankliniella insularis (Syn. *Euthrips insularis, Frankliniella fortissima, Franklinothrips insularis, Franklinothrips caribae)*[81]	Blossom thrips, Cuban flower thrips, West Indian flower thrips, bean-flower thrips	Pigeon pea, capsicum, papaya, citrus, coconut, sweetpotato, banana, tobacco, beans, tomato	Whole plant, above ground, Leaves, flowers	Infested plant material, contaminated soil, tools and machinery. Pupation occurs in the soil.	Asia (Singapore) North America (Barbados, Bermuda, Cuba, Guadeloupe, Jamaica, Martinique, Mexico, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, United States) South America (Guyana) Oceania (Fiji)	LOW Papaya	HIGH Papaya	HIGH Papaya	LOW Papaya	LOW Papaya
Crypticerya multicicatrices	Multicicatrices fluted scale	Breadfruit, papaya, mango, avocado, soursop, coconut,	Leaves, branches		South America (Colombia)	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Davara caricae	Papaya webworm	Papaya	Stem, fruit		North America (Cuba, USA)	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Empoasca papayae	Papaya leaf hopper	Papaya	Leaves, stem (known vector of bunchy top)		North America (Antigua and Barbuda, Barbados, Grenada, Montserrat, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Trinidad and Tobago)	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Empoasca stevensii	Stevens leaf hopper	Polyphagous; Papaya, avocado, plumeria	Leaves, stem (known secondary vector of		North America (Antigua and Barbuda, Barbados, Grenada, Montserrat, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Trinidad and Tobago)	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM

[81] Frankliniella insularis is a vector of plant viruses (Bailey 1935)

			bunchy top)							
Eutetranychus africanus	Spider mite, citrus brown mite, African red mite, Texas citrus mite, Oriental red mite, Oriental mite [125]	Polyphagous; Papaya, citrus, cotton, cassava, castor bean, pea, peach, durian, apple, grape, guava, eggplant, sweet potato, fig, corn, and a variety of ornamentals	Leaves, stem, fruit		Africa (Reunion, Comoros, Kenya, Madagascar, Mauritius, Mayotte, Mozambique, South Africa) Asia (Iran, Japan, Taiwan, Thailand, India, Myanmar-Burma, Egypt) Oceania (Papua New Guinea, French Polynesia, Vanuatu) South America (Bolivia, Brazil, Chile, Colombia, Peru)	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Eutetranychus banksi (Syn. *Tetranychus banksi*)	Citrus mite	Polyphagous including Papaya, breadfruit, castor bean, *Citrus* spp., lima bean, plumeria, lablab bean leaves, *Annona* spp. (sousop, sugar apple, cherimoya, wild sweetsop, pond apple), oleander, taro, elephant ear (arrowroot/coco yam), curcubits, purple yam, *Euphorbia*, cassava, castor oil plant, peanut, *Bauhinia* spp., pigeon pea, cotton, Hibiscus, cocoa, black pepper, coffee, black nightshade, grapevine; many other ornamentals and economic plants including: date palm (*Phoenix dactylifera*)	Leaves		North America (Costa Rica, Cuba, Mexico, Colombia, Cuba, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, Panama, USA) South America (Venezuela, Argentina, Brazil, Peru, Paraguay, Uruguay) Africa (Mozambique), Egypt, Iran, Portugal, Spain	MEDIUM	HIGH	HIGH	MEDIUM	MEDIUM
Scaphytopius nitridus[82]	Leafhopper	Polyphagous including *Citrus* spp., rice, barley, corn, sugarcane, wheat, sorghum, apple, pear, palms, grapevine, carrot, potato, tomato, papaya, peach, strawberry, *Rubus* spp., ornamentals, weeds, other grasses and cereals	Leaves	Infested plant parts (leaves and fruit), soil and hitchhiking	Asia (Turkey)North America (Mexico, USA)	LOW	HIGH	HIGH	MEDIUM to HIGH	MEDIUM
Toxotrypana curvicauda (*Syn. T. fairbatesi Munro*)	Papaya fly	Papaya, mango	Fruit, seed	Infested plant material (fruit). Adults capable of flight.	North America (Bahamas, Belize, Costa Rica, Cuba, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, Netherlands Antilles, Nicaragua, Panama, Puerto Rico, Saint Kitts and Nevis, Trinidad and Tobago, US Virgin Islands, USA) South America (Colombia, Venezuela)	LOW Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya	MEDIUM Papaya
Tetranychus bastosi	Spider mite	Polyphagous: reported from 25 plant species including papaya, bean, cassava, sweet potato	Leaves		South America (Brazil)	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Tetranychus macfarlanei	Spider mite	Papaya, grapefruit, manihot spp.,	Leaves		Asia (India)	MEDIUM	HIGH	HIGH	MEDIUM -	MEDIUM -

[82] Vector of Western X-disease phytoplasma 16SrIII-A
https://www.catalogueoflife.org/col/details/species/id/527ea2303b252ef8238450f44d185708

(Syn. *T. malaysiensis*) *Tetranychus malaysiensis* (Syn. *T. macfarlanei*). This should be the other way around i.e., *T. malaysiensis* is a junior synonym of *Tetranychus macfarlanei*		argyreia spp., chempedak, gumbo, okra, cotton, eggplant			Europe (Spain), Africa (Madagascar, Mauritius), Asia (Bangladesh, China, India, Malaysia, Philippines, Thailand)				HIGH	HIGH
Tetranychus merganser	Spider mite	Polyphagous: Papaya, Capsicum, prickly pear, squash, cassava, European privet, strawberry, jasmine, desert ash, blackberry nightshade	Leaves		Asia (China, Thailand) North America (Mexico, USA)	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Tetranychus nakahari	Spider mite	Papaya, cocoa, cassava, okra (gumbo), *Citrus* spp., *Citrofortunella* spp.	Leaves		North America (El Salvador, Guatemala, Suriname, Trinidad and Tobago)	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Tetranychus papayae	Spider mite	Papaya	Leaves		Asia (India)	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Tetranychus paraguayensis	Spider mite	Papaya, citrus	Leaves		South America (Paraguay)	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Tetranychus puschelii	Spider mite	Polyphagous; Papaya, capsicum, Cucurbits, bottle gourd, basil, *Ranunculus* spp., okra, jasmine, Capsicum, *Cannabis sativa,*	Leaves		Africa (South Africa) Asia (India)	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Tetranychus recki	Spider mite	Papaya, chenille	Leaves		North America (Costa Rica, Honduras)	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Tetranychus truncatus	Spider mite	Polyphagous: peanut, melon, carrot, cotton, cassava, castor bean, eggplant, maize, white mulberry, papaya, bean, rice, corn, cabbage, canola, *Citrus* spp., soybean, garden pea, mung bean, capsicum, tomato, grapevine, cowpea, sweetpotato, brown mustard, cauliflower, watermelon, muskmelon, cucumber, squash, silky gourd (ridged gourd, chinese okra), castor bean/castor oil plant, common bean, lima bean, winged bean, broad bean, mung bean, okra, neem tree, moringa (horseradish tree), guava, sesame, rice, jujube, Asian pear, *Rosa hybrida*, sweet peppers, chili peppers, black nightshade, garlic	Leaves		Asia (Bangladesh, China, India, Iran, Japan, Malaysia, Philippines, Republic of South Korea, Taiwan, Thailand, Vietnam, Indonesia) North America (USA) Oceania (Guam)	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Tetranychus mexicanus	Spider mite	Polyphagous; Papaya, cotton, lychee, passionfruit, Spanish cedar, Citrus, Cocoa, pecan, coconut, avocado, banana, peanut, guava, sugar cane, strawberry, pear, apple, peach, star	Leaves		Central America and Caribbean (Barbados, Costa Rica, Cuba, Nicaragua, El Salvador, Honduras, Guadeloupe, Martinique) South America (Brazil, Suriname,	MEDIUM Lychee, Papaya, Passionfruit	HIGH Lychee, Papaya, Passionfruit	HIGH Lychee, Papaya, Passionfruit	MEDIUM Lychee, Papaya, Passionfruit	MEDIUM Lychee, Papaya, Passionfruit

		fruit, bean, cassava; wide range of ornamental plants			Argentina, Columbia, Paraguay, Peru, Uruguay, Venezuela)					
Oligonychus (Tetranychus) bicolor[83] *Oligonychus yothersi (Syn. Tetranychus yothersi*	Spider mite; avocado red mite	Polyphagous; Lychee, grape, oak, chestnut, hickory, maple, spruce, birch, papaya, mango, coffee, castor bean, *Eucalyptus* spp.	Leaves, foliage	Infested plant material and soil	Asia (Iran, Taiwan)North America (Canada, United States)Central America and Caribbean (Costa Rica, Cuba)	MEDIUM Lychee, Papaya	HIGH Lychee, Papaya	HIGH Lychee, Papaya	MEDIUM Lychee, Papaya	MEDIUM-Lychee, Papaya
Oligonychus yothersi (Syn. *Tetranychus yothersi*)	Spider mite; avocado red mite	Polyphagous including lychee, papaya, mango, coffee, avocado, banana, cassava, pomegranate, grape, castor bean, *Eucalyptus grandis* and *Eucalyptus urophylla,* other *Eucalyptus* spp., *Grevillea* sp., *Camellia sinensis;* also, a range of ornamental plants	Leaves Foliage	Infested plant material and soil	Asia (Iran) North America (USA [Hawaii]), , Central America and Caribbean (Costa Rica, Cuba, Nicaragua), South America (Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru), China	MEDIUM Lychee, Papaya	HIGH Lychee, Papaya	HIGH Lychee, Papaya	MEDIUM Lychee, Papaya	MEDIUM Lychee, Papaya
Tetranychus tumidus	Spider mite	Wide host range including papaya, Araceae, sweetpotato, banana, corn, cotton, bean, canola, common bean, cassava, cotton, garlic, taro, celery, coconut, maize, potato, tomato, sunflower, mint	Leaves	Infested plant material, and hitchhiking. Wind dispersal for localised spread.	North America (Antigua and Barbuda, Barbados, Cuba, Saint Lucia, USA, American Samoa, Guam, Costa Rica, Panama, Puerto Rico) South America (Colombia) Europe (Greece)	MEDIUM Papaya	HIGH Papaya	HIGH Papaya	MEDIUM Papaya	MEDIUM Papaya
Tetranychus cinnabarinus. This species is a synonym of *Tetranychus urticae* which is an endemic species in Australia with a very wide host range. Hence, this species information can be removed from here.	Carmine spider mite	Okra, onion, garlic, peanut, broccoli, tea, peppers, papaya, chrysanthemum, watermelon, Citrus, taro, morning glory, melon, cucumber, pumpkin, marrow, cucurbits, carnation, yam, strawberry, soyabean, cotton, sweetpotato, apple, cassava, lucerne, banana, beans, common beans, peach, castor bean, tomato, eggplant, potato, sorghum, spinach, cowpea, grapevine, elephant ear, maize, common jujube	Leaves	Infested plant material, machinery, personal effects, hitchhiking. Wind dispersal for localised spread.	Africa (Cape Verde, Egypt, Kenya, Libya, Morocco, South Africa, Togo, Tunisia, Uganda, Zimbabwe) Asia (China, India, Indonesia, Iran, Israel, Japan, Malaysia, Singapore, Taiwan, Thailand, Turkey) Europe (Austria, Bulgaria, France, Montenegro, Poland, Portugal, Spain, United Kingdom) North America (Costa Rica, Mexico, United States) South America (Brazil, Colombia, Peru, Venezuela)	MEDIUM Papaya	HIGH Papaya	HIGH Papaya	MEDIUM Papaya	MEDIUM Papaya
Calacarus citrifolii	Citrus grey mite/ citrus blotch mite	Polyphagous including Citrus, banana, cotton, peanut, passionfruit, papaya, cassava, beans, sugarcane, pigeon pea, okra, sweetpotato, soursop, Tannia, eggplant, capsicum, tomato, taro, pumpkin, giant passionfruit, *Poinsettia* spp., *Rhus* spp., *Holmskioldia* spp., *Brunsfelsia* spp., *Pappea capensis*, *Rhamnus prinoides*, *Lippia javanica*, *Duranta repens*, *Mimusops seyheri*, *Euphorbia pulcherrima*, Musa paradisiaca, *Capsicum chinense* (chilli	Leaves, fruit, twigs	Infested plant material and machinery.	South Africa, India, Taiwan, Cuba, Angola, Zimbabwe, Mozambique, Zambia, Nigeria	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

[83] The environment in parts of Australia is likely to be suitable for the establishment of O. yothersi.

		pepper)								
Adoretus versutus	Rose beetle	Polyphagous: Lychee, Acacia, cashew nut, groundnut, camel's foot, Bougainvillea, papaya, Citrus spp., coffee, taro, yam, fig, sweetpotato, apple, plantain, banana, avocado, beans, longan, plum, guava, pear, radish, roses, sugarcane, aubergine, sorghum, Malay apple, Singapore almond, cocoa, cowpea, cowpea, grape, ginger, Eucalyptus	Leaves Foliage (adults), roots (larvae) for cut flowers inflorescence	Infested plant material and machinery, adults capable of flight, eggs and larvae are soilborne	Asia (Bangladesh, British Indian Ocean Territory, India, Indonesia, Malaysia, Pakistan, Sri Lanka), Africa (Madagascar, Mauritius, Réunion, Saint Helena, Seychelles) Oceania (American Samoa, Cook Islands, Fiji, Samoa, Tonga, Vanuatu, Wallis and Futuna Islands)	MEDIUM Lychee UNKNOWN Papaya	MEDIUM Lychee UNKNOWN Papaya	MEDIUM Lychee UNKNOWN Papaya	HIGH Lychee UNKNOWN Papaya	MEDIUM Lychee UNKNOWN Papaya
Eotetranychus lewisi[84]	Lewis spider mite	Polyphagous; Papaya, citrus, grape, castor bean, poinsettia, clover, peach, pear, Rosa species, strawberry, olive, cotton, *Ipomoea* sp., *Cucurbita* sp., *Euphorbia* spp., *Acacia* spp., *Pinus* spp., *Rubus* spp., *Solanum* spp.	Leaves, fruit	Infested plant material, soil and machinery. Can be transported in wind currents.	Africa (Libya, South Africa, Asia (Taiwan, Philippines), Iran,Europe (Austria, Netherlands, Portugal [Madeira I], United Kingdom)North America (Canada, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, United States)South America (Bolivia, Brazil, Chile, Colombia, Ecuador, Peru)	MEDIUM Papaya	HIGH Papaya	HIGH Papaya	MEDIUM Papaya	MEDIUM Papaya
Dasineura papivora	Papaya midge	Papaya	Fruit		Asia (India)	LOW	Low	LOW	LOW	NEGLIGIBLE
Aphis middletonii	Erigeron root, aphid	Papaya	Roots, trunk, stem, leaves		Asia (Turkey) North America (El Salvador, USA)	LOW	LOW	MEDIUM	LOW	NEGLIGIBLE
Aspidiotus excisus (Syn. Aglaonema scale; Cyanotis scale (*Temnaspidiotus excisus*)	Green scale	Polyphagous including banana, *Citrus* spp., papaya, coconut, *Ipomoea* spp., sugar apple, pineapple, orchids, grapevines, eggplant	Above ground plant parts	Infested plant material and machinery.	Widespread throughout South, Central and North America, Asia (India), South America (Suriname)and the Pacific[157][158]	MEDIUM	LOW	LOW	LOW	NEGLIGIBLE
Leptostylus praemorsus	Boring beetle	Papaya, Citrus	Trunk, stems		North America (Antigua and Barbuda, Barbados, Bermuda, Dominica, Mexico, Saint Lucia)	LOW	LOW	MEDIUM	LOW	NEGLIGIBLE
Pseudaulacaspis papayae (Syn. *Phenacaspis papayae*; *Chionaspis papayae*)[205]	No common name	Papaya	Leaves, fruit		Asia (Indonesia, Thailand)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Spodoptera eridania	Southern armyworm	Okra, onion, Welsh onion, garlic, red ginger, celery, peanut, asparagus, beetroot, *Brassica napus* var. oleifera, black mustard, cabbages, cauliflowers, collards, cruciferous crops, bell pepper, papaya, quinoa, chickpea, watermelon,	Fruits, leaves		Africa (Benin, Cameroon, Gabon, Nigeria) Europe (Denmark, Netherlands, Slovenia) North America (Antigua and Barbuda, Bahamas, Barbados, Bermuda, Costa	LOW	LOW	LOW	LOW	NEGLIGIBLE

[84] https://www1.montpellier.inra.fr/CBGP/spmweb/notespecies.php?id=168

		Citrus, lemon, navel orange, coffee, coriander, melon, cucumber, pumpkin, carrot, carnation, yam, Eucalyptus, soyabean, cotton, sunflower, kenaf, China-rose, sweetpotato, lettuce, lavender, leucaena, flax, apple, cassava, lucerne, mints, Peppermint, Spear mint, banana, watercress, oleander, tobacco, rice, passionfruit, elephant grass, avocado, beans, lima bean, common bean, pea, Poaceae (grasses), guava, European pear, rhubarb, castor bean, roses, raspberry, willows, Brazilian pepper tree, tomato, eggplant, potato, spinach, dandelion, clovers, blueberry, cranberry, faba bean, cowpea, grapevine, cocoyam, maize			Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, United States) South America (Argentina, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela)					
Thaumatotibia leucotreta (Syn. *Cryptophlebia roerigii; Cryptophlebia leucotreta; Olethreutes leucotreta; Thaumatotibia roerigii*)[85]	False codling moth	Polyphagous: Lychee, pineapple, carambola, cotton, Citrus spp., capsicum, cotton, mango, avocado, peach, maize, soursop, guava, lima bean, common bean, sorghum, cowpea, olive, *Prunus* spp., cherry, macadamia, castor bean, pomegranate, Australian brush-cherry, water apple, tomato (secondary host)	Leaves, fruit, seed	Infested plant material and soil. Adults capable of flight.	Asia (Israel), Africa (Angola, Benin, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Congo Democratic Republic, Côte d'Ivoire, Eritrea, Ethiopia, Gambia, Ghana, Kenya[14], Madagascar, Malawi, Mali, Mauritius, Mozambique, Niger, Nigeria, Réunion, Rwanda, Saint Helena, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe), Europe (Denmark, Finland, Germany, Italy, Netherlands, Spain, Sweden, UK)	LOW Lychee	LOW Lychee	HIGH Lychee	MEDIUM Lychee	VERY LOW Lychee
Aponychus sulcatus[86]	No common name	Papaya, tar vine, giant reed, wild sugarcane, giant cane (elephant grass)	Leaves		India, Pakistan	LOW	LOW	LOW	LOW	NEGLIGIBLE
Amorbia emigratella	Mexican leafroller	Polyphagous including avocado, broccoli, cocoa, Citrus spp., cotton, eggplant, green beans, guava, macadamia, orchids, papaya, passionfruit, potato, rose, sweetpotato, tomato, pineapple, other ornamentals, shrubs, fruit trees and indigenous plants in the mountains, corn, blackberry, peanut, gorse	Leaves, fruit, flowers, shoots	Infested soil and plant material. Adults are capable of flight	North America (Costa Rica, Hawaii, Mexico, USA)	LOW Papaya Passionfruit	LOW Papaya Passionfruit	MEDIUM Papaya Passionfruit	LOW Papaya Passionfruit	NEGLIGIBLE Papaya Passionfruit

[85] Intercepted only in Denmark, Finland, Italy, Spain, Sweden and UK. Eradicated from Netherlands

[86] Bolland, H. R., Gutierrez, J., & Flechtmann, C. H. (1998). World catalogue of the spider mite family (Acari: Tetranychidae). Brill. https://www1.montpellier.inra.fr/CBGP/spmweb/notespecies.php?id=30

Acicnemis crassiusculus	Weevil	Papaya	Foliage		Oceania (Fiji, French Polynesia, Tonga, Vanuatu)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Bemisia tabaci (MED) [(Syn. Bemisia tabaci biotype Q, Bemisia tabaci Q, Mediterranean (MED) species (Bemisia tabaci)]	Silverleaf whitefly	Okra, maples, cauliflower, cruciferous crops, Capsicum (bell pepper), papaya, pumpkin, Bourbon cotton, lettuce, cassava, Passifloraceae, Rosaceace, tomato, eggplant	Leaves, stems, whole plant (early senescence)		Africa (South Africa) Asia (China, Israel, Japan, South Korea, Turkey) Europe (Finland, Greece, Italy, Sweden, United Kingdom) North America (Bermuda, Canada, Costa Rica, Guatemala, Mexico, United States) South America (Argentina, Brazil, Uruguay)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Attacus atlas	Atlas moth	Lychee, papaya, mango, avocado, guava, water apple, citrus, soursop, sugar apple, jackfruit, tea, camphor, cinnamon, coffee, turmeric, cardamon, pepper, castor bean, big leaved mahogany, cocoa, carambola, cinchona	Leaves	Flight, machinery and infested plant material.	Asia (Bangladesh, Brunei Darussalam, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Philippines, Singapore, Taiwan, Thailand, Vietnam)	MEDIUM Lychee UNKNOWN Papaya	HIGH Lychee UNKNOWN Papaya	HIGH Lychee UNKNOWN Papaya	UNKNOWN Lychee, Papaya	UNKNOWN Lychee, Papaya
Adoxophyes cyrtosema	Citrus brown banded tortrix	Polyphagous: Lychee, Citrus, Dimocarpus longan, groundnut, Juglans, Clerodendrum, Morus alba, tea	Leaves	Plant material, adults are capable of flight	Asia (China), Oceania (Tonga, New Hebrides, New Guinea)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Bagrada hilaris[87]	Bagrada bug ; Painted stink bug	Broccoli, cabbage, mustard, cauliflower, kale, turnip, radish, canola, swede, bok choy, Chinese cabbage, purple-vein rocket, black gram, maize, sorghum, potato, cotton, sunflower, papaya, pea, wheat, bean, shepherds' purse and others	Whole plant, above ground		Africa (Angola, Botswana, Cape Verde, Congo, Democratic Republic of the, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Senegal, Seychelles, Somalia, South Africa, Sudan, Tanzania, Uganda, Zambia, Zimbabwe) Asia (Afghanistan, India, Iran, Iraq, Myanmar, Nepal, Pakistan, Sri Lanka, Yemen) Europe (Italy, Malta) North America (Mexico, United States) South America (Chile)	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Corythucha gossypii	Cotton lacebug; bean lacebug	Polyphagous including okra, peanut, pigeon pea, bell pepper, papaya, cassava, banana, beans, castor bean, sugarcane, eggplant, sweetpotato, soursop, *Tannia*, capsicum, tomato,	Leaves	Infested plant material and machinery, adults capable of flight.	North America (Antigua and Barbuda, Barbados, Belize, Carribean, Costa Rica, El Salvador, Cuba, Dominica, Dominican Republic, Guadeloupe, Guatemala, Haiti, Honduras,	LOW	MEDIUM	MEDIUM	LOW	VERY LOW

[87] LeVeen, E., & Hodges, A. C. (2014). Bagrada bug, painted bug, Bagrada hilaris Burmeister (Insecta: Hemiptera: Pentatomidae). Department of Entomology and Nematology, UF/IFAS Extension. Available in: http://edis. ifas. ufl. edu.(Sin fecha de consulta).
Native to Africa, also present in southern Asia and Europe and recently (2008) introduced into the United States (Le Veen and Hodges 2014)
Spread with infested material. Reported to be found on trucks travelling between states in the United States (Le Veen and Hodges 2014)

		eggplant, cotton, pumpkin, giant passionfruit, taro, pumpkin, Breadfruit, soursop and sweet potato			Nicaragua, Panama, Jamaica, Martinique, Montserrat, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, USA) South America (Colombia, Venezuela)					
Darna diducta	Nettle caterpillar	Annona spp. (soursop, sugar apple), sugar plum, tea, papaya, coconut, banana, cocoa	Leaves		Asia (Indonesia, Malaysia, Philippines, Thailand)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Elytrurus griseus[88]	Weevil	Papaya, Hibiscus, *Citrus* spp.	Leaves, young stem		Oceania (Fiji)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Empoasca fabalis[89]	Leafhopper	Pigeon pea, sweetpotato, beans, Ipomoea spp., Japanese honeysuckle, morning glory, white clover, cotton, maize, papaya, bean, beet, carrot, cowpea, melon, malojillo, potato, tomato	Leaves	Infested plant material. Adults are capable of flight.	North America (Barbados, Haiti, Puerto Rico, USA) South America (Argentina, Brazil, Colombia, Peru)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Empoasca solana[90]	Southern garden leafhopper	Sweetpotato, beans, banana, beet, blackeye bean, celery, cowpea, cucumber, eggplant, garden bean, green bean, lettuce, lima beans, melon, papaya, peanut, potato, summer squash, Swiss chard, tomato, watermelon. Yellow cosmos and other ornamental plants. Several weeds, such as amaranth, castor bean, and Datura, are reservoir hosts of this pest.	Leaves	Infested plant material. Adults are capable of flight.	Widespread throughout North America (Barbados, Haiti, United States), Central and South America, Europe, Asia and South Africa	LOW	HIGH	HIGH	LOW	VERY LOW
Erinnyis alope	Papaya hornworm	Papaya, cassava	Leaves		Europe (Austria, Netherlands, Portugal, United Kingdom)	LOW	HIGH	HIGH	LOW	VERY LOW
Erinnyis ello	Cassava hornworm	Papaya, rubber, cassava, sesame, guava	Leaves		North America (Antigua and Barbuda, Bahamas, Barbados, Belize, British Virgin Islands, Canada, Cayman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Nicaragua, Panama, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago,	LOW	HIGH	HIGH	LOW	VERY LOW

[88] http://www.padil.gov.au/maf-border/pest/host%20family-maf-border/142444
[89] https://www.discoverlife.org/20/q
http://dmitriev.speciesfile.org/taxahelp.asp?hc=19748&key=Erythroneura&lng=En
[90] http://www.extento.hawaii.edu/kbase/crop/Type/e_solana.htm

					U.S. Virgin Islands, United States) Oceania (Papua New Guinea) South America (Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela)					
Icerya samaraia	Steatococcus scale	Papaya, Acacia, soursop, pigeon pea, *Citrus* spp., coconut, coffee, taro, mango, banana, guava, Rosa (roses), cocoa	Leaves, fruit	Plant materials, adults are usually stationary or completely immobile on the host plant; Hitchhiker; Seedlings, Micro propagated plants	Asia (Indonesia) Oceania (Federated states of Micronesia, Guam, New Caledonia, Northern Mariana Islands, Palau, Papua New Guinea, Solomon Islands)	LOW	LOW	LOW	MEDIUM	VERY LOW
Oryctes rhinoceros (Syn. *Oryctes stentor; Scarabaeus rhinoceros*)	Coconut rhinoceros beetle; Asiatic rhinoceros beetle; black beetle; coconut black beetle; coconut palm rhinoceros beetle; date palm beetle; dung beetle; rhinoceros beetle; scarab beetle	Coconut, pineapple, palms (including oil palm, date palm, sago palm), taro, sugarcane, lantana, plantain, banana, papaya, pine	Leaves	Infested plant material and machinery, adults capable of flight.	Africa (Mauritius, Réunion)Asia (Bangladesh, British Indian Ocean Territory, Brunei, Cambodia, China, Cocos Islands, Hong Kong, India, Indonesia, Iran, Japan, Laos, Malaysia, Maldives, Myanmar, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Yemen)North America (United States)Oceania [American Samoa, Federated States of Micronesia, Fiji, Guam, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, (Wallis and Futuna), Vanuatu]	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Pseudoparlatoria ostreata	Acalypha scale	Papaya, agave, banana, *passiflora laurifolia*, pepper, Vitis; avocado	Leaves, stem	Infested plant material and machinery.	Africa (Democratic Republic of the Congo) Europe (United Kingdom) North America (Cuba)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW

*Transmitted by infested plant material, contaminated soil tools and machinery, water and hitchhiking.

Pathogens

Table 17. Papaya industry pathogen threat summary table.

SCIENTIFIC NAME	COMMON NAME	PRIMARY HOSTS	AFFECTED PLANT PART	MOVEMENT & DISPERSAL	GEOGRAPHIC RANGE	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Bacteria										
Rickettsia spp.	Papaya bunchy top	Papaya	Leaves, stems		Africa (Sudan, Tanzania) Asia (India, Sri Lanka) North America (Antigua and Barbuda, Barbados, Costa Rica, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Montserrat, Netherlands Antilles, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, USA) South America (Guyana, Suriname)	LOW	MEDIUM	LOW	MEDIUM	LOW
Enterobacter cloacae (Jordan)	Internal yellowing	Papaya	Fruit	Fruit flies, other insects	North America (USA-Hawaii)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Erwinia mallotivora[91]	Bacterial crown rot (aka papaya bacterial canker)	Papaya, known to survive on the leaves of cowpea, tomato and rockmelon for at least 14 days.	Leaves, fruit, stems		DAFF lists as: Anguilla; Antigua and Barbuda; Barbados; Dominica; Grenada; Guadeloupe; Indonesia; Japan; Malaysia; Martinique; Montserrat; Northern Mariana Islands; Philippines; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Tonga; Trinidad and Tobago; Venezuela, Bolivarian Republic of; and Virgin Islands, United States of America.	LOW	HIGH	HIGH	HIGH	MEDIUM
Erwinia mallotivora	papaya dieback	Papaya, Mallotus japonicus Alternate hosts weeds; *Amaranthus viridius, Amaranthus spinosus, Syndrella nodiflora Achelpha indica and Commelina benghalensis*	Leaves, stem and flowers, whole plant	Vegetative propagative material	DAFF lists as: Anguilla; Antigua and Barbuda; Barbados; Dominica; Grenada; Guadeloupe; Indonesia; Japan; Malaysia; Martinique; Montserrat; Northern Mariana	LOW	HIGH	HIGH	HIGH	MEDIUM

[91] In the Biosecurity Reference Panel meeting #4 the scientific name of Bacterial crown rot was updated from *Erwinia papaya*.

					Islands; Philippines; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Tonga; Trinidad and Tobago; Venezuela, Bolivarian Republic of; and Virgin Islands, United States of America.					
Pantoea cypripedii (aka Erwinia cypripedii)[92]	black rot of papaya	papaya				UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Erwinia herbicola (exotic strains)	Purple stain fruit rot	Papaya, pineapple, golden-fruited palm; the species affects a very wide host range and survives well in the environment	Fruit		North America (USA-Hawaii), South America (Brazil): the species is globally distributed	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Fungi										
Phytophthora tropicalis[93]		Cherimoya, breadfruit, papaya, carnation, macadamia nut, black pepper, apricot, rosemary, sesame, eggplant, cocoa, vanilla, periwinkle, rubber, Leucoedema, cyclamen, verbena, camellia, rhododendron	Foliage, Leaves, stems, whole plant (wilting)		Asia (Taiwan, Vietnam) Europe (Germany, Italy, Netherlands, Poland, Spain) North America (Mexico, USA) Oceania (French Polynesia) South America (Brazil)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Ovulariopsis papayae	Papaya powdery mildew	Papaya	Leaves		South Africa	LOW	LOW	LOW	LOW	NEGLIGIBLE
Phyllosticta caricae-papayae	Target spot	Papaya	Leaves		Asia (India)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Pseudomonas carica papayae - reclassified as Pseudomonas syringae phylogroup 6	Leaf spot	Papaya	Leaves		South America (Brazil)	NEGLIGIBLE	LOW	MEDIUM	LOW	NEGLIGIBLE
Armillaria tabescens, A. mellea, A. socialis[94]	Armillaria root rot Wood rot (Summerfruit) Clitocye root rot (Tea Tree, Truffles)	Papaya, lychee, Aleurites, Carya (hickories), Casuarina (beefwood), *Casuarina equisetifolia* (casuarina), mandarin lime, navel orange, *Eucalyptus*, lychee, *Melaleuca quinquenervia* (paperbark tree), oleander, pines, almond, peach,	Leaves, fruit, Whole plant Roots and collar region (Truffles)	Infected Plant	Asia (China, India, Japan, Republic of Korea, Malaysia, Nepal, Turkey) Africa (Madagascar, Malawi, Mauritius, Tanzania, Zimbabwe) North America (Mexico, USA) Central America and Caribbean	LOW Lychee, Papaya	MEDIUM Lychee, Papaya	MEDIUM Lychee, Papaya	LOW Lychee, UNKNOWN Papaya	NEGLIGIBLE Lychee UNKNOWN Papaya

[92] https://gd.eppo.int/taxon/ERWICY, https://www.cabi.org/ISC/abstract/19811376771

[93] This is likely to have a similar impact on the 4 other species of Phytophthora in Australia that affect carnation.

[94] Widespread. Similar impact to other Armillaria spp. in Australia. Established Armillaria spp. are not economically significant in tea tree plantations. Unlikely to be a problem on mulch from tea tree as it is heated for oil extraction prior to use.

		Japanese plum, guava, *Vitis spp. (grape)*, oak, *Acacia* spp., blueberry, common Jujube, banana, plantain, coffee, macadamia, pear, apple, apricot, plum, summerfruit, persimmon, loquat, hickories, range of Australian native trees including Rosaceous species, Ornamental trees, shrubs and fruit crops.			(Panama, Trinidad and Tobago) South America (Brazil) Europe (Albania, Czech Republic, France, Germany, Greece, Italy, Montenegro, Netherlands, Portugal, Serbia, Slovakia, Slovenia, Spain, UK) Oceania (Fiji)					
Colletotrichum magna		Papaya	Fruit		South America (Brazil)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Guignardia spp.	Guignardia spot	Papaya	Leaves		Hawaii	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Oidium caricae-papayae	Powdery mildew: Papaya	Papaya	Leaves		Asia (India, Taiwan) North America (Canada)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Cercospora papayae	Black spot disease of papaya	Papaya	Leaves, fruit		Hawaii, Caribbean region, Central America, South America	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Pseudoidium neolycopersici	Tomato powdery mildew	Papaya, ornamental croton, tomato	Leaves, stems		Africa (South Africa, Tanzania)Asia (Bhutan, China, Hong Kong, India, Iran, Japan, Malaysia, Nepal, South Korea, Thailand, Turkey)Europe (Bulgaria, Croatia, Czechia, Denmark, France, Germany, Greece, Hungary, Italy, Netherlands, Poland, Serbia, Spain, Switzerland, United Kingdom)North America (Canada, Guadeloupe, Jamaica, Mexico, United States)South America (Argentina, Colombia, Venezuela)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Nematodes										
Hoplolaimus pararobustus	Lance nematode	Papaya, banana, oil palm, cotton, citrus, coffee, cowpea, grapevine, guava, mango, rice, plantain, pineapple, roses, sorghum, sugarcane, tea, wheat	Root		Africa (Angola, Burkina Faso, Cameroon, Congo, Democratic Republic of the, Côte d'Ivoire, Egypt, Gambia, Guinea, Kenya, Madagascar, Malawi, Mozambique, Namibia, Niger, Nigeria, Réunion, Rwanda, São Tomé and Príncipe, Senegal, South Africa, Tanzania, Togo, Uganda, Zimbabwe) Asia (China, Pakistan, Sri Lanka) North America (Dominica,	LOW	HIGH	MEDIUM	MEDIUM	LOW

					Grenada, Saint Lucia, Saint Vincent and the Grenadines)					
Meloidogyne enterolobii (Syn. *Meloidogyne mayaguensis*)	Pacara earpod tree root-knot nematode	Papaya, herbaceous and woody plants. Principal hosts are coffee, mango, pineapple, cashew, cucurbits, peanut, broccoli, capsicum, papaya, carrot, Eucalyptus, *Gossypium* spp., sweetpotato, lettuce, lantana, bean, cotton, eggplant, guava, pepper, potato, soybean, tobacco, tomato, ginger, watermelon[14]	Roots		Africa (Burkina Faso, Côte d'Ivoire, Kenya, Malawi, Niger, Nigeria, Senegal, South Africa, Togo) Asia (China, India, Singapore, Thailand, Vietnam) Europe (Switzerland) North America (Costa Rica, Cuba, Guadeloupe, Guatemala, Martinique, Mexico, Puerto Rico, Trinidad and Tobago, USA). South America (Brazil, Venezuela)	HIGH (Papaya)	HIGH (Papaya)	HIGH (Papaya)	HIGH (Papaya)	HIGH (Papaya)
Scutellonema clathricaudatum		Okra, onion, peanut, cabbages, cauliflowers, pigeon pea, papaya, lemon, melon, cucumber, carrot, yam, strawberry, Bourbon cotton, lettuce, cassava, banana, tobacco, rice, pearl millet, pepper, tomato, eggplant, potato, wheat, mung bean, cowpea, grapevine, maize	Leaves, roots		Africa (Benin, Burkina Faso, Cameroon, Central African Republic, Congo, Democratic Republic of the, Congo, Republic of the, Côte d'Ivoire, Ethiopia, Ghana, Guinea, Kenya, Malawi, Mali, Mozambique, Niger, Nigeria, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Uganda) Asia (China, India, Thailand) North America (Cuba)	MEDIUM	MEDIUM	MEDIUM	MEDIUM	LOW
Phytoplasmas and viruses										
Cotton leafcurl virus complex (Begomovirus)	Cotton leaf curl Alabad virus (India/Pakistan), cotton leaf curl Bangalore virus, Cotton leaf curl Gezira virus (Africa), Cotton leaf curl Kokhran virus (India/Pakistan). Cotton leaf curl Multan virus (India/Pakistan/China), Cotton leaf curl Rajasthan virus (India), Cotton leaf curl Shahdapur virus, Papaya leaf curl virus (India/Pakistan), Tomato leaf curl	Cotton. Additional hosts include Hibiscus, Okra, tobacco, radish, tomato, French bean, chilli, papaya and many weeds	Leaves symptomatic, whole plant affected		Asia (Oman)	MEDIUM	HIGH	HIGH	HIGH	HIGH

	Bangalore virus (India/Pakistan), Okra enation leaf curl virus (Pakistan)									
Papaya lethal yellowing virus	Papaya lethal yellowing disease	Papaya	Leaves, fruit		South America (Brazil)	LOW	MEDIUM	MEDIUM	LOW-MEDIUM	LOW
Papaya droopy necrosis virus (PDNV); Papaya apical necrosis virus (PANV)[37]		Papaya	Leaves		North America (USA) South America (Venezuela)	LOW	LOW	LOW	LOW	LOW
Papaya lethal yellowing virus	Papaya lethal yellowing disease	Papaya	Leaves, fruit		South America (Brazil)	LOW	MEDIUM	MEDIUM	LOW-MEDIUM	LOW
Moroccan watermelon mosaic virus		Papaya, marrow	Leaves		Africa (Democratic Republic of Congo, Nigeria, South Africa, Tunisia) Asia (Iran) Europe (France, Greece, Italy)	LOW	LOW	MEDIUM	LOW	LOW
Papaya leaf medium distortion mosaic virus (Potyvirus)	Papaya leaf medium distortion mosaic virus	Papaya, oriental pickling melon, cucumber, spiked/horned melon	Leaves, fruit		North America (Mexico)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW-MEDIUM
Papaya leaf curl virus (several Reoviruses can cause this disease)	Papaya leaf curl virus	Papaya	Leaves		Asia (India)	LOW	MEDIUM	MEDIUM-HIGH	MEDIUM-HIGH	MEDIUM
Croton yellow vein mosaic Begomoviral	Croton yellow vein mosaic virus	Solanaceae, beetroot, papaya, peas and beans	Leaves		Asia (India)	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Papaya leaf curl Guangdong virus		Papaya, passionfruit, bell pepper, tobacco	Systemic infection		Asia (South Korea, Taiwan)	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Papaya leaf curl virus (several Begomoviruses can cause this disease)	Papaya leaf curl virus	Papaya	Leaves		Asia (India)	LOW	MEDIUM	MEDIUM-HIGH	MEDIUM-HIGH	MEDIUM
Tomato leaf curl Albatinah virus		Papaya, tomato	Systemic infection		Asia (Oman)	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Tobacco leaf curl virus (syn. Tobacco leaf curl bigeminivirus,	Tobacco leaf curl virus (TLCV)	Tomato, capsicum, papaya, tobacco, spinach and *Zinnia elegans*	Leaves, stem, fruit, flowers, whole plant (dwarfing)		Africa (Burkina Faso, Cameroon, Comoros, Democratic Republic of the Congo, Egypt, Ghana, Madagascar, Malawi, Mauritius,	LOW Papaya	MEDIUM Papaya	MEDIUM Papaya	LOW Papaya	VERY LOW Papaya

Tobacco cabbaging virus, Tobacco curly leaf virus, Tobacco frenching virus, Tobacco leaf curl begomovirus, Tobacco leaf curl bigeminivirus, Tobacco leaf curl geminivirus, Tobacco leaf curl virus 1, Tomato yellow dwarf virus)					Morocco, Mozambique, Nigeria, Sierra Leone, South Africa, Sudan, Tanzania, Uganda, Zambia, Zimbabwe) Asia (Cambodia, China, Georgia, India, Indonesia, Iraq, Japan, Malaysia, Myanmar, Pakistan, Philippines, South Korea, Sri Lanka, Taiwan, Thailand, Yemen) Europe (Denmark, Romania, Spain, Switzerland) North America (Cuba, Jamaica, Panama, Puerto Rico, United States) Oceania (Papua New Guinea, South America, Colombia, Venezuela)					
Papaya mosaic virus (Potexvirus)	Papaya mosaic virus	Papaya	Leaves, whole plant (dwarfing)		Africa (Tanzania) Asia (India, Philippines) North America (Dominica, Mexico, Saint Vincent and the Grenadines, Trinidad and Tobago, USA) Oceania (Guam) South America (Brazil, Venezuela)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Papaya leaf curl Guandong virus		Papaya, passionfruit, bell pepper, tobacco	Systemic infection		Asia (South Korea, Taiwan)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Tomato leaf curl Albatinah virus		Papaya, tomato	Systemic infection		Asia (Oman)					
Chickpea chlorotic dwarf virus		Beetroot, bell pepper, papaya, chickpea, watermelon, cucumber, cotton, lentil, common bean, pea, tomato, spinach, faba bean	Leaves, whole plant (stunting)		Africa (Egypt, Ethiopia, Nigeria, Sudan) Asia (India, Iran, Iraq, Oman, Pakistan, Syria, Yemen)	MEDIUM	MEDIUM	MEDIUM	LOW	
Okra enation leaf curl virus		Papaya, okra,	Systemic infection		Asia (India, Pakistan)	LOW-MEDIUM	MEDIUM	MEDIUM	LOW-MEDIUM	
Candidatus Phytoplasma asteris 16SrI	Yellow disease phytoplasmas	Onion, garlic, celery, asparagus, oats, beetroot, Bougainvillea, canola, cabbages, cauliflowers, broccoli, turnip, pigeon pea, bell pepper, papaya, safflower, *Citrus* spp., coconut, coriander, pumpkin, marrow, carrot, loquat, Eucalyptus, Euphorbia round kumquat, strawberry, soyabean, cotton, china-	Fruit, growing point, inflorescence leaves, roots, stems	Latent infection of propagation material - cuttings	Africa (Mozambique, South Africa, Zambia) Asia (China, India, Indonesia, Iran, Israel, Japan, Lebanon, Malaysia, Myanmar, South Korea, Taiwan, Thailand, Turkey, Pakistan) Europe (Belarus, Belgium, Czechia, Finland, France,	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM

		rose, barley, hop, lettuce, larches, lily, loofah, lupins, macadamia nut, apple, mallow, mango, cassava, lucerne, bitter gourd, Japanese mulberry, wild banana, myrtle, watercress, basil, European olive, prickly pear, common poppy, passionfruit, pearl millet, parsley, common bean, date-palm, black pepper, poplars, primrose, apricot, cherries, peach, nectarine, Japanese plum, European pear, common oak, radish, blackcurrant, red currant, roses, blackberry, raspberry, willows, sesame, tomato, eggplant, potato, spinach, lilac, marigold, pyrethrum, dandelion, clovers, wheat, blueberries, grapevine, maize, zinnia			Germany, Greece, Hungary, Italy, Lithuania, Poland, Portugal, Russia, Spain, Ukraine, United Kingdom) North America (Bermuda, Canada, Cuba, Guatemala, Mexico, Saint Vincent and the Grenadines, United States) South America (Argentina, Brazil, Colombia, Peru) Oceania (Futuna islands)					
Candidatus Phytoplasma solani 16SrXII-A	Stolbur phytoplasma	Kiwifruit, celery, beetroot, cabbages, cauliflowers, bell pepper, papaya, chicory, carrot, common fig, strawberry, apple, lucerne, Peppermint, tobacco, parsnip, avocado, parsley, common bean, pea, broad-leaved plantain, stone fruit, American plum, sweet cherry, plum, European pear, radish, blackberry, tomato, eggplant, black nightshade, potato, Johnson grass, dandelion, thyme, red clover, lavender, maize	Fruit, inflorescence, leaves, stems, vegetative organs, whole plant	Parasitic plants and latently infected vegetative propagation material	Africa (Niger) Asia (Armenia, Azerbaijan, China, Georgia, India, Iran, Israel, Jordan, Kyrgyzstan, Lebanon, Saudi Arabia, South Korea, Syria, Tajikistan, Turkey, Uzbekistan) Europe (Albania, Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, France, Germany, Greece, Hungary, Italy, Moldova, Montenegro, North Macedonia, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Switzerland, Ukraine, United Kingdom) South America (Chile)	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Polygala phyllody phytoplasma (16SrII)	Polygalla phyllody phytoplasma	papaya, Beach naupaka (Scaevola taccada) .	stems		Cuba	LOW	MEDIUM	LOW	UNKNOWN	UNKNOWN
Candidatus Phytoplasma caricae (16SrXVII)		papaya	stems		Cuba	LOW	MEDIUM	LOW	UNKNOWN	UNKNOWN
Candidatus Liberibacter crescens		papaya	stems		Puerto Rico	LOW	MEDIUM	LOW	UNKNOWN	UNKNOWN
Candidatus	Papaya bunchy top	Papaya, red hibiscus (*Hibiscus rosa-*	stem		Peru, Brazil, Costa Rica	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

phytoplasma brasiliense	disease	*sinensis* L.), sunn hemp (Croalaria juncea L.), Cuban jute (Sida rhmobifolia L.), cauliflower (Brassica oleraceae), bastard cedar trees (Guazuma ulmifolia Lam.), grapevine								

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Biosecurity Plan
for the Passionfruit Industry

A shared responsibility between government and industry

Version 2.4 November 2024

Plant Health AUSTRALIA

Hort Innovation
Strategic levy investment

PASSIONFRUIT FUND

PASSION FRUIT AUSTRALIA INC.

Location: Level 1
1 Phipps Close
DEAKIN ACT 2600
Phone: +61 2 6215 7700
Email: biosecurity@phau.com.au
Visit our website www.planthealthaustralia.com.au

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Revision history

VERSION NUMBER	DATE	DETAILS
2.0	October 2021	Biosecurity Plan for the Passionfruit Industry
2.1	July 2022	Biosecurity Plan for the Passionfruit Industry (updated following BRP meeting #1)
2.2	June 2023	Biosecurity Plan for the Passionfruit Industry (updated following BRP meeting #2)
2.3	May 2024	Biosecurity Plan for the Passionfruit Industry (updated following BRP meeting #3)
2.4	November 2024	Biosecurity Plan for the Passionfruit Industry (updated following BRP meeting #4)

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The *Biosecurity Plan for the Passionfruit 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 Passionfruit Industry (Version 2.0)* was formally endorsed by the Passionfruit industry (through the Passionfruit Australia in September 2021, and all state and territory governments (through the Plant Health Committee) in November 2021.

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 30 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, Forestry and Fisheries 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.

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LIST OF ACRONYMS

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACIAR	Australian Centre for International Agricultural Research
ACPPO	Australian Chief Plant Protection Officer
AgVic	Agriculture Victoria
ALGA	Australian Lychee Growers Association
APC	AUSPest*Check*®
APVMA	Australian Pesticides and Veterinary Medicines Authority
AS/NZS	Australian Standard/New Zealand Standard
BICON	Australian Biosecurity Import Conditions Database
BIRA	Biosecurity Import Risk Analysis
BISOP	Biosecurity Incident Standard Operating Procedure
BRP	Biosecurity Reference Panel
BMP	Best Management Practise
BOLT	Biosecurity On-Line Training
BP	Biosecurity Plan
CABI	Centre for Agriculture and Bioscience International
CCEPP	Consultative Committee on Emergency Plant Pests
CPHM	Chief Plant Health Manager
DAF NT	Department of Agriculture and Fisheries, Northern Territory
DAF Qld	Department of Agriculture and Fisheries, Queensland
DAFF	Department of Agriculture, Fisheries and Forestry
DAWE	Department of Agriculture, Water and the Environment (now DAFF)
DEECA	Department of Energy, Environment and Climate Action, Victoria
DITT NT	Department of Industry, Tourism and Trade, Northern Territory (now DAF NT)
DPI NSW	Department of Primary Industries, New South Wales
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
ILO	Industry Liaison Officer
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
LLC	Local Control Centres
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
NPBS	National Plant Biosecurity Strategy
NPPP	National Priority Plant Pest
NSP	National Surveillance Protocol
NSW	New South Wales
NRE Tas	Department of Natural Resources and Environment, Tasmania
NT	Northern Territory
ORC	Owner Reimbursement Costs
PA	Papaya Australia
PAI	Passionfruit Australia Inc
PaDIL	Pest and Disease Image Library
PBRI	Plant Biosecurity Research Initiative
PHA	Plant Health Australia
PHC	Plant Health Committee
PIC	Property Identification Code
PIRSA	Primary Industries and Regions South Australia
PPIM	Plant Property Identification Model
QA	Quality Assurance
R&D	Research and Development
RDC	Research and Development Corporation
RD&E	Research, Development and Extension
SA	South Australia
SARDI	South Australian Research and Development Institute
SCC	State Coordination Centres
SDQMA	Subcommittee for Domestic Quarantine and Market Access (now SMART)
SMART	Subcommittee on Market Access, Risk and Trade
SNPHS	Subcommittee for Plant Health Surveillance
SPHD	Subcommittee on Plant Health Diagnostics
SPS	Sanitary and Phytosanitary
T2M	Transition to Management
TBA	To be announced
TRP	Technical Review Panel
TST	Threat Summary Table
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[1], 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 27.

[1] https://www.planthealthaustralia.com.au/response-arrangements/emergency-plant-pest-response-deed-epprd/

EXECUTIVE SUMMARY

To ensure their future viability and sustainability, it is important that the Passionfruit industry, represented by Passionfruit Australia as the peak industry body, minimise 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 the passionfruit 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 these industries. It identifies and prioritises exotic plant pests (not currently present in Australia) and other pests of biosecurity concern and focuses on future biosecurity challenges.

The Biosecurity Plan for the Passionfruit Industry (this biosecurity plan) was developed in concert with the development of biosecurity plans for the Australian Lychee and Australian Papaya Industries. Facilitated by Plant Health Australia (PHA) and involving the collaboration of plant health and biosecurity experts from relevant Commonwealth, State and Territory agriculture agencies, and representatives from the Australian Lychee Growers Association (ALGA), Papaya Australia and Passionfruit Australia. These parties will be referred to as key stakeholders in the remainder of this document.

Key stakeholders were represented in the Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG), and these groups provided advice in the development of the three Biosecurity Plans (Lychee Biosecurity Plan, Papaya Biosecurity Plan, Passionfruit Biosecurity Plan).

A key part of the biosecurity planning process was the development of combined Threat Summary Tables (TST) for all three industries. Containing over 70 exotic plant pests, these tables demonstrate the potential biosecurity threats faced by the passionfruit industry. Each pest on the list was given an overall risk rating based on four criteria; entry potential, establishment potential, spread potential, and potential for economic impact. In this biosecurity plan, other pests of biosecurity significance for the passionfruit industry were also identified as good biosecurity practices benefit the ongoing management of and surveillance for these pests.

The Biosecurity Plan 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 passionfruit industry. This enables identification of gaps and prioritisation of specific actions, as listed in the Biosecurity Implementation Table (Table 3; Table 4). The development of this table will increase the industry's biosecurity preparedness and response capability by outlining specific areas of action which could be undertaken through a government and industry partnership.

The Biosecurity Plan is principally designed for use by decision makers. It provides industry and government with a mechanism to identify exotic plant pests as well as to address the specific strengths and weaknesses of the Australian Passionfruit Industry's current biosecurity position. It is envisaged that annual reviews of this biosecurity plan will be undertaken to assess progress against agreed activities, with another formal review conducted after five years.

The Biosecurity Plan is a document outlining the commitment to the partnership between the key stakeholders to improve biosecurity.

SIGNIFICANT BIOSECURITY THREATS

Document overview

Biosecurity for the Australian Passionfruit industry focuses on five key areas to identify the components to be implemented through the life of the biosecurity plan 2021-2026. These five areas are outlined in the sections below.

High priority exotic pests and other pests of biosecurity significance

A key outcome of this biosecurity plan is the identification of the exotic high priority pests, and other pests of biosecurity significance for the Australian Passionfruit industry. This section includes:

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

The exotic HPP list, and other 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 through consultation with government and industry.

Implementing biosecurity for the Australian Passionfruit Industry 2021-2026

This section includes the biosecurity implementation plan and a gap analysis of the current level of preparedness for HPPs of the Passionfruit 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. The TEG, the BIG and the BRP all contained representatives of the three industries as well as technical experts from commonwealth, state and territory governments.

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 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. Other 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 Passionfruit 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 RD&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)[2] incursions that would affect the Australian Passionfruit 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 other pests of biosecurity significance to the Australian Passionfruit Industry. This section provides information on the High Priority Pest (HPP) list, and the other pests of biosecurity significance for the Australian Passionfruit industry. These pest lists, provide the Australian Passionfruit Industry, commonwealth, state and territory governments, and other relevant stakeholders with the information needed to prioritise resources for biosecurity risk management.

The exotic HPP list and other 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 activities.

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

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

Passionfruit industry High Priority Pests

Table 1 provides an overview of the top ranked biosecurity pest threats (invertebrates, pathogens and nematodes) for the Australian Passionfruit industry. Further details on each pest along with the basis for the likelihood ratings are provided on page 60. 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.

Table 1. High Priority pests of the passionfruit industry.

Common name	Scientific name	Host(s)	Affected plant part	Movement and dispersal	Geographic distribution[3]	Entry potential	Est.[4] potential	Spread potential	Economic impact	Overall risk
Invertebrates										
Diptera (flies and midges)										
Carambola fruit fly	*Bactrocera carambolae*	Highly polyphagous (75 hosts from 26 families) including grapefruit, orange, lemon, lime, mandarin, cashew, breadfruit, jackfruit, carambola, capsicum, mango, guava, banana, avocado, tomato, mangrove, papaya	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Asia (Brunei, India, Indonesia, Malaysia, Singapore, Thailand) South America (Brazil, French Guiana, Guyana, Suriname)	HIGH	HIGH	HIGH	HIGH	HIGH
Oriental fruit fly	*Bactrocera dorsalis (Bactrocera invadens; Bactrocera papayae; Bactrocera philippinensis)*	Polyphagous, with wide host range including cashew, soursop, breadfruit, jackfruit, bell pepper, chilli, Citrus, watermelon, coffee, melon, cucumber, longan, persimmon, mangosteen, dragon fruit, mango, apple, banana, avocado, lychee, papaya	Fruit	Infested plant material (including fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the soil	Asia, Africa, North America, Europe, Oceania.[5]	HIGH	HIGH	HIGH	HIGH	HIGH
Fijian fruit fly	*Bactrocera passiflorae*	Polyphagous (49 hosts in 28 families) including Cashew, breadfruit, lime, mandarin, mango, avocado, guava, eggplant, cocoa, papaya	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Oceania (Fiji, Niue, Tonga, Tuvalu, Wallis & Futuna)	HIGH	HIGH	HIGH	HIGH	HIGH

[3] (CABI, 2023).

[4] Establishment potential.

[5] Asia (Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Christmas Island (Indian Ocean), India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, United Arab Emirates, Vietnam). Africa, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Liberia, Madagascar, Mali, Mauritania, Mayotte, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe). North America (USA). Europe (Italy). Oceania (Federated states of Micronesia, French Polynesia, Northern Mariana Islands, Palau, Papua New Guinea)

Common name	Scientific name	Host(s)	Affected plant part	Movement and dispersal	Geographic distribution[3]	Entry potential	Est.[4] potential	Spread potential	Economic impact	Overall risk
Melon fruit fly	*Zeugodacus cucurbitae*	Watermelon, rockmelon, cucumber, pumpkin, tomato	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.		HIGH	HIGH	HIGH	HIGH	HIGH
Hemiptera (stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)										
	Dysmicoccus grassii (Syn. *Pseudococcus grassi*)[6]	Polyphagous including fig, acacia, pineapple, mango, asparagus, avocado, oleander, banana, coffee, avocado, hibiscus, prickly pear, sugar apple, papaya	Leaves, fruit, stems	Infested soil and plant material. Adult males capable of flight over short distances.	Africa (Canary Islands, Nigeria), Asia (Malaysia), Europe (France, Italy, Sicily, Spain), North America (Bahamas, Belize, Cuba, Costa Rica, Dominican Republic, Haiti, Honduras, Mexico, Panama, Puerto Rico & Vieques Island, Trinidad and Tobago, United States), South America (Colombia, Brazil, Ecuador, Peru)	MEDIUM	HIGH	HIGH	HIGH	HIGH
Cocoa mirids	*Helopeltis clavifer*	Polyphagous, including tea, cocoa; cashew, sweetpotato and other host plants reported from New Guinea	Pods	Infested plant materials	Asia (Indonesia, Malaysia) Oceania (Papua New Guinea); New Britain and New Ireland	HIGH	HIGH	HIGH	HIGH	HIGH
Pathogens										
Bacteria (including phytoplasmas)										
Bacterial canker of stone fruit, bacterial canker of trees	*Pseudomonas syringae* exotic strains	Broad host range over 50 hosts including sweet cherry, sour cherry, onion, capsicum, leek, lucerne, rice, chrysanthemum, citrus, cucumber, pumpkin, garden dahlia, hibiscus, walnut, lettuce, magnolia, mango, bean, avocado, stone fruit, roses, tomato, maize, willows, clover, blueberry, grapevine, cowpea	Whole plant Leaves, inflorescence, stems, pods, seeds, flowers, fruit	Infected plant material, wind, insect vector, mechanical, plant stress	Global if not splitting endemic and exotic	HIGH	HIGH	HIGH	HIGH	HIGH
Viruses and viroids										
Passionfruit severe leaf distortion virus	**Passionfruit severe leaf distortion virus**	*Passiflora spp.*	Systemic infection		South America (Brazil)	HIGH	HIGH	HIGH	HIGH	HIGH
Passionfruit Sri Lankan mottle	**Passionfruit Sri Lankan mottle**	*Passiflora spp.*	Systemic infection		Asia (Sri Lanka)	HIGH	HIGH	HIGH	HIGH	HIGH

[6] http://scalenet.info/catalogue/Dysmicoccus%20grassii/

Common name	Scientific name	Host(s)	Affected plant part	Movement and dispersal	Geographic distribution[3]	Entry potential	Est.[4] potential	Spread potential	Economic impact	Overall risk
potyvirus	**potyvirus**									
East Asian Passiflora virus	**East Asian Passiflora virus**	*Passiflora* spp. (including *P. edulis, P. edulis* x *P. edulis* f. *flavicarpa* and *P. edulis* f. *flavicarpa*).	Systemic infection		Asia (Japan)	HIGH	HIGH	HIGH	HIGH	HIGH

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 in Australia. Pollination services of the European honey bee are provided by beekeepers to growers of pollinator-reliant crops.

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

Established and exotic pests of European honey bees as well as exotic pest bees can have a major impact on crop pollination services. Honey bee pests and pest bees can also impact unmanaged colonies which also provide pollination.

Passionfruit rely on a range of native and established insect species for pollination, including European honey bees. A list of the high priority bee pests and pest bees which could impact the Passionfruit industry can be located on the PHA website planthealthaustralia.com.au/industries/honey-bees/ and the BeeAware website beeaware.org.au/pests/

Other pests of biosecurity significance

Introduction

This section identifies other pests of biosecurity significance for the passionfruit industry in Australia. By identifying pests which are either currently under quarantine arrangements or which passionfruit producers already 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 industry.

Identification of other 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

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

- currently under quarantine arrangements or 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. Other pests of biosecurity significance.

Common name (Scientific name)	Hosts	Affected plant part	Distribution in Australia	State movement controls or market impact by pests	Factsheets	Comments
Invertebrates						
Acari (mites and ticks)						
Varroa mite (*Varroa destructor*)	*Apis cerana, A. mellifera*.	Brood and adults (honey bee life stage)	NSW and Vic[7].	Movement restrictions of hives and other equipment apply for Qld[8], SA[9], NT[10], WA[11], Vic[12], ACT[13], Tas[14]	PHA[15], BeeAware[16], NSWDPI[17]	A 2-year transition to management (T2M) plan was approved in February 2024.[18]
Diptera (Flies and midges)						
Queensland fruit fly *Bactrocera tryoni*	Polyphagous including papaya	Fruit	NSW, NT, Qld, Vic	Movement restrictions in the Greater Sunraysia Pest Free Area	NSW DPI[19], PHA[20], QDAF[21], AgVic[22]	https://www.fruitflyidentification.org.au/species/bactrocera-tryoni/
Mediterranean fruit fly *Ceratitis capitata*	Polyphagous including papaya	Fruit	WA (except Ord River Irrigation Area - ORIA)	Movement controls of fruit	PHA[20], NSW DPI[23], DPIRD[24], AgVic[25] QDAF[26]	https://www.fruitflyidentification.org.au/species/ceratitis-capitata/

[7] https://www.dpi.nsw.gov.au/emergencies/biosecurity/current-situation/varroa-mite-emergency-response
[8] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/animal/industries/bees/move
[9] https://pir.sa.gov.au/biosecurity/animal_health/animal_species/bees/moving_bees_and_bee_products
[10] https://nt.gov.au/industry/agriculture/livestock-and-animals/honey-bees-and-beekeeping
[11] https://www.agric.wa.gov.au/livestock-animals/livestock-species/bees
[12] https://agriculture.vic.gov.au/biosecurity/moving-livestock-and-animals/moving-bees-interstate
[13] https://www.environment.act.gov.au/parks-conservation/plants-and-animals/biosecurity/biosecurity-alerts/varroa-destructor-mite
[14] https://nre.tas.gov.au/biosecurity-tasmania/animal-biosecurity/bees/bee-pests-diseases-and-welfare/varroa-mite
[15] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/Varroa-mites-FS.pdf
[16] https://beeaware.org.au/archive-pest/varroa-mites/#ad-image-0
[17] https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/268026/DPI-Primefact-Varroa-Mites-13062024.pdf
[18] https://www.varroa.org.au/nvmmp
[19] https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/1482740/Queensland-fruit-fly.pdf
[20] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/01/QFly-and-Medfly-FS-1.pdf
[21] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/insects/horticultural/queensland-fruit-fly
[22] https://fruitflycontrol.com.au/wp-content/uploads/2024/05/Managing-QFF-in-your-garden-English.pdf
[23] https://www.dpi.nsw.gov.au/biosecurity/insect-pests/medfly
[24] https://www.agric.wa.gov.au/medfly/mediterranean-fruit-fly-life-cycle-biology
[25] https://agriculture.vic.gov.au/biosecurity/pest-insects-and-mites/priority-pest-insects-and-mites/mediterranean-fruit-fly
[26] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/biosecurity/plants/priority-pest-disease/mediterranean-fruit-fly

Pathogens						
Fungi						
Alternata spot & Brown spot *Alternaria alternata* & *A. passiflorae*	Passionfruit, granadilla and weed relatives (e.g., stinking passion flower, *Passiflora foetida*).	Leaves, stems, fruit	*Alternaria alternata*: Australia wide. *Alternaria passiflorae*: NSW, Qld, NT, WA.		Agrobase[27], ACIAR[28], QDAF[29]	
Fusarium wilt *Fusarium oxysporum f. sp. passiflorae*	Passionfruit, *Passiflora spp.*	Leaves, stems	Qld, NSW			

[27] https://agrobaseapp.com/australia/disease/brown-spot-of-passionfruit
[28] https://apps.lucidcentral.org/pppw_v12/text/web_full/entities/passionfruit_spots_153.htm
[29] https://www.daf.qld.gov.au/__data/assets/pdf_file/0016/57202/factsheet-passionfruit-and-wet-weather.pdf

Implementing biosecurity for the Australian Passionfruit Industry 2021-2026

This section includes the biosecurity implementation plan and a gap analysis of the current level of preparedness for HPP of the Australian Passionfruit Industry. The Biosecurity Implementation Group (BIG), comprising of representatives of key stakeholders and other relevant experts, developed the implementation plan that sets out the Biosecurity Plans shared goals and objectives. It is intended that the implementation plan is revisited by the BRP regularly over the next five years to maintain its relevance. The TEG, the BIG and the BRP contain representatives of the three industries as well as scientific and technical experts from Australian commonwealth, state and territory governments, and other relevant organisations.

Biosecurity Implementation Table

The Biosecurity Implementation Table aims to build upon the themes outlined in the Intergovernmental Agreement on Biosecurity (IGAB)[30] and the National Plant Biosecurity Strategy (NPBS)[31] by providing a clear line of sight between the development of this Biosecurity Plan and broader plant health policy and legislation.

This table also aims to provide focus and strategic direction for plant biosecurity activities relating to the Australian Passionfruit industry over the next five years (i.e. the life of this Biosecurity Plan). The Biosecurity Implementation Table provides specific recommendations for potential biosecurity activities identified by key stakeholders to improve biosecurity preparedness for pest threats.

Biosecurity is a shared responsibility between the key stakeholders and other stakeholders. The Biosecurity Implementation Table has been produced to help coordinate actions and resources in the Australian biosecurity system. Activities may require additional funding to be sourced prior to commencement. Implementing the specific actions listed in the Biosecurity Implementation Table, will not only strengthen Australian Passionfruit Industry biosecurity systems, but also the broader Australian plant biosecurity systems. Future versions of this table will also track progress on the activities described.

The Biosecurity Implementation Table previously outlined eight strategy areas where industry and government should align their biosecurity efforts. The eight strategy areas were:

- Capacity and Capability
- Education and Awareness
- Preparedness and Response
- Surveillance
- Diagnostics
- Established Pests of Biosecurity Concern
- Research, Development & Extension
- Legislation and Regulatory Issues of Importance

During the life of the Biosecurity Plan, changes have been made to the structure of the Implementation Table to better align with the structure of the IGAB and the NPBS. The Implementation Table has been updated to reflect this new structure below.

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

Table 3. The Biosecurity Implementation Table for the Australian Passionfruit industry 2021-2026.

Biosecurity Plan Strategy	Action	Output	Outcome	Potential Partners	Current Activities	Timeframe
1. Preparedness and Response	1.1 Develop a Biosecurity Incident Standard Operating Procedures (BISOP) which is designed to guide industry and government in the event of an exotic pest/pathogen incursion.	Passionfruit BISOP which identifies and documents corporate knowledge, organisational procedures, and roles/responsibilities for responding to a biosecurity incident/incursion.	The BISOP will provide industry and govt with operational guidance when responding to a biosecurity incursion/response.	Passionfruit Australia Inc., Hort Innovation, Plant Health Australia (PHA).		
	1.2 Describe and evaluate current biosecurity risk pathways into Australia and determine appropriate mitigation measures.	Passionfruit biosecurity pathway risk analysis.	Greater understanding of the biosecurity risks associated with pathways will provide the opportunity to develop pre-emptive mitigation measures.	Passionfruit Australia Inc., Department of Agriculture, Fisheries and Forestry (DAFF), State and Territory Governments (where appropriate).		
	1.3 Understand current surveillance programs undertaken by industry and government.	Surveillance analysis and a Passionfruit industry surveillance program.	Early detection of key exotic pests and an improved knowledge of geographic spread of established pests.	Passionfruit Australia Inc., Commonwealth, State and Territory Governments, Subcommittee on National Plant Health Surveillance (SNPHS), PHA.		Ongoing
	1.4 Participate in future simulation exercises that test the preparedness and response of the biosecurity system to exotic pest and/or pathogen incursions.	Simulation exercises.	Participating industries and governments are better prepared to respond to a pest incursion.	Passionfruit Australia Inc., Commonwealth, State and Territory Governments, Hort Innovation, PHA.		Ongoing
	1.5 Review the availability of crop protection products available to manage exotic pests and pathogens and identify gaps in control options.	A list of important pests and control options are available with gaps identified.	Industry will have a list of identified gaps in control options for important pests and pathogens.	Passionfruit Australia Inc., State and Territory Governments (where appropriate), Australian Pesticides and Veterinary Medicines Authority (APVMA), collaborating industries.		
	1.6 Prioritise identified gaps in pest control options and develop options to address gaps.	A plan to address crop protection gaps.	A prioritised list of pests and control options with strategies developed to gain access.	Passionfruit Australia Inc., APVMA, collaborating industries, crop protection companies.		
	1.7 Review availability of diagnostics for the high priority pests and assess the capability to perform diagnostics (normal capacity and surge capacity).	Diagnostic tools and methods that provide accurate and timely identification of pests and pathogens.	Increased accuracy and rapid diagnosis of pests/pathogens will provide greater opportunity for eradication and/ or management.	Passionfruit Australia Inc., State and Territory Governments (where appropriate), collaborating industries, Subcommittee on Plant Health Diagnostics (SPHD).		Ongoing
	1.8 Maintain an understanding of relevant biosecurity legislation and regulations in all states/territories.	Regular legislation and regulation update.	Any specific state/ territory or discordant requirements identified. Increase industry awareness of legislation and	Passionfruit Australia Inc.		Ongoing

			regulations impacting their businesses.			
	1.9 Develop Owner Reimbursement Costs (ORC) that provide a framework for calculating ORC payments for Passionfruit growers in the event of a response.	Current ORC framework and cost structure.	ORC framework and costs structures remain relevant to key industry sectors.	Passionfruit Australia Inc., State and Territory Governments (where appropriate), Rural Assistance Authorities (RAA), PHA.		2024
2. Capacity & Capability	2.1 Ensure Passionfruit Australia Inc. executives regularly undertake biosecurity training (e.g., Emergency Plant Pest Response Deed (EPPRD), Biosecurity OnLine Training (BOLT)).	Biosecurity skilled members and staff.	Knowledge and understanding of biosecurity systems and processes will provide Passionfruit Australia Inc. with greater capacity to contribute to biosecurity for the benefit of their industry.	Passionfruit Australia Inc., Hort Innovation, PHA.		2022
	2.2 In collaboration with industry and governments, gain an understanding of diagnostic capacity within both government and private providers and assess methods to address capacity and capability gaps.	Diagnostic capacity analysis.	Increased diagnostic capacity or a greater understanding of gaps and methods to address these gaps.	Passionfruit Australia Inc., Hort Innovation, collaborating industries, State and Territory Governments.		
	2.3 Build and maintain international networks of production and biosecurity specialists who can contribute to growth of knowledge and skills within the Australian Passionfruit industry.	International Biosecurity Network.	Improved preparedness to manage both established and exotic pests.	Passionfruit Australia Inc., Hort Innovation.		Ongoing
	2.4 Development and implementation of a biosecurity training framework for the Passionfruit industry.	Biosecurity training framework.	Passionfruit framework with training modules will assist develop a skilled biosecurity focussed workforce.	Passionfruit Australia Inc., Hort Innovation, PHA.		
3. Communication and Engagement	3.1 Passionfruit Australia Inc. maintains an industry database which holds current contact information for Passionfruit growers and key industry stakeholders.	Industry database.	Critical information on biosecurity can be delivered rapidly to the industry.	Passionfruit Australia Inc., other authorised buyers.		Ongoing
	3.2 Passionfruit Australia Inc. delivers an effective industry communications program with multiple delivery methods which has the capacity to deliver relevant biosecurity information, including Beeaware and the National Fruit Fly Council (NFFC).	Passionfruit communications program.	The Passionfruit industry is well informed on the range of issues impacting on industry and business.	Passionfruit Australia Inc.		Ongoing
	3.3 Promote, disseminate, and demonstrate benefits of biosecurity to industry within and across each component of the supply chain.	BOLT courses.	Improved knowledge of biosecurity and process and systems supporting biosecurity.	Passionfruit Australia Inc., State and Territory Governments, PHA.		Ongoing
	3.4 Prepare articles (including fact sheets) on biosecurity and key pests (exotic and	Articles, fact sheets, other information.	Industry stakeholders are informed on pests, current	Passionfruit Australia Inc., State and Territory Governments, PHA.		2021-2022

	established) for publication in industry journals and website.		management practices and research activities.			
	3.5 Ensure industry (in particular new entrants) are aware of the Emergency Plant Pest Response Deed (EPPRD), the Owner Reimbursement Cost (ORC) Framework and the implications for the industry and business.	Biosecurity awareness material.	Industry retains and builds knowledge of the response and management of exotic pests and pathogens.	Passionfruit Australia Inc., PHA.		
4. Innovation, Research, Development and Extension	4.1 Review and prioritise Passionfruit biosecurity Research, Development and Extension (RD&E) annually and identify opportunities for collaboration and cross-sectoral investment.	Passionfruit biosecurity RD&E plan.	A Passionfruit innovation and RD&E program that addresses key issues challenging the Passionfruit industry.	Passionfruit Australia Inc., Biosecurity Reference Panel (BRP), State and Territory Governments (where appropriate), PHA.		Ongoing
	4.2 Keep informed of activities with SPHD through the national Diagnostic and Surveillance Network Coordinator.	Rapid field diagnostic tools.	More rapid diagnosis of pathogens will asset growers implement the most suitable eradication or management program.	Passionfruit Australia Inc., State and Territory Governments.		Ongoing
5. Collaboration and partnerships	5.1 Build strong networks among both researchers and regulators in Commonwealth and State/Territory governments.	A robust and collaborative research and regulatory network.	Greater input into future decisions making that may impact on the industry.	Passionfruit Australia Inc., State and Territory Governments, Universities.		
	5.2 Maintain collaborative arrangements with universities and other research and education providers so opportunities for Passionfruit research and development activities can be addressed.	Collaborative biosecurity programs.	The Passionfruit industry maintains access to innovative solutions and products.	Passionfruit Australia Inc., State and Territory Governments (where appropriate), Universities.		
	5.3 Support addressing gaps in biosecurity preparedness by collaborating with other industries, governments, and other stakeholders.	Collaborative biosecurity programs.	Improved biosecurity preparedness by industry and government.	Passionfruit Australia Inc., other industries, State and Territory Governments.		
	5.4 Facilitate and maintain an international network of Passionfruit technical specialists who can contribute to growth of knowledge and skills within the Australian Passionfruit industry.	Passionfruit pest and disease network.	Improved capability and capacity to manage both established and exotic pests.	Passionfruit Australia Inc.		Ongoing
	5.5. Engage in initiatives to improve preparedness and response to cross sectoral pests and or diseases.	Improved preparedness for pests and diseases.	Shared investment into RD&E.	Passionfruit Australia Inc., Plant Biosecurity Research Initiative (PBRI), PHA.		Ongoing

Australian Passionfruit industry - biosecurity preparedness

The following table has been populated with the high priority pests of the Passionfruit 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 Passionfruit industry.

Common name (Scientific name)	National Diagnostic Protocol[32]	Surveillance programs[33]	Fact sheets	Contingency plan	EPPRD category[34]	National Priority Plant Pest[35]	Potential Collaborators[36]
Invertebrates							
Diptera (flies and midges)							
Carambola fruit fly *Bactrocera carambolae*	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[37]	Australian Government & all states (excl. ACT), NAQS[38]	Not developed	Not developed	Not categorised	No. 4	Avocado, Citrus, Mango, Tomato, Vegetable
Oriental fruit fly *Bactrocera dorsalis*	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[37]	Australian Government & all states (excl. ACT), NAQS[38]	PHA[39], QDAF[40], NSW DPI[41], NFFC[42]	Not developed	2	No. 4	Avocado, Mango, Summerfruit, Apple and Pear, Citrus, Viticulture, Banana, Coffee, Cherry, Tomato, Vegetable
Fijian fruit fly *Bactrocera passiflorae*	For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies.[37]	Australian Government & all states (excl. ACT), NAQS[38]	PHA[43]	Not developed	Not categorised	Not listed	Mango, Avocado, Vegetable

[32] https://www.plantbiosecuritydiagnostics.net.au/resources/?category=national-diagnostic-protocols
[33] Information presented has been taken from National Plant Biosecurity Status Report 2020, National Plant Health Surveillance Program and the Northern Australian Quarantine Strategy and confirmed through the Plant Health Committee.
[34] https://www.planthealthaustralia.com.au/response-arrangements/emergency-plant-pest-response-deed-epprd/
[35] https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/plant/national-priority-plant-pests-2019
[36] Industries listed in this column identify these pests within their biosecurity plans. Pests listed as a High Priority Pest are indicated by HPP.
[37] https://www.fruitflyidentification.org.au/wp-content/uploads/2018/10/The-Australian-Handbook-for-the-Identification-of-Fruit-Flies-v3.1.pdf
[38] Australian Gov.: Northern Australian Quarantine Survey exotic fruit fly trapping, NSW: Exotic Fruit Flies-Ports & Riverina (protocol based on pheromone traps), Tas.: Fruit Fly Trapping program (area freedom & export protocol), VIC: National Plant Health Surveillance Project (protocol developed), SA: Ports of Entry Trapping Program (protocol developed), WA: Port of Entry Fruit Fly Trapping (Fruit fly Codes of Practice protocol), QLD: Exotic fruit fly trapping (protocol developed), NT: Fruit Fly monitoring and surveillance
[39] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/02/Exotic-fruit-flies-FS.pdf
[40] https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease/oriental-fruit-fly
[41] https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/orientalff
[42] https://www.preventfruitfly.com.au/about-the-oriental-fruit-fly/
[43] https://www.planthealthaustralia.com.au/wp-content/uploads/2024/02/Fijian-fruit-fly-FS.pdf

Common name (Scientific name)	National Diagnostic Protocol[32]	Surveillance programs[33]	Fact sheets	Contingency plan	EPPRD category[34]	National Priority Plant Pest[35]	Potential Collaborators[36]
Hemiptera (stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)							
Mealybug *Dysmicoccus grassii* (Syn. *Pseudococcus grassi*)	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	
Cocoa mirids *Helopeltis clavifer*	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	
Pathogens							
Bacteria (including phytoplasmas)							
Bacterial canker of stone fruit, bacterial canker of trees *Pseudomonas syringae* exotic strains	Not developed	Not covered by a pest specific surveillance program	NSW DPI[44]	Not developed	Not categorised	Not listed	Nursery & Garden
Viruses and viroids							
Passionfruit severe leaf distortion virus (*Begomovirus*)	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	
Passionfruit Sri Lankan mottle potyvirus (*Potyvirus*)	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	
East Asian Passiflora virus (*Potyvirus*)	Not developed	Not covered by a pest specific surveillance program	Not developed	Not developed	Not categorised	Not listed	

[44] https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0015/41514/Bacterial_canker_of_stone_fruit_-_Primefact_77.pdf

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 exotic 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 our way of life.

Plant pests include (but are not limited to) insects, mites, snails or diseases (pathogens, including nematodes) that have the potential to adversely affect fresh food, fibre, ornamental crops, honey bees and stored products, as well as environmental flora and fauna. For agricultural systems, if exotic plant 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 plant 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 focus on continuous improvement from industry and governments to keep Australia's plant biosecurity system effective, 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.

Passionfruit peak industry body

Passionfruit Australia Inc. is the peak industry body for the Passionfruit industry. They are a signatory to the EPPRD and are the key industry contact point if a suspect emergency plant pest affecting the Australian Passionfruit Industry is detected. For a background on the Passionfruit industry, refer to page 58.

Passionfruit Australia Inc. 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/ .

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. The main activities of PHA are funded from annual subscriptions paid by members. The Australian Government, state and territory governments and 38 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 PHA.

Plant Health Australia 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 Australia's plant industries. Through PHA, current and future needs of the plant biosecurity system can be mutually agreed, issues identified, and solutions to problems found. The independence and impartiality of PHA, allows the organisation 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 Australian Passionfruit Industry was developed in consultation with the Technical Expert Group and Biosecurity Implementation Group. These groups were comprised of plant health and biosecurity experts and industry representatives from key stakeholders.

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

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

Biosecurity planning

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

Ensuring the Passionfruit 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 economic and social costs of pest incursions on both growers and the wider community. The information gathered during these processes provides additional assurance that the Australian Passionfruit 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.

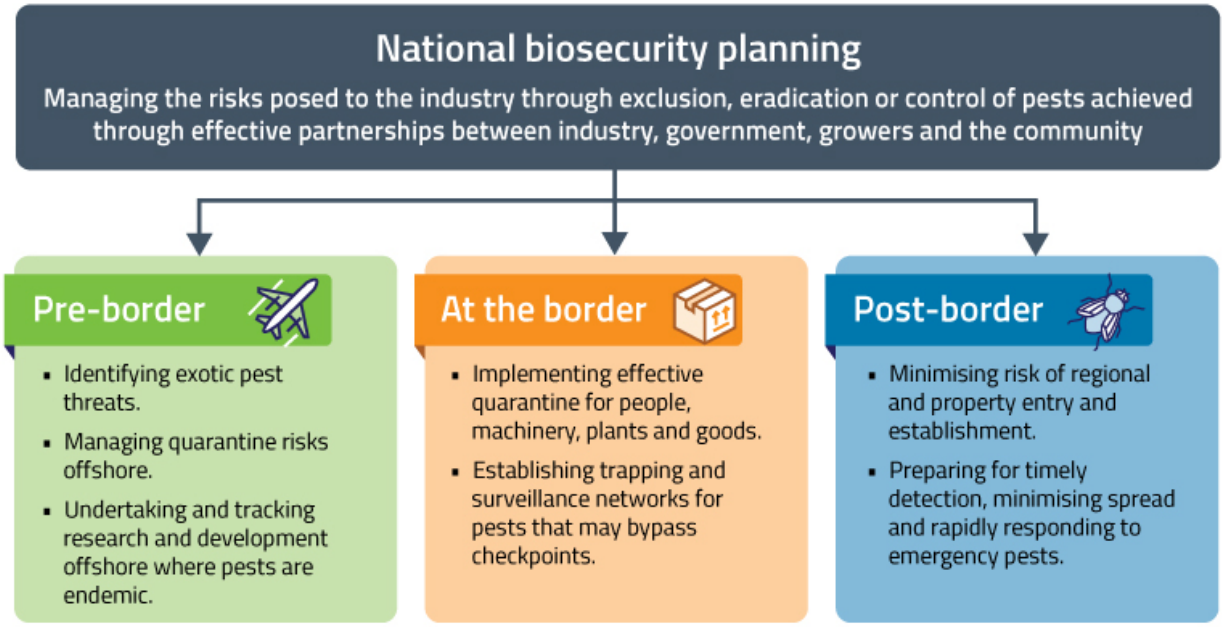

Figure 1. Industry biosecurity: a shared responsibility.

Biosecurity Plan development

With the assistance of Passionfruit Australia, Australian Lychee Growers Association and Papaya Australia, a Tropical Fruits Technical Expert Group (TEG) and a Tropical Fruits Biosecurity Implementation Group (BIG) were formed to work on the review of the Biosecurity Plan for the Passionfruit industry. These groups were coordinated by Plant Health Australia (PHA) and included representatives from the three industries, relevant Commonwealth, state, and territory agriculture agencies.

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

- identifying and documenting key threats to the Passionfruit 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 Tropical Fruit Technical Expert Group (TEG) and/or the Tropical Fruit Biosecurity Implementation Group (BIG).

NAME	ORGANISATION	AREA OF EXPERTISE	MEMBER OF TEG	MEMBER OF BIG
Jill Houser	ALGA	Industry	✓	✓
Gerard Kath	Papaya Australia	Industry	✓	✓
Joe Zappala	Papaya Australia	Industry		✓
Dennis Chant	Passionfruit Australia	Industry	✓	✓
Jane Richter	Passionfruit Australia	Industry	✓	
Greg Chandler	Hort Innovation	Biosecurity, R&D	✓	
Matt Adkins	NSW DPI	R&D	✓	
Ruth Huwer	NSW DPI	Entomology	✓	✓
Fucheng Shan	WADPIRD	Research	✓	✓
Touhidur Rahman	WADPIRD	Entomology	✓	
Alison Mackie	WA DPIRD	Pathology, Research		✓
Ceri Pearce	DAF QLD	Pathology	✓	✓
Fiona Giblin	DAF QLD	Pathology	✓	✓
Lindy Coates	DAF QLD	Pathology	✓	
Christine Horlock	DAF QLD	Pathology	✓	
Ian Newton	DAF QLD	Entomology	✓	✓
Jose Liberato	NTDITT	Pathology	✓	✓
Stuart Kearns	PHA	Biosecurity	✓	
Victoria Ludowici	PHA	Biosecurity	✓	

Bosibori Bett	PHA	Biosecurity	✓	
Trevor Dunmall	PHA	Biosecurity	✓	✓
Stephen Quarrell	PHA	Biosecurity		✓
Rebecca Powderly	PHA	Biosecurity		✓

Table 6. Scientists and others who contributed information for the review of the biosecurity plan. [45]

NAME	ORGANISATION	AREA OF EXPERTISE
Cherie Gambley	DAF QLD	Virology
Danuta Knihinicki	DPI NSW	Entomology
Denis Persley	DAF QLD	Virology
Jennifer Cobon	DAF QLD	Nematology
Marc Poole	WA DPIRD	Entomology
Nanditha Panthania	DAF QLD	Pathology
Peter Gillespie	DPI NSW	Entomology
Tony Pattison	DAF QLD	Pathology
Sharl Mintoff	NT DITT	Pathology
Merran Neilsen	NT DITT	Pathology
Brian Thistleton	NT DITT	Entomology

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 are 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.

[45] 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.

THREAT IDENTIFICATION AND PEST RISK ASSESSMENTS

Introduction

This section identifies high-risk exotic plant pest threats to the Australian Passionfruit 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 Australian Passionfruit 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 when pest incursions occur. One such mechanism is the EPPRD that has been negotiated between PHA government and industry members. The EPPRD ensures reliable and agreed funding arrangements are in place in advance of EPP incursions and can assist in responses to EPP incursions, particularly for those EPP identified as key threats.

Identification of high-risk exotic plant 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.

Other pests of biosecurity significance are also considered in this biosecurity plan. It has been demonstrated that good biosecurity practice is beneficial for the ongoing management of other pests, as well as for surveillance and early detection of exotic plant pests. Other plant pests cause ongoing hardships for growers and these plant 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 plant pests for the benefit of the Australian Passionfruit industry.

Exotic pests of the Passionfruit industry

Threat identification

Information on exotic pest threats to the Passionfruit 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 biosecurity plan was developed in accordance with the International Standards for Phytosanitary Measures (ISPM) No. 2[46] and 11 [Food and Agriculture Organization of the United Nations.[47] A summary of the pest risk analysis protocol followed in this biosecurity plan is shown in Table *7*.

While there are similarities in the ranking system used in this document and the Biosecurity Import Risk Analysis (BIRA)[48] process followed by the Department of Agriculture, Fisheries and Forestry (DAFF), 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.

Modifications of the DAWR[49] (Department of Agriculture and Water Resources, 2016) protocol have been made to suit the analysis required in the biosecurity plan development process, including, but not limited to:

- Entry potential: The determination of entry potential in this biosecurity plan considers 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 in the BIRA process, which only considers legal importation of plants or plant commodities.
- Potential economic impact of pest establishment in this document only considers the impacts on the Australian passionfruit industry. The BIRA process has a wider scope, including the impacts on all of Australia's plant industries, trade, the environment, social amenity and public health.
- Risk potential and impacts: The categories used in this biosecurity plan for describing the entry, establishment, spread, and potential economic impacts (see page 31) differs in comparison to that used in the 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

[46] FAO (2007).
[47] FAO (2004).
[48] https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/bira-guidelines-2016.pdf
[49] Now the Department of Agriculture, Fisheries and Forestry (DAFF).

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 Threat Summary Tables (page 60) present a list of potential plant pest threats to the Australian Passionfruit 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 TST 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 human-assisted spread (including illegal means such as smuggling). This is a broader view of potential risk than the BIRA process conducted by DAFF which focuses 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 biosecurity plans, sharing similar pest ratings. However, the economic impact of a pest is considered at an industry specific level (i.e., only for the Australian Passionfruit Industry in this biosecurity plan), and therefore this rating may differ between biosecurity plans.

Description of terms used in pest risk tables

The descriptions below relate to terms used in Table 1 and elsewhere in the document. Table 1 provides an overview of the top ranked biosecurity pest threats (invertebrates, pathogens and nematodes) for the Australian Passionfruit industry. Further details on each pest along with the basis for the likelihood ratings are provided in the TST. 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.

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

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

Department of Agriculture and Water Resources 2019b, *Final group pest risk analysis for mealybugs and the viruses they transmit 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/mealybugs/final-report

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[50] and Commonwealth and state/territory legislation.

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the Australian Passionfruit Industry (Figure 2). Such risk mitigation and preparedness practices are the joint 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 commonwealth, state and territory governments, and Australian Passionfruit 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 individual situation.

Figure 2. Examples of biosecurity risk mitigation activities.

[50] https://www.ippc.int/en/core-activities/standards-setting/ispms/

Barrier quarantine

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

National level – importation restrictions

The Department of Agriculture, Fisheries and Forestry (DAFF) is the Australian Government department responsible for maintaining and improving international trade and market access opportunities for agriculture, fisheries, forestry, and food industries. DAFF 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.

DAFF is responsible for developing biosecurity (i.e. SPS) risk management policy and reviewing existing quarantine measures for the importation of live animals and plants, and animal and plant products. In particular, DAFF undertakes import risk analyses to determine which products may enter Australia, and under what quarantine conditions. DAFF 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, DAFF 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 DAFF under the Australian Government *Biosecurity Act 2015*. Quarantine policies are developed through the Biosecurity Import Risk Analysis (BIRA) process. This process is outlined in the BIRA Guidelines 2016 (Department of Agriculture and Water Resources, 2016). DAFF maintains barrier quarantine services at all Australian international sea and airports, 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 DAFF.

The Australian Biosecurity Import Conditions Database (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. BICON can be accessed at agriculture.gov.au/import/bicon. For export conditions see the Manual of Importing Country Requirements (MICoR) database at https://micor.agriculture.gov.au/Pages/default.aspx.

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 DAFF on 1800 900 090, or visit the website at awe.gov.au/biosecurity-trade/import/online-services/bicon.

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.

State and regional level – movement restrictions

The ability to control movement of materials that can carry and spread passionfruit pests is of high importance. Each state/territory may have quarantine legislation in place to control the importation of passionfruit and or passionfruit pest carriers interstate and intrastate, and to manage agreed pests if an incursion occurs (contact details in Table 8). 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 Subcommittee on Market Access, Risk and Trade (SMART; previously the Subcommittee 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 lychee can be obtained by contacting your local state or territory agriculture department directly (contact details in Table 8), or through the SMART website[51] 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 and weed seed. 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 agriculture department (contact details in Table 8).

[51] https://interstatequarantine.org.au/

Table 8. 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*	https://www.environment.act.gov.au/__data/assets/pdf_file/0007/902293/act-biosecurity-strategy-2016-2026.pdf	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	https://www.dpi.nsw.gov.au/biosecurity/managing-biosecurity/legislation	(02) 6391 3384
NT	Department of Agriculture and Fisheries, Northern Territory https://daf.nt.gov.au/biosecurity	*Plant Health Act 2008* *Plant Health Regulations 2011*	https://industry.nt.gov.au/__data/assets/pdf_file/0011/396587/Plant-Quarantine-Manual.pdf	(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*	https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/379138/qld-biosecurity-manual.pdf	132 523
SA	Primary Industries and Regions SA pir.sa.gov.au	Plant Health Act 2009 Plant Health Regulations 2022	pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia	(08) 8207 7820
TAS	Biosecurity Tasmania, a part of the Department of Natural Resources and the Environment Tasmania https://nre.tas.gov.au/biosecurity-tasmania	Biosecurity Act 2019 Plant Quarantine Act 1997 Weed Management Act 1999	https://nre.tas.gov.au/documents/Plant%20Biosecurity%20Manual%20Tasmania.pdf	1300 368 550
VIC	Agriculture Victoria, a part of the Department of Energy, Environment and Climate Action https://agriculture.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 Agriculture Management Act 2007	https://www.agric.wa.gov.au/qtine/default.asp	(08) 9368 3333

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 Industry, Tourism and Trade (DITT) 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 QLD website (Restrictions on moving plant material, soil and related equipment into Queensland | Business Queensland)

Further details can be obtained from the DAF Queensland Customer Service Centre by phoning 13 25 23 or by fax 07 3404 6900.

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 8). 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) 9368 3333.

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 pest entry 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 44). The Australian Passionfruit 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, minimises costs associated with eradication and are necessary to meet the treaty obligations of the WTO SPS Agreement with respect to the area freedom status of Australia, Australian states and territories and intra state/territory 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 SPS 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 No. 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, detection techniques available and the potential impact of the pest.

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 to determine the presence or absence in each area (state/territory or region.

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, Fisheries and Forestry (DAFF) maintains barrier quarantine services at all international ports and in the Torres Strait region. DAFF 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).[52] NAQS surveillance programs relevant to the Australian Lychee Industry are listed in Table 9.

State surveillance programs

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

[52] https://www.agriculture.gov.au/biosecurity-trade/policy/australia/naqs

- communication, training and extension strategies with industry,
- biosecurity training, and
- 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 agriculture agencies run diagnostic programs whereby samples of pests suspected to be EPP or HPP can be forwarded to the local agency and diagnosed for the presence of exotic pests free of charge. Official surveillance programs that target pests of the Australian Passionfruit Industry (exotic or those under official control in a region or state/territory) are shown in Table *9*.

Table 9. Official surveillance programs that target pests of the Passionfruit industry (as of July 2020). [53]

SURVEILLANCE PROGRAM	TARGET PEST(S)	TARGET HOST(S)
Australian Government		
External Territories Surveillance Program	High priority exotic pests	Various environmental, production and ornamental plants
International Plant Health Surveillance Program	High priority exotic pests	Tropical horticultural, environmental and agricultural species
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Bee swarms at first points of entry
National Border Surveillance Program	Specific high priority exotic pests and any pest belonging to key taxonomic groups	Plant families of high economic importance and known or potential key hosts of specific exotic pests, focusing on regulatory import pathway risks
National Plant Health Surveillance Program (delivered through states and territories)	High priority exotic pests including exotic gypsy moth and fruit fly species	Various, based on the species surveyed
Northern Australia Quarantine Strategy – exotic fruit fly trapping	Exotic fruit flies including *Bactrocera dorsalis, B. latifrons, B. trivialis, B. umbrosa, Zeugodacus atrisetosa, Z. cucurbitae, Z. decipiens*	Various
Northern Australia Quarantine Strategy – pest and disease surveys	123 high priority exotic pests, diseases and weeds	Tropical horticultural, environmental and agricultural species
Within New South Wales		
Exotic fruit flies – Riverina	Mediterranean fruit fly (*Ceratitis capitata*), other tri lure responsive exotic fruit flies	Various horticultural crops (citrus, stone fruit)
Exotic longhorn beetle trapping	Asian longhorn beetle (*Anoplophora glabripennis*), Japanese pine sawyer beetle (*Monochamus alternatus*), brown mulberry longhorn beetle (*Apriona germari*)	Various hosts around ports

[53] Information presented has been taken from the National Plant Biosecurity Status Report 2020 and confirmed by the Sub-committee on National Plant Health Surveillance (sub-committee of the Plant Health Committee) and NAQS

National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including *Bactrocera albistrigata, B. carambolae, B. caryae, B. correcta, B. curvipennis, B. dorsalis, B. facialis, B. kandiensis, B. kirki, B. melanotus, B. occipitalis, B. passiflorae, B. psidii, B. trilineola, B. trivialis, B. umbrosa, B. xanthodes, B. zonata, Ceratitis capitata, Zeugodacus cucurbitae, Z. tau,* gypsy moth (*Lymantria* spp.), 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
Serpentine leafminer	Serpentine leafminer (*Liriomyza huidobrensis*)	Multiple horticultural and ornamental hosts
Within the Northern Territory		
Area Freedom Surveillance Program	Queensland fruit fly (*Bactrocera tryoni*)	Horticultural crops
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca, Aethina tumida,* acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris,* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including citrus canker (*Xanthomonas axonopodis* pv. *citri*), huanglongbing (*Candidatus* Liberibacter spp.), Asiatic citrus psyllid (*Diaphorina citri*), giant African snail (*Achatina fulica*), glassy winged sharpshooter (*Homalodisca vitripennis*), Pierce's disease (*Xylella fastidiosa*), banana black sigatoka (*Mycosphaerella fijiensis*), red imported fire ant (*Solenopsis invicta*), electric ant (*Wasmannia auropunctata*), yellow crazy ant (*Anoplolepis gracilipes*), *Bactericera cockerelli*, *Candidatus* Liberibacter solanacearum, potato leafminer, pea leafminer, serpentine leafminer (*Liriomyza huidobrensis*), American leafminer (*Liriomyza trifolii*), vegetable leafminer (*Liriomyza sativae*), exotic fruit flies (*Bactrocera* spp. and *Ceratitis* spp.)	Multiple
Plant Pest Diagnostic Service – horticulture	All pests and pathogens that can affect horticultural crops (mango, chilli, watermelon, Cucurbitaceae)	Horticultural crops
Regional Fruit Fly Monitoring and Surveillance	Exotic fruit flies (*Bactrocera* spp. and *Ceratitis* spp.)	Horticultural crops
Within Queensland		
Area freedom surveys	Multiple pests	Multiple
Exotic Fruit Fly in the Torres Strait Program	Exotic fruit fly including *Bactrocera* and *Zeugodacus* spp.	Multiple
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

National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca, Aethina tumida,* acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris,* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple, including exotic fruit flies and Mediterranean fruit fly (*Ceratitis capitata*), exotic gypsy moths, Pierce's disease (*Xylella fastidiosa*) and glassy winged sharpshooter (*Homalodisca vitripennis*), and brown marmorated stink bug (*Halyomorpha halys*).	Multiple
Bee pest and pest bee diagnostic service	Multiple pests	European honey bee
Within South Australia		
Area freedom surveys	Multiple pests	Multiple
Bee surveillance – endemic disease	American foulbrood (*Paenibacillus* spp.)	European honey bees
Mediterranean fruit fly	Mediterranean fruit fly (*Ceratitus capitata*)	Horticultural crops
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple, including exotic invasive ants (tramp ants), Asian and African citrus psyllids (*Diaphorina citri*, *Candidatus* Liberibacter africanus), huanglongbing (*Candidatus* Liberibacter asiaticus), citrus canker (*Xanthomonas axonopodis* pv. *citri*), glassy winged sharpshooters (*Homalodisca vitripennis* and *H. coagulata*), brown mamorated stink bug (*Halyomorpha halys*), xylella (*Xylella fastidiosa*)	Multiple
Ports of Entry Trapping Program	Multiple – *Bactrocera albistrigata, B. carambolae, B. caryae, B. correcta, B. curvipennis, B. dorsalis, B. facialis, B. kandiensis, B. kirki, B. melanotus, B. occipitalis, B. passiflorae, B. psidii, B. trilineola, B, trivialis, B. tryoni, B. umbrosa, B. xanthodes, B. zonata, Ceratitis capitata, C. rosa, Zeugodacus cucurbitae, Z. tau*	Various fruit fly hosts
Mediterranean fruit fly	Mediterranean fruit fly (*Ceratitis capitata*)	Horticultural crops
Queensland fruit fly	Queensland fruit fly (*Bactrocera tryoni*)	Horticultural crops
Within Tasmania		
Bee surveillance – endemic disease and pests	American foulbrood (*Paenibacillus* spp.), European foulbrood (*Melissococcus pluton*), chalkbrood (*Ascophera apis),* sacbrood (*Nosema apis, N. ceranae),* sacbrood virus (*Morator aetatulas*), greater wax moth *(Galleria mellonella)*, lesser wax moth (*G. achroia grisella)*, European wasps (*Vespula germanica*), *Braula coeca,* bumble bee *(Bombus terestris)*	European honey bees
Fruit fly trapping surveillance	*Bactrocera dorsalis, B. tryoni, Ceratitis capitata* and exotic fruit flies	Host fruit trees, fruit and vegetables
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Aethina tumida*, acute bee paralysis virus, deformed wing virus and slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Brown marmorated stink bug (*Halyomorpha halys*), citrus canker (*Xanthomonas citri* subsp. *citri*), gypsy moths (including *Lymantria albescens, L. atameles, L. concolor, L. dispar asiatica, L. dispar dispar, L. dispar japonica, L. dissoluta, L. fumida, L. marginata, L. minomonis, L.*	Multiple

	monacha, L. postalba, L. pulverea, L. sinica, L. umbrosa, L. xylina), huanglongbing (*Candidatus* Liberibacter asiaticus), *Bactericera cockerelli*, *Diaphorina citri*, *Trioza erytreae*, *B. trigonica*, *Trioza apicallis*, Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*), *Bactrocera, Zeugodacus* and *Ceratitis spp.* (exotic fruit fly species)	
Within Victoria		
Alert contacts	All plant pests	All hosts, general surveillance
Exotic fruit flies – Sunraysia	Mediterranean fruit fly (*Ceratitis capitata*)	Various horticultural crops (citrus, stone fruit)
MyPestGuide e-surveillance	All plant pests	All hosts, general surveillance
National Bee Pest Surveillance Program	*Varroa destructor, V. jacobsoni, Tropilaelaps clareae, T. mercedesae, Acarapis woodi, Oplostoma fuligineus, Braula coeca,* acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana, A. dorsata, A. florea, Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including citrus canker (*Xanthomonas axonopodis* pv. *citri*), exotic fruit flies (*Bactrocera* spp., *Ceratitis captitata*), Pierce's disease (*Xylella fastidiosa*), glassy winged sharpshooter (*Homalodisca vitripennis*), plum pox virus, Asian gypsy moth (*Lymantria dispar* and other *Lymantria* spp.), brown marmorated stink bug (*Halyomorpha halys*), Asian citrus psyllid (*Diaphorina citri*), African citrus psyllid (*Trioza erytreae*) and spotted wing drosophila (*drosophila suzukii*)	Multiple
Passive MedFly Program	Mediteranean fruit fly (*Ceratitis capitata*)	Fruit trees in backyards
Urban Plant Health Network	Various, including brown marmorated stink bug (*Halyomorpha halys*), Asian citrus psyllid (*Diaphorina citri*), African citrus psyllid (*Trioza erytreae*), Asian honeybee, red imported fire ant (*Solenopsis invicta*), spotted wing drosphila (drosophila suzukii) and glassy winged sharpshooter (*Homalodisca vitripennis*)	Multiple plant hosts in periurban landscape, including community gardens
Within Western Australia		
Ant Blitz	Browsing ant (*Lepisiota frauenfeldi*), Red Imported Fire Ant (*Solenopsis invicta*), Small black sugar ant (*Lepisiota capensis*)	Urban areas
Biosecurity Blitz	All plant pests	General surveillance, all hosts
Medfly Area Freedom (Ord River Irrigation Area)	Mediterranean fruit fly (*Ceratitis capitata*)	Many horticultural hosts
MyPestGuide e-surveillance	All plant pests	All hosts, general surveillance
National Bee Pest Surveillance Program	*Varroa destructor*, *V. jacobsoni*, *Tropilaelaps clareae*, *T. mercedesae*, *Acarapis woodi*, *Oplostoma fuligineus*, *Braula coeca*, acute bee paralysis virus, deformed wing virus, slow paralysis virus, *Apis cerana*, *A. dorsata*, *A. florea*, *Bombus terrestris* and new exotic swarms of *A. mellifera*	Ports and surrounding environment
National Plant Health Surveillance Program – multi pest surveillance	Multiple including Asian citrus psyllid (*Diaphorina citri*), citrus canker (*Xanthomonas axonopodis* pv. *citri*), citrus longicorn beetle (*Anoplophora chinensis*), glassy winged sharpshooter (*Homalodisca vitripennis*), xylella (*Xylella fastidiosa*), brown marmorated stink bug (*Halyomorpha halys*)	Pome and citrus crops
Port of Entry – Asian gypsy moth trapping	Asian gypsy moth (*Lymantria dispar*)	More than 600 forest, orchard, ornamental and native species
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

Farm level pest monitoring

Farm level monitoring involves the participation and interaction of growers, agribusinesses 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 plant pests early and implementing eradication or management responses.

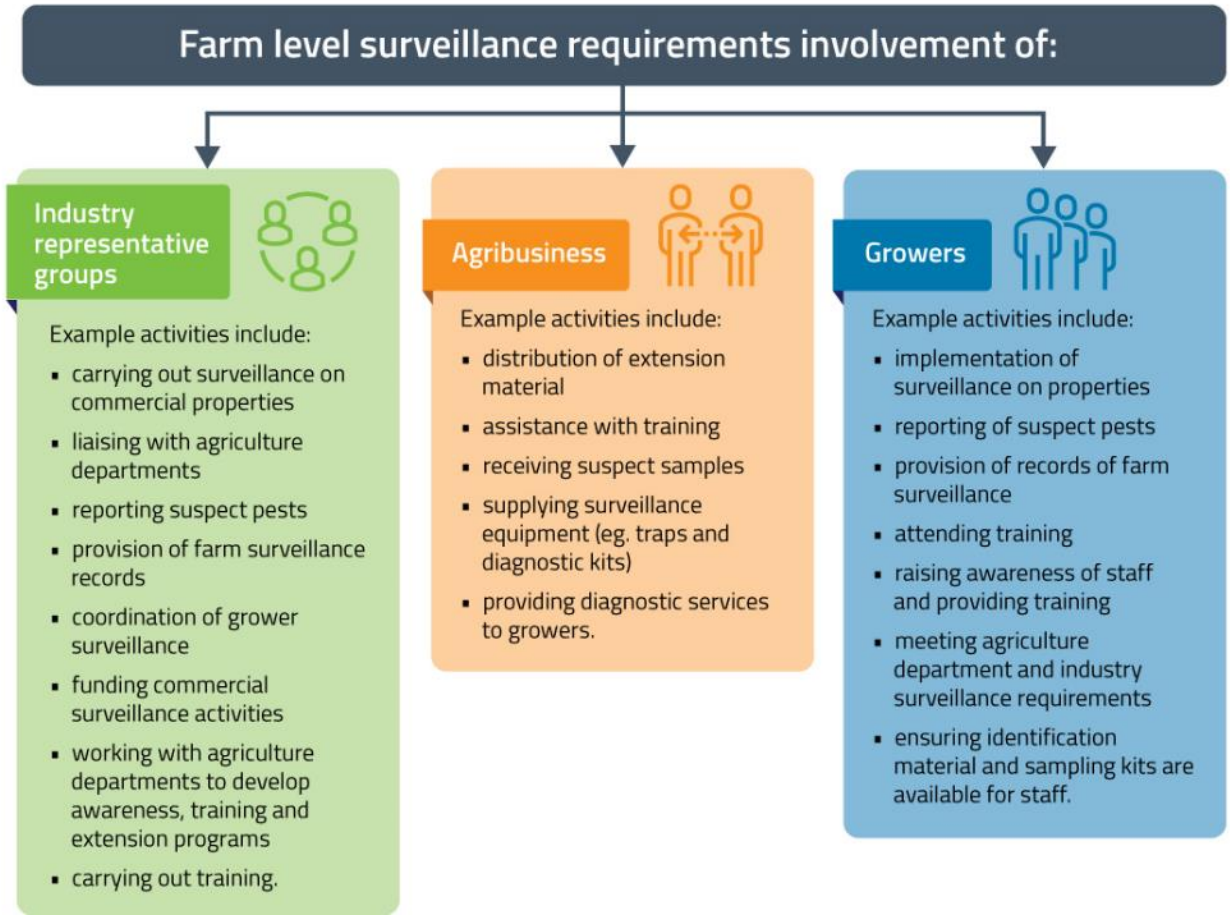

Figure 3. Examples of farm level surveillance activities.

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 Passionfruit 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 related documents

Pests listed in Table 1 have been identified as high priority threats to the Australian Passionfruit 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 contain information on pests across most plant industries, including the Passionfruit industry.

Table 10. Sources of information on high priority pest threats for the Passionfruit industry.

SOURCE	WEBSITE
CABI – Crop Protection Compendium	cabi.org/cpc/
DAF QLD Priority plant pests and diseases	https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/crop-growing/priority-pest-disease
Department of Agriculture, Water and the Environment	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 Passionfruit industry biosecurity (Table 11).

Table 11. Industry and government contact details.

AGENCY	WEBSITE/EMAIL	PHONE	ADDRESS
National			
Passionfruit Australia	passionfruitaustralia.org.au/		PO Box 507, Murwillumbah NSW 2484
Department of Agriculture, Water and the Environment	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	41 George St Brisbane, QLD 4000
Northern Territory			
Department of Industry, Tourism and Trade	https://industry.nt.gov.au/	(08) 8999 5511	Berrimah Farm, Makagon Road Berrimah, NT 0828
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	DPIRD, 1 Nash Street, Perth, Western Australia 6000 DPIRD, Locked Bag 4, Bentley Delivery Centre, WA 6983

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 passionfruit that are not currently known to be present in Australia.

Farm biosecurity measures can be used to minimise the impacts of both exotic and established plant pests The farm biosecurity and hygiene measures outlined in this section, can be considered as options for each farm's risk management. Many of these measures can be implemented in a range of different ways, so that the individual needs of any given farm can be addressed, and each farm can have an appropriate level of biosecurity.

Farm biosecurity measures, reporting procedures and hygiene strategies that reduce the impact of plant pest threats covered in this document are:

- selection and preparation of appropriate planting material,
- appropriate use of chemical and other plant pest control measures,
- control of vectors,
- control of alternative hosts,
- management of 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,
- managing the movement of people,
- how to safely visit other farms/orchards (including interstate and international trips) – what to watch out for when you return,
- including farm biosecurity in industry best management practice and quality assurance schemes, and
- an example farm biosecurity checklist.

Development of a specific farm biosecurity plan tailored to the needs of an individual business or farm is a good way to integrate best practice biosecurity into day-to-day operations (farmbiosecurity.com.au/planner/).

Further information on farm biosecurity can be found at farmbiosecurity.com.au or by contacting Passionfruit 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 12. 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 12. 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 https://www.daf.qld.gov.au/contact/report-a-biosecurity-pest-or-disease
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 state or territory.

Some passionfruit 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 agriculture agency of the presence of those pests within a defined timeframe.

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. Over time, as more resources are produced for pests of the Australian Passionfruit 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 HPP (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 TST.

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 4 for a list of current fact sheets available for passionfruit 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. 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 how to diagnose or identify a specific plant pest, or related group of pests. National Diagnostic Protocols (NDP) are nationally agreed diagnostic protocols for the unambiguous taxonomic identification of a pest in a manner consistent with ISPM No. 27 – Diagnostic Protocols for Regulated Pests. NDP include diagnostic procedures and data on the pest, its hosts, taxonomic information, and detection and identification.

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

Endorsed NDP 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 passionfruit pests 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. The Handbook is endorsed by the Subcommittee on Plant Health Diagnostics (SPHD).

Research Development and Extension

Research, Development and Extension – Linking Biosecurity Outcomes to Priorities

Through the biosecurity planning process, gaps in knowledge or the extension of knowledge will have been identified and 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 goals 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 places 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 Passionfruit industry

Export is currently not a major focus for the industry although individual growers may participate in limited export opportunities. There is limited data to support evidence of substantial export volumes.

Implementation actions

To help maintain or facilitate market access, in the event of an incursion, the Passionfruit industry in partnership with the Department of Agriculture, Water and the Environment and the relevant state and territory governments should develop the following, for the HPP pests:

- 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. 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 incident response 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 the detection of an Emergency Plant Pest (EPP) within Australia.

The following section includes key contact details and communication procedures that should be used in the event of an exotic plant pest incursion affecting the Australian Passionfruit Industry. A list of pest-specific documents that may support incident response activities, are also provided. Over time, documents produced for plant pests relevant to the Australian Passionfruit Industry will be included in updated versions of this biosecurity plan 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 commonwealth, state and territory governments, 38 plant industries (including Passionfruit Australia) and PHA (collectively known as the signatories), that facilitates the rapid and efficient responses EPP incursions. The EPPRD is a legally binding document that outlines the basic operating principles and guidelines for EPP eradication responses.

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 associated with eradication activities undertaken in response to the detection of EPP 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 suspected 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
- Mechanisms to support early detection and response to EPP.
- Rapid responses to EPPs (excluding weeds)
- A framework to ensure that 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.
- 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 several 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. 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 13. 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. If 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*.

Passionfruit EPPs categorised to date

EPPs relevant to the Passionfruit industry that are categorised and listed within Schedule 13 of the EPPRD.

Table 14. Formal categories for pests of the Passionfruit industry listed in Schedule 13 of the EPPRD (as of July 2021).

FORMAL CATEGORY	SCIENTIFIC NAME	COMMON NAME
2	*Bactrocera dorsalis* (syn. *B. invadens, B. papayae, B. philippiensis*)	Oriental fruit fly

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 Passionfruit 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 Passionfruit 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

Passionfruit Australia is the peak industry body for the Australian Passionfruit industry, i.e., signatory to the EPPRD and will be the key industry contact point if a plant pest affecting the Passionfruit industry is detected and responded to using the arrangements in the EPPRD. Passionfruit 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 Passionfruit Australia will be contacted 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 15. Contact details for Passionfruit Australia.

Website	passionfruitaustralia.org.au
Postal address	PO Box 507 Murwillumbah, NSW, 2484
Email	admin@passionfruitaustralia.org.au
Phone	

References

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

APPENDIX 1: PROFILE OF THE AUSTRALIAN PASSIONFRUIT INDUSTRY

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

Passionfruit Australia Inc

Passionfruit Australia is the recognised body representing the Australian Passionfruit industry along with its growers, industry people, associated businesses and its members. It was formed to represent the interests of Australian passionfruit growers and foster the growth of the industry.

All commercial passionfruit growers in Australia pay statutory national levies which are used for research and development (R&D) and marketing. These levies are collected by the Australian Government. Passionfruit Australia works closely with Hort Innovation through the Passionfruit Strategic Industry Advisory Panel (SIAP) to ensure that the R&D and marketing levies are well directed to the needs of the industry. The Passionfruit Strategic Investment Plan 2017-2021 provides guidance in the investment of Passionfruit marketing and R&D levies.

Passionfruit	Marketing	R&D	TOTAL
Packed in cartons	20 cents per carton	20 cents per carton	**40 cents per carton**
Not packed in cartons	20 cents per 8 kilograms	20 cents per 8 kilograms	**40 cents per 8 kilograms**
Processing	1.5 cents per kilograms	1.5 cents per kilograms	**3 cents per kilogram**

Figure 5. Passionfruit levy and charge rates as of November 2024.[54]

[54] https://www.agriculture.gov.au/agriculture-land/farm-food-drought/levies/rates/passionfruit

Industry profile

The Australian passionfruit industry has growers across Australia, with Queensland (60%) and New South Wales (35%) dominating production. In 2022/2023 Australian production was 4,711 tonnes with a farmgate value of $29.6 million (Australian Horticulture Statistics Handbook 2022/23).

Passionfruit are originally from Brazil in South America. The Australian passionfruit industry began with the import of fruit from Brazil in the early 1900s. It is cultivated in tropical and subtropical regions.

Panama style varieties are normally hand-picked from the vine when they reach maturity and the right stage of ripeness. Growers will harvest regularly during the season to ensure fruit is picked at its optimum maturity stage. Purple style varieties ripen and fall from the vine to the ground when they are ready to eat

All varieties grown in Australia are sorted by size and graded according to their external skin quality and their eating quality

The major passionfruit production areas are the Wide Bay region, Cooktown, Daintree and Mareeba, Sunshine Coast in Queensland and northern New South Wales.

Many growers produce passionfruit as a second, third or fourth crop and have minimal engagement with industry bodies or supply chains. Passionfruit farm establishment requires a high initial outlay due to the costs of the trellis infrastructure, high use of grafted vines, grading and packing equipment, cold room and associated farm machinery. The vines usually come into production six to 12 months after planting and reach mature phase yields in 12 to 24 months.

The industry is primarily dependent on the purple varieties, Misty Gem and Sweetheart, and two Panama varieties Pandora and McGuffies Red. In areas with subtropical climates, such as South-East Queensland and Northern New South Wales, hybrids (Australian hybrid varieties are known to have a greater depth of flavour) of the purple passionfruit (*Passiflora edulis*) and the Panama passionfruit (*Passiflora edulis f. flavicarpa*) are preferred for commercial production. In Northern Queensland, Panama, *P. edulis f. flavicarpa* hybrids (golden passionfruit resistant to Fusarium wilt) are grown.

References

Hort Innovation (2024). *Australian Horticulture Statistics Handbook (AHSH) 2022/23.* Horticulture Innovation Australia Limited, Sydney NSW. Available online at: https://public.tableau.com/app/profile/flopenanalytics/viz/HortStatsOnlinev1_1FY23-HIADRAFTMain/MainPage

APPENDIX 2: THREAT SUMMARY TABLES

The information provided in the threat summary tables is an overview of exotic plant pest threats to the Passionfruit industry. More than 70 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[55] or eradication may be included in these tables where appropriate. However, Passionfruit pests that are established but regionalised within Australia are not included in 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 29. Additional information on several the pests listed in the TSTs can be found in Table 4.

Invertebrates

Table 16. Passionfruit invertebrate threat summary table.

SCIENTIFIC NAME	COMMON NAME	PRIMARY HOSTS	AFFECTED PLANT PART	MOVEMENT & DISPERSAL	GEOGRAPHIC RANGE	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Dysmicoccus grassii (Syn. *D. alazon, Pseudococcus grassi*)	piojo harinoso de la pina	Polyphagous including fig, acacia, pineapple, mango, asparagus, avocado, oleander, banana, **passionfruit**, coffee, hibiscus, **papaya**, prickly pear, sugar apple	Leaves, fruit, stems	Infested soil and plant material. Adult males capable of flight over short distances.	Africa (Canary Islands, Nigeria) Asia (Malaysia) Europe (France, Italy, Sicily, Spain) North America (Bahamas, Belize, Cuba, Costa Rica, Dominican Republic, Haiti, Honduras, Mexico, Panama, Puerto Rico & Vieques Island, Trinidad and Tobago, United States) South America (Colombia, Brazil, Ecuador, Peru)	MEDIUM	HIGH	HIGH	HIGH	HIGH
Helopeltis clavifer	Cocoa mirids	**Passionfruit**, tea, cocoa; cashew, sweet potato and other host plants reported from New Guinea include *Acalypha caturus, Annona spp., Bixa orellana, Camellia sinensis, Cassia fistula, Centrosema pubescens, Eucalyptus deglupta, Flemingia strobilifera, Glincidia sepium, Ixora sp., Leucaena leucocephala, Mangifera indica, Mimosa invisa, Passiflora edulis, Persea americana, Polyscias sp., Psidium guajava and Pueraria*	Pods	Infested plant materials	Asia (Indonesia, Malaysia) Oceania (Papua New Guinea); New Britain and New Ireland	HIGH	HIGH	HIGH	HIGH	HIGH

[55] 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.

		phaseoloides								
Selenaspidus articulatus [(Syn. *Aspidiotus* (Selanaspidus) *articulatus; Aspidiotus* (Selenaspidus) *articulatus v. simplex; Aspidiotus articulatus; Aspidiotus rufescens; Aspidiotus simplex; Pseudaonidia articulatus* (Morgan)*; Selenaspis articulatus* (Morgan)]	West Indian red scale	**Lychee**, cashew nut, cherimoya, soursop, jackfruit, bilimbi, carambola, sea poison tree, camel's foot, beauty-leaf, tea, citrus, coconut, croton, coffee, fig, forest trees (woody plants), round kumquat, cape jasmine, gliricidia, shrubby althaea, flame of woods, jasmine, lantana, mamey apple, mango, banana, plantain, European olive, **passionfruit,** avocado, date-palm, Mexican frangipani, roses, sugarcane, mahogany, Indian tamarind, grapevine	Fruit, leaves, stem, growing point	Infested plant material and windborne crawlers; Adults capable of flight.	Asia (Philippines, Sri Lanka, Taiwan), Africa (Angola, Benin, Cameroon, Côte d'Ivoire, Eritrea, Ethiopia, Ghana, Guinea, Kenya, Madagascar, Mali, Mauritius, Mozambique, Niger, Nigeria, Réunion, Sao Tome and Principe, Sierra Leone, Somalia, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe) North America (Bermuda, Mexico, USA) Central America and Caribbean (Antigua and Barbuda, Bahamas, Barbados, Belize, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica, Martinique, Montserrat, Nicaragua, Panama, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago) South America (Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Venezuela) Oceania (Fiji, Solomon Islands)	LOW	HIGH	HIGH	HIGH	MEDIUM
Tetranychus piercei[56] (Syn. *T. manihotis*)	Pierce's spider mite; Red spider mite	Highly polyphagous including peanut, **papaya,** butterfly-pea, sweet potato, banana, bean, castor bean, Ageratum spp., cucurbits, maize, rose, banana, grapevine, cassava, eggplant, mulberry, **passionfruit**, peach, oil palm, lab lab, soybean, maize, turmeric, grape,	Above ground plant parts (Leaves, fruits)	Infested plant material and machinery, natural dispersal from PNG (wind dispersal for localised spread)	Asia (Bangladesh, China, Indonesia, Malaysia, Japan, Philippines, Taiwan, Thailand, South Korea, Vietnam) North America (Suriname) Oceania (Papua New Guinea)	MEDIUM Papaya	HIGH Papaya	HIGH Papaya	MEDIUM - HIGH Papaya	MEDIUM – HIGH Papaya

[56] Present in the Philippines Modelling of potential distribution does not put Australia as an area the mite may expand to
After spraying to control banana weevil, mites become more abundant and are currently causing damage in the Australian banana industry. This mite species could cause significant issues if it becomes established in Australian banana growing regions. *T. piercei* is found in the Far northern biosecurity zone.

		capsicum, jasmine, rose, frangipani, taro, wild ginger, cowpea, mungbean								
Anastrepha ludens	Mexican fruit fly	Cashew nut, cherimoya, hardshell custard-apple, soursop, sugar apple, papaya, *Citrus* spp., coffee, persimmon, apple, mango, passionfruit, avocado[208], peach, strawberry guava, guava, pomegranate, European pear, rose apple	Fruit	Infested plant material, machinery and soil. Adults are capable of flight over long distances [209]. Transmitted via infested plant material (fruit and puparia in soil or packaging with plants that have already fruited).	North America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, United States)	LOW Papaya Passionfruit,	HIGH Papaya LOW Passionfruit	HIGH Papaya LOW Passionfruit	HIGH Papaya MEDIUM Passionfruit	MEDIUM Papaya LOW Passionfruit
Anastrepha striata	Guava fruit fly	Cherimoya, soursop, carambola, navel orange, sapote, Surinam cherry, mango, cassava, passionfruit, avocado[208], peach, guava, strawberry guava, mombin, rose apple, Malay apple, Singapore almond.	Fruit	Adults capable of flight over long distances[207].Infested plant material (including fruit), soil and machinery. Adults capable of flight over long distances. Pupariation is in the soil[220]	North America (Belize, Costa Rica, Guatemala, Honduras, Mexico, Netherlands Antilles, Nicaragua, Panama, Trinidad and Tobago, United States)South America (Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela)	LOW Passionfruit	LOW Passionfruit	LOW Passionfruit	MEDIUM Passionfruit	LOW Passionfruit
Bactrocera carambolae	Carambola fruit fly	Highly polyphagous (75 hosts from 26 families) including grapefruit, orange, lemon, lime, mandarin, cashew, breadfruit, jackfruit, soursop, carambola, capsicum, mango, guava, **passionfruit**, **papaya**, banana, avocado, tomato, bell pepper, coco plum, navel orange, pomegranate, mangrove, common jujube	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Asia (Brunei, India, Indonesia, Malaysia, Singapore, Thailand) South America (Brazil, French Guiana, Guyana, Suriname)	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit
Bactrocera dorsalis (Syn. Bactrocera; Bactrocera invadens; Bactrocera papayae; Bactrocera philippinensis;	Oriental fruit fly, Philippine fruit fly, Invasive fruit fly, Asian Papaya fruit fly	**Lychee, papaya, passionfruit**, red fruit passion flower, giant granadilla, corkystem passionflower, red-bead tree, cashew nut, cherimoya, pond apple, soursop, bullock's heart, wild custard apple, sugar apple, black currant tree, coral berry, sugar palm, breadfruit, jackfruit, champedak,	Fruit	Infested plant material (including fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the	Asia (Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Christmas Island (Indian Ocean), India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, United Arab Emirates, Vietnam)	HIGH Lychee, Papaya, Passionfruit	HIGH Lychee, Papaya, Passionfruit	HIGH Lychee, Papaya, Passionfruit	HIGH Papaya, Passionfruit LOW Lychee	HIGH Papaya, Passionfruit, LOW Lychee

		monkey jack, bilimbi, carambola, Akee apple, toddy palm, Alexandrian laurel, perfume tree, Indian caper, bell pepper, chilli, tummy wood, caranda, white sapote, evergreen chinkapin, Chittagong wood, Citrus, watermelon, scarlet-fruited ivy gourd, coffee, melon, cucumber, giant pumpkin, marrow, Burma simpoh, longan tree, persimmon, loquat, weeping fig, Indian laurel tree, cluster tree, sacred fig tree, sycamore fig, governor's plum, rukam, round kumquat, oval kumquat, mangosteen, dragon fruit, wild mango, bottle gourd, langsat, Indian laurel, acerola, apple, mango, sapodilla, Spanish cherry, bitter gourd, black mulberry, banana, plantain, avocado, common bean, cutleaf groundcherry, black pepper, fijian longan, Trifoliate orange, canistel, apricot, sweet cherry, sour cherry, plum, peach, Japanese plum, strawberry guava, guava, pomegranate, European pear, Oriental pear tree, mangrove, Downy rose-myrtle, marula, grey bitter-apple, tomato, aubergine, watery rose-apple, clove, black plum, sea apple, rose apple, Malay apple, water apple, Singapore almond, cocoa, limeberry, christmas palm, shea tree, common jujube, jujube, pomelo, tropical almond, star fruit, sour orange, calamondin orange		soil[33]	Africa, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Liberia, Madagascar, Mali, Mauritania, Mayotte, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe) North America (USA) Europe (Italy) Oceania (Federated states of Micronesia, French Polynesia, Northern Mariana Islands, Palau, Papua New Guinea)					
Bactrocera facialis	Tongan fruit fly, tropical fruit fly	Citrus spp., mango, **papaya,** avocado, **passionfruit**, peach, guava, cashew nut, capsicum, tomato, breadfruit, longan tree	Fruit	Infested plant material (including fruit), soil and hitchhiking. Adults capable of flight. Pupation occurs in the soil.	Oceania (Tonga)	HIGH Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya	HIGH Papaya
Bactrocera kirki[57]	Fijian fruit fly	Pineapple, carambola, Capsicum (bell	Fruit	Infested plant	Oceania (American Samoa, Fiji, French	HIGH	HIGH	HIGH	HIGH	HIGH

[57] https://fruitflyidentification.org.au/species/bactrocera-kirki/
http://www.pestnet.org/fact_sheets/fruit_flies__tonga_171.htm

		pepper), chilli, Citrus spp., mango, passionfruit, peach, guava, rose apple, pumpkin, avocado, Surinam cherry, Malay apple, Singapore almond, zucchini, pomelo, avocado, custard apple, noni, sweet pepper, tomato, eggplant, cashew nut		material (fruit). Adults capable of flight. Long distance dispersal. Pupae are soilborne.	Polynesia, Niue, Samoa, Tonga, Niue, Tahiti, Wallis & Futuna)	Papaya Passionfruit	Papaya Passionfruit	Papaya Passionfruit	Papaya Passionfruit	Papaya Passionfruit
Bactrocera passiflorae	Fijian fruit fly	Polyphagous (49 hosts in 28 families) including Cashew, breadfruit, **papaya**, lime, mandarin, mango, **passionfruit**, giant granadilla, avocado, guava, eggplant, cocoa	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Oceania (Fiji, Niue, Tonga, Tuvalu, Wallis & Futuna)	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit	HIGH Papaya, Passionfruit
Bactrocera tau (Syn. *Zeugodacus tau*)	Pumpkin fruit fly	**Passionfruit,** wax gourd, bell pepper, watermelon, melon, cucumber, pumpkin, marrow, longan tree, cluster tree, loofah, mango, sapodilla, bitter gourd, common bean, guava, snake gourd	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Asia (Bangladesh, Bhutan, Brunei, Cambodia, China, Hong Kong, India, Indonesia, Laos, Malaysia, Myanmar, Singapore, Taiwan, Thailand, Vietnam)	LOW Passionfruit	MEDIUM Passionfruit	MEDIUM Passionfruit	MEDIUM Passionfruit	LOW Passionfruit
Bactrocera xanthodes[58]	Pacific fruit fly	**Papaya, passionfruit**, breadfruit, mandarin, guava, tomato, soursop, mango, tropical almond, watermelon, avocado, Tahiti chestnut, jackfruit, round kumquat, tangerine, sweet orange, star apple, pomelo, capsicum	Fruit	Infested plant material (fruit). Adults capable of flight. Pupae are soilborne.	Oceania (American Samoa, Cook Islands, Fiji, Nauru, New Zealand, Niue, Samoa, Tonga, Tuvalu, Vanuatu, Wallis and Futuna)	LOW Papaya Passionfruit	LOW Papaya Passionfruit	LOW Papaya Passionfruit	LOW Papaya UNKNOWN Passionfruit	NEGLIGIBLE Papaya UNKNOWN Passionfruit
Aepytus serta	Passionfruit stem borer	**Passionfruit**	Roots, stems		North America (Costa Rica)	LOW	LOW	MEDIUM	HIGH	LOW
Aleurocanthus woglumi	Citrus black fly	Polyphagous: Citrus, avocado, cashew nut, jackfruit, **papaya**, coconut, coffee, lychee, mango, sapodilla, banana, **passionfruit**, quince, guava, frangipani, pomegranate, pears, roses, grapevine, ginger	Leaves, stems	Infested plant material and machinery, adults capable of flight. Natural movement, infested soil and plant material and vectors	Asia (Bangladesh, Bhutan, Cambodia, China, Christmas Island (Indian Ocean), India, Iran, Laos, Malaysia, Maldives, Myanmar, Nepal, Oman, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, United Arab Emirates, Vietnam, Yemen), Africa (Kenya, Seychelles, South Africa, Swaziland, Tanzania, Uganda, Zimbabwe), North America (Bermuda, Mexico, USA), Central America and Caribbean (Antigua and Barbuda, Bahamas, Barbados, Belize, British Virgin Islands, Cayman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Guadeloupe, Guatemala,	HIGH	HIGH	MEDIUM	LOW	LOW

[58] Leblanc, L., Vueti, E. T., & Allwood, A. J. (2013). Host plant records for fruit flies (Diptera: Tephritidae: Dacini) in the Pacific Islands: 2. Infestation statistics on economic hosts.

					Haiti, Jamaica, Netherlands Antilles, Nicaragua, Panama, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Trinidad and Tobago), South America (Brazil, Ecuador, French Guiana, Guyana, Suriname, Venezuela), Oceania (Papua New Guinea)					
Asterolecanium pustulans (Syn. *Asterolecanium sambuci; Russelaspis pustulans*)[59]	Oleander pit scale, akee fringed scale	Sugar apple (sweet sop), **papaya**, akee apple, pigeon pea, tea, coconut, coffee, silky oak, leucaena, mango, sapodilla, aubergine, cocoa, oleander, cabbage, broccoli, cauliflower, kale, Brussels sprouts, collard greens, savoy, Australian pine tree, Euphorbia, Acacia, *Bauhinia tomentosa*, pigeon pea, Leucaena, cotton, Hibiscus, fig tree, plantain, Eucalyptus, guava, Syzygium, Bougainvillea, jasmine, **passionfruit**, olive, Grevillea, Prunus, roses, citrus, chilli pepper, Solanum (nightshade), tea, lantana, grapevine	Stems, branches		Africa (Egypt, São Tomé and Príncipe, Mozambique, Tanzania, South Africa, Sierra Leone, Seychelles, Rodrigues Island, Madagascar, Malawi, Kenya, Comoros, Gabon) Asia (China, Cape Verde, India, Indonesia, Iran, Israel, Taiwan, Oman, Pakistan, Yemen, Sri Lanka, Saudi Arabia, Bonin Islands - Ogasawara Islands) Europe (Cyprus, Italy, Malta, United Kingdom) North America (Agalega Islands, Anguilla, Antigua and Barbuda, Bahamas, Barbados, Bermuda, Costa Rica, Cuba, Curaçao, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Haiti, Hawaiian Islands, Honduras, Jamaica, Martinique, Mexico, Montserrat, Nicaragua, Panama, Panama Canal Zone, Puerto Rico and Vieques Island, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Saint Martin and Saint Barthelemy, Saint Croix, Trinidad and Tobago, U.S. Virgin Islands, USA) Oceania (Fiji, French Polynesia, Guam, Papua New Guinea, Tuvalu, New Caledonia, Kiribati) South America (Brazil, Colombia, Ecuador, Guyana, Peru, Venezuela, Galapagos Islands)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Azamora penicillana[60]	No common name	**Passionfruit**, passionflower	Leaves, fruits, branches		South America (Brazil)	LOW	LOW	LOW	HIGH	LOW

[59] http://scalenet.info/catalogue/Russellaspis%20pustulans/

[60] Pirovani, V. D., Fancelli, M., Moreira, B. M., Silveira, L. F. V., & Pratissoli, D. (2020). Azamora penicillana occurrence in sour passion fruit in the state of Minas Gerais. Revista Brasileira de Fruticultura, 42(1).

Brachylybas variegatus[61]	Brown coreid bug, passionvine bug	Polyphagous including giant passionfruit, **papaya**, taro, pumpkin, tomato, coconut, fig, sugarcane, Eucalyptus, cabbage, banana, ginger	Leaves, stem, fruit	Infested plant material and machinery, adults capable of flight.	Fiji, Tonga	MEDIUM	LOW	HIGH	MEDIUM	LOW
Chramesus bispinus[62]	No common name	**Passionflower**, banana passionfruit (*Passiflora mollisima*)	Stems		South America (Colombia)	LOW	LOW	MEDIUM	HIGH	LOW
Cyclocephala melanocephala	Masked chafer	**Passionfruit**, Sunflower	Flowers, leaves		South America (Brazil)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Stenygra conspicua	No common name	**Passionfruit** (*Passioflora* spp.)	Stems		South America (Argentina, Brazil, Paraguay)	LOW	LOW	MEDIUM	HIGH	LOW
Stizocera spp.	No common name	**Passionfruit** (*Passioflora* spp.)	Stems		South America (Neotropical region - Brazil, Bolivia)	LOW	LOW	MEDIUM	HIGH	LOW
Veneza zonatus (Syn. *Leptoglossus zonatus*)	Western leaf-footed bug; large-legged bug	**Passionfruit** (*Passiflora spp.*), pecan, lime, navel orange, melon, pumpkin, cotton, jatropha, avocado, guava, pomegranate, tomato, eggplant, sorghum, maize, peach, watermelon	Leaves, fruit		North America (Mexico, United States) Central America (Nicaragua, Honduras, El Salvador) South America (Brazil, Venezuela, Colombia)	LOW	MEDIUM	MEDIUM	MEDIUM - HIGH	LOW - MEDIUM
Tetranychus yusti[63]	Yustin mite	Polyphagous including common bean, cucurbits, sweetpotato, wheat, millet, cowpea, maize, peanut, barley, soybean, sunflower, pigeon pea, cotton, *Musa* spp. (including hybrids of *M. acuminata* and *M. balbisiana*), *Xanthosoma sagittifolium*, **passionfruit,** strawberry and several ornamentals	Above ground plant parts	Infested plant material and machinery.	Africa (Nigeria) Asia (Thailand) Europe (Greece) North America (Mexico, United States) South America (Brazil, Colombia, Ecuador, El Salvador, Guadeloupe, Honduras, Venezuela, Cape Verde) Oceania (Cook Islands, French Polynesia)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW-MEDIUM
Dione juno[64]	Silverspot butterfly	**Passionfruit**, passionflower	Leaves, buds, flowers		North America (Trinidad and Tobago) South America (Brazil, Colombia, Venezuela)	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM

[61] https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/ba/plant/2013/islandcabbage/Final-PRA-Island-Cabbage.pdf

[62] Wood, S. L. (1982). New species of American bark beetles (Coleoptera: Scolytidae). The Great Basin Naturalist, 223-231.
Also: https://www.barkbeetles.info/regional_chklist_target_species.php?lookUp=816

[63] T. yusti may be of quarantine concern to Australia (Flechtmann et al., 2002).

[64] Aguiar-Menezes, E. L., Menezes, E. B., Cassino, P. C. R., & Soares, M. A. (2002). 12 Passion Fruit. Tropical Fruit Pests and Pollinators: Biology, Economic Importance, Natural Enemies, and Control, 361.

Paracoccus burnerae	Oleander mealybug; Oleander scale	Indian mangrove, oleander, Chinese cinnamon, cotton, Hibiscus fuscus, Asparagus, mallow, cocoa, neem tree, guava, olive, **passionfruit**, sugar plum, coffee, bitter orange, hopbush, potato	Fruit, leaves, stems	Infested plant material	Africa (Ascension Island, Angola, Cote d'Ivoire, Comoros, Kenya, Madagascar, Namibia, Reunion, Seychelles, Saint Helena Island, South Africa, Swaziland, Zambia, Zimbabwe) Asia (China, India, Iran, Sri Lanka, Thailand, Vietnam, Yemen) Europe (Spain, United Kingdom)	HIGH	HIGH	HIGH	MEDIUM	MEDIUM
Philonis spp. (P. passiflorae, P. obesus, P. crucifer)	No common name	**Passionfruit** (*Passioflora* spp.)	Stems		South America (Brazil)	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Tetranychus mexicanus	Spider mite	Polyphagous; **Papaya**, cotton, **lychee**, **passionfruit**, Spanish cedar, Citrus, Cocoa, pecan, coconut, avocado, banana, peanut, guava, sugar cane, strawberry, pear, apple, peach, star fruit, bean, cassava; wide range of ornamental plants	Leaves		Central America and Caribbean (Barbados, Costa Rica, Cuba, Nicaragua, El Salvador, Honduras, Guadeloupe, Martinique) South America (Brazil, Suriname, Argentina, Columbia, Paraguay, Peru, Uruguay, Venezuela)	MEDIUM Lychee, Papaya, Passionfruit	HIGH Lychee, Papaya, Passionfruit	HIGH Lychee, Papaya, Passionfruit	MEDIUM Lychee, Papaya, Passionfruit	MEDIUM Lychee, Papaya, Passionfruit
Calacarus citrifolii	Citrus grey mite/ citrus blotch mite	Polyphagous including Citrus, banana, cotton, peanut, **passionfruit, papaya**, cassava, beans, sugarcane, pigeon pea, okra, sweetpotato, soursop, Tannia, eggplant, capsicum, tomato, taro, pumpkin, giant passionfruit, *Poinsettia* spp., *Rhus* spp., *Holmskioldia* spp., *Brunsfelsia* spp., *Pappea capensis*, *Rhamnus prinoides*, *Lippia javanica*, *Duranta repens*, *Mimusops seyheri*, *Euphorbia pulcherrima*, Musa paradisiaca, *Capsicum chinense* (chilli pepper)	Leaves, fruit, twigs	Infested plant material and machinery.	South Africa, India, Taiwan, Cuba, Angola, Zimbabwe, Mozambique, Zambia, Nigeria	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Agraulis vanillae	Silverspotted flambeau, Gulf fritillary	Passionfruit, passionflower, morning glory, red fruit passionflower	Leaves		North America (United States) South America (Colombia, Venezuela)	LOW	LOW	MEDIUM	LOW	NEGLIGIBLE
Eueides isabella	Isabella tiger	Passionfruit, passionflower	Leaves		North America (Trinidad and Tobago) South America (Brazil, Venezuela)	LOW	LOW	MEDIUM	LOW	NEGLIGIBLE
Gargaphia lunulata	No common name	Okra, gotani bean, showy rattlepod, passionfruit, common rue, jack bean	Leaves		South America (Argentina, Brazil, Colombia, Paraguay, Uruguay)	LOW	LOW	LOW	LOW	NEGLIGIBLE

Pococera spp.	No common name	Passionfruit (*Passioflora* spp.)	Calyx, fruit		North America (United States)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Sabulodes spp.	No common name	Passionfruit (*Passioflora* spp.)	Leaves		North America (United States) South America (Peru)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Spodoptera eridania	Southern armyworm	Okra, onion, Welsh onion, garlic, red ginger, celery, peanut, asparagus, beetroot, *Brassica napus* var. oleifera, black mustard, cabbages, cauliflowers, collards, cruciferous crops, bell pepper, papaya, quinoa, chickpea, watermelon, Citrus, lemon, navel orange, coffee, coriander, melon, cucumber, pumpkin, carrot, carnation, yam, Eucalyptus, soyabean, cotton, sunflower, kenaf, China-rose, sweetpotato, lettuce, lavender, leucaena, flax, apple, cassava, lucerne, mints, Peppermint, Spear mint, banana, watercress, oleander, tobacco, rice, passionfruit, elephant grass, avocado, beans, lima bean, common bean, pea, Poaceae (grasses), guava, European pear, rhubarb, castor bean, roses, raspberry, willows, Brazilian pepper tree, tomato, eggplant, potato, spinach, dandelion, clovers, blueberry, cranberry, faba bean, cowpea, grapevine, cocoyam, maize	Fruits, leaves		Africa (Benin, Cameroon, Gabon, Nigeria) Europe (Denmark, Netherlands, Slovenia) North America (Antigua and Barbuda, Bahamas, Barbados, Bermuda, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Panama, Puerto Rico, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, United States) South America (Argentina, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela)	LOW	LOW	LOW	LOW	NEGLIGIBLE
Zapriothrica salebrosa	No common name	*Passiflora* spp.	Flowers, buds		South America (Colombia, Ecuador, Peru, Venezuela)	Low	LOW	LOW (	LOW	NEGLIGIBLE
Anastrepha serpentina	Sapodilla fruit fly; Sapote fruit fly	Cherimoya, pond apple, wild cherry, Citrus (sour orange, pummelo, mandarin, navel orange, grapefruit), quince, sapote, loquat, apple, mango, sapodilla, avocado, peach, guava, mombin **passionfruit**, cherry, European pear	Fruit	Infested plant material (including fruit), soil and machinery. Adults capable of flight over long distances. Pupariation is in the soil	North America (Belize, Costa Rica, Guatemala, Honduras, Mexico, Netherlands Antilles, Panama, Trinidad and Tobago, United States) South America (Argentina, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela)	NEGLIGIBLE Passionfruit	NEGLIGIBLE Passionfruit	NEGLIGIBLE Passionfruit	NEGLIGIBLE Passionfruit	NEGLIGIBLE Passionfruit

Amorbia emigratella	Mexican leafroller	Polyphagous including avocado, broccoli, cocoa, Citrus spp., cotton, eggplant, green beans, guava, macadamia, orchids, **papaya, passionfruit**, potato, rose, sweetpotato, tomato, pineapple, other ornamentals, shrubs, fruit trees and indigenous plants in the mountains, corn, blackberry, peanut, gorse	Leaves, fruit, flowers, shoots	Infested soil and plant material. Adults are capable of flight	North America (Costa Rica, Hawaii, Mexico, USA)	LOW Papaya Passionfruit	LOW Papaya Passionfruit	MEDIUM Papaya Passionfruit	LOW Papaya Passionfruit	NEGLIGIBLE Papaya Passionfruit
Anisocelis flavolineata	Flag footed bug	Passiflora spp.	Leaves, buds, fruit		North America (Costa Rica, Panama)	MEDIUM	HIGH	HIGH	UNKNOWN	UNKNOWN
Anisocelis foliacea	Passion vine leaf footed bug[65]	Passiflora spp.	Leaves, buds, fruit		South America (Suriname)	MEDIUM	HIGH	HIGH	UNKNOWN	UNKNOWN
Bemisia tabaci (MED) [(Syn. Bemisia tabaci biotype Q, Bemisia tabaci Q, Mediterranean (MED) species (Bemisia tabaci)]	Silverleaf whitefly	Okra, maples, cauliflower, cruciferous crops, Capsicum (bell pepper), **papaya,** pumpkin, Bourbon cotton, lettuce, cassava, **Passifloraceae**, Rosaceace, tomato, eggplant	Leaves, stems, whole plant (early senescence)		Africa (South Africa) Asia (China, Israel, Japan, South Korea, Turkey) Europe (Finland, Greece, Italy, Sweden, United Kingdom) North America (Bermuda, Canada, Costa Rica, Guatemala, Mexico, United States) South America (Argentina, Brazil, Uruguay)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Neosilba pendula	Cassava shoot fly	**Passionfruit**, Citrus, cassava, coffee, jatropha	Flowers, buds		North America (Haiti, Mexico, Trinidad and Tobago) South America (Brazil, Venezuela)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Odonna passiflorae	No common name	**Passionfruit** (*Passioflora* spp.)	Stem		South America (Colombia)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Spodoptera cosmioides	Armyworm	***Passiflora edulis,*** soybean, cotton, wheat, rice, corn.	Leaves, flowers, fruits		South America (Brazil)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Ceroplastes cirripediformis[66]	Barnacle scale, barnacle wax scale	Polyphagous: Sweetpotato, Citrus, arabica coffee, cassava, Indian tamarind, *Chrysophyllum cainito* (caimito), grape, passionfruit, avocado, guava, mango, soursop, oleander, grapevine	Stems and leaves	Infested plant material.	North America (Antigua and Barbuda, Barbados, Bermuda, Dominica, Grenada, Guadeloupe, Jamaica, Martinique, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, United States)	LOW	HIGH	HIGH	LOW	VERY LOW

[65] Brathwaite, C. W., Marte, R., & Porsche, E. (1985). Pests and diseases as constraints in the production and marketing of fruits in the Caribbean (No. IICA-PRRET A2/TT No. 86-001). IICA, Port of Spain (Trinidad and Tobago).

[66] http://scalenet.info/catalogue/Ceroplastes%20cirripediformis/

					South America (Argentina, Brazil, Bolivia, Chile, Greece, Indonesia, Italy, Peru, Philippines)					
Corythucha gossypii	Cotton lacebug; bean lacebug	Polyphagous including okra, peanut, pigeon pea, bell pepper, papaya, cassava, banana, beans, castor bean, sugarcane, eggplant, sweetpotato, soursop, *Tannia*, capsicum, tomato, eggplant, cotton, pumpkin, giant passionfruit, taro, pumpkin, Breadfruit, soursop and sweet potato	Leaves	Infested plant material and machinery, adults capable of flight.	North America (Antigua and Barbuda, Barbados, Belize, Caribbean, Costa Rica, El Salvador, Cuba, Dominica, Dominican Republic, Guadeloupe, Guatemala, Haiti, Honduras, Nicaragua, Panama, Jamaica, Martinique, Montserrat, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, USA) South America (Colombia, Venezuela)	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Dasiops inedulis	Passion fruit flower bud fly	Passionfruit	Flowers, Buds		South America (Colombia)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Dryadula phaetusa[67]	Banded orange heliconian	Passiflora spp.	Leaves		North America (Costa Rica, Panama) South America (Brazil)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Epicauta atomaria	No common name	Passionfruit	Leaves		South America (Brazil)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Euryscopa cingulata	No common name	Passiflora spp.	Leaves		North America (Panama)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Hexaleurodicus spp.	No common name	Passionfruit	Leaves, stems		South America (Colombia)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Holhymenia clavigera	No common name	Passiflora spp., guava	Stems, leaves, fruit, buds		South America (Brazil)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Holhymenia histrio	No common name	Passiflora spp.	Stems, leaves, fruit, buds		South America (Brazil)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Langsdorfia spp.	No common name	Passionfruit	Stems		South America (Colombia)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Lonchaea cristula	No common name	Passionfruit	Flower bud		Europe (Spain) South America (Colombia)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW

[67] León-Cortés, J. L., Caballero, U., & Almaraz-Almaraz, M. E. (2015). Diversity and eco-geographical distribution of insects. In Biodiversity and Conservation of the Yucatán Peninsula (pp. 197-226). Springer, Cham.

Peridroma saucia[68]	Pearly underwing moth; variegated cutworm	**Passionfruit**, firs, maples, onion, celery, peanut, asparagus, oats, beetroot, sugarbeet, canola, black mustard, cabbages, cauliflowers, turnip rape, bell pepper, quinoa, daisy, chickpea, chicory, thistle, watermelon, lemon, navel orange, melon, cucumber, pumpkin, globe artichoke, carrot, carnation, strawberry, cotton, sunflower, barley, hop, sweet potato, lettuce, sweet pea, flax, rye grasses, apple, lucerne, honey clover, Peppermint, Spear mint, tobacco, avocado, lima bean, common bean, white spruce, pea, poplars, stone fruit, apricot, sour cherry, plum, peach, Japanese plum, European pear, radish, rhubarb, gooseberry, roses, blackberry, raspberry, common sage, rye, white mustard, tomato, potato	Fruit, Growing point, Inflorescence, leaves, seeds, stems, whole plant	Flight. Migratory flight - Adults capable of flight	Africa (Burundi, Democratic Republic of the Congo, Republic of the Congo, Côte d'Ivoire, Ghana, Kenya, Malawi, Mauritius, Nigeria, Rwanda, Sierra Leone, Sudan, Tanzania, Togo, Uganda, Zimbabwe)	LOW Passionfruit	LOW Passionfruit	LOW Passionfruit	MEDIUM Passionfruit	VERY LOW Passionfruit
Philaethria dido	Dido longwing	***Passiflora* spp.**	Leaves		South America (Neotropic region including Brazil, Colombia, Guyana, Honduras, Venezuela, Panama)	LOW	LOW	LOW	MEDIUM	VERY LOW
Trichaltica bogotana	No common name	**Passionfruit** (*Passiflora spp*.)	Leaf		South America (Colombia, Panama)	LOW	LOW	MEDIUM	MEDIUM	VERY LOW
Aleurodicus dugesii	Giant whitefly	Wattles, bamboo, camel's foot, Citrus, navel orange, papyrus, Eucalyptus, Euphorbia, Ficus, Bourbon cotton, ivy, rosemallows, cottonrose, banana, orchids, Passiflora (passionflower), avocado, frangipani, castor bean, willows, ivy, Solanum (nightshade), ginger, liquidamber, and many other ornamentals, apricot, apple, pear, cinnamon, guava, coconut, **passionfruit**, geranium, boxwood	Leaves	Wind dispersal Infested plant material and machinery, adults capable of flight.	Asia (Indonesia, Pakistan) North America (Belize, Costa Rica, El Salvador, Guatemala, Mexico, Nicaragua, United States) South America (Venezuela) **Canary Islands, Hawaii**	HIGH	HIGH	HIGH	UNKNOWN	UNKNOWN

[68] Occurs in Europe, northern Africa, Middle east, North and South America and parts of Asia (including China, Korea, Japan, Sri Lanka and India) (CABI 2015g) Defoliator

Pathogens

Table 17. Passionfruit pathogen threat summary table.

SCIENTIFIC NAME	COMMON NAME	PRIMARY HOSTS	AFFECTED PLANT PART	MOVEMENT & DISPERSAL	GEOGRAPHIC RANGE	ENTRY POTENTIAL	EST. POTENTIAL	SPREAD POTENTIAL	ECONOMIC IMPACT	OVERALL RISK
Bacteria										
Pseudomonas syringae exotic strains[69]	Bacterial canker of stone fruit, bacterial canker of trees	Broad host range over 50 hosts including sweet cherry, sour cherry, onion, capsicum, leek, lucerne, rice, chrysanthemum, citrus, cucumber, pumpkin, garden dahlia, hibiscus, walnut, lettuce, magnolia, mango, **passionfruit**, bean, avocado, stone fruit, roses, tomato, maize, willows, clover, blueberry, grapevine, cowpea	Whole plant Leaves, inflorescence, stems, pods, seeds, flowers, fruit	Infected plant material, wind, insect vector, mechanical, plant stress	**global if not splitting endemic and exotic**	HIGH	HIGH	HIGH	HIGH[56]	HIGH
Xanthomonas axonopodis pv. passiflorae	Bacterial blight	*Passiflora spp.*	Seedlings and adult plants Local and Systemic infection	Seed and latently infected seedlings/plants	South America (Brazil, Colombia)	LOW	HIGH	MEDIUM	HIGH	MEDIUM
Fungi										
Aecidium Passifloraceae [70]*(exotic strains) (anamorph of Puccinia scleirae)*	Passionfruit rust	*Passiflora* spp. (*P. edulis, P. glandulosa, P. cyanea, P. rubra, P. serrato-digitata, P. suberosa, P. tricuspis, P. tuberosa*)	Leaves and stems		Asia (China, Indonesia, Japan, Malaysia, Philippines, Taiwan) South America (Brazil) Central America (Panama) Oceania (Papua New Guinea)	HIGH	HIGH	HIGH	MEDIUM	MEDIUM
Pseudomonas syringae pv. syringae (exotic races)	Bacterial canker	Passionfruit, onion, leek, capsicum, chrysanthemum, citrus, cucumber, pumpkin, garden dahlia, hibiscus, walnut, lettuce, magnolia, mango, lucerne, rice, avocado, bean, poplar, stonefruit, azalea, roses, tomato, willows, clover, blueberries, grapevine and maize. Attacks plants from the seedling stage through to maturity.	Leaves, inflorescence, stems, pods, seeds, flowers, fruit	Seed and vegetative propagating material	global if not splitting endemic and exotic	HIGH	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH

[69]Infected plant material, wind-driven rain, insects, use of infected budwood or nursery stock, contaminated pruning tools, aerosols in plant debris, sap and water movement when weeds or crops are cut (Moorman unknown). Predisposing stress factors listed were: freeze injury, wounds, nematode damage, coincident infections with plant-pathogenic fungi such as Leucostoma sp. and Nectria sp.
[56]Causes rapid death of trees in nurseries and orchards and have a significant effect on fruit production (CABI, Compendium of Stone Fruit Diseases).
[70] Perhaps the strain that affects passionfruit is different from the one affecting other plants. Minor disease.

Asterina megalospora	Black mildew	*Passiflora spp.*	Leaf		Asia (Japan) North America (Cuba, Dominican Republic, Puerto Rico, Trinidad and Tobago) South America (Brazil, Colombia, Ecuador, Peru, Venezuela)[59]	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Haematonectria ipomoeae		Passionfruit	Stem, whole plant (wilting)		Asia (China, Japan) Europe (Germany)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Phytoplasmas and viruses										
Passionfruit crinkle virus	Passionfruit crinkle virus	*Passiflora spp.*	Systemic infection		Asia (Taiwan)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Passionfruit ringspot virus	Passionfruit ringspot virus	*Passiflora spp.*	Systemic infection		Africa (Ivory coast)	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Passionfruit severe leaf distortion virus	Passionfruit severe leaf distortion virus	*Passiflora spp.*	Systemic infection		South America (Brazil)	HIGH	HIGH	HIGH	HIGH	HIGH
Passionfruit Sri Lankan mottle potyvirus	Passionfruit Sri Lankan mottle potyvirus	*Passiflora spp.*	Systemic infection		Asia (Sri Lanka)	HIGH	HIGH	HIGH	HIGH	HIGH
Passionfruit vein clearing rhabdovirus	Passionfruit vein clearing rhabdovirus	*Passiflora spp.*	Leaves, fruit		South America (Brazil)	LOW	HIGH	HIGH	HIGH	MEDIUM
Passionfruit yellow mosaic virus	Passionfruit yellow mosaic virus	*Passiflora spp.*	Systemic infection		South America (Brazil)	LOW	LOW	LOW	LOW	LOW
ES	East Asian Passiflora virus	*Passiflora* spp. (including *P. edulis, P. edulis* x *P. edulis* f. *Claviceps* and *P. edulis* f. *Claviceps*).	Systemic infection		Asia (Japan)	HIGH	HIGH	HIGH	HIGH	HIGH
Euphorbia mosaic virus		Passionfruit, Euphorbia (wild poinsettia)	Systemic infection		North America (Costa Rica, Cuba, Mexico, Nicaragua, Puerto Rico, U.S. Virgin Islands, United States)South America (Argentina, Brazil, Venezuela)	LOW	LOW	MEDIUM	LOW	LOW
Candidatus Phytoplasma asteris 16SrI	Yellow disease phytoplasmas	Onion, garlic, celery, asparagus, oats, beetroot, Bougainvillea, canola, cabbages, cauliflowers, broccoli, turnip, pigeon pea, bell pepper, **papaya**, safflower, *Citrus* spp., coconut, coriander, pumpkin, marrow, carrot, loquat, Eucalyptus,	Fruit, growing point, inflorescence leaves, roots, stems	Latent infection of propagation material - cuttings	Africa (Mozambique, South Africa, Zambia) Asia (China, India, Indonesia, Iran, Israel, Japan, Lebanon, Malaysia, Myanmar, South Korea, Taiwan, Thailand, Turkey, Pakistan)	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM

		Euphorbia round kumquat, strawberry, soyabean, cotton, china-rose, barley, hop, lettuce, larches, lily, loofah, lupins, macadamia nut, apple, mallow, mango, cassava, lucerne, bitter gourd, Japanese mulberry, wild banana, myrtle, watercress, basil, European olive, prickly pear, common poppy, **passionfruit,** pearl millet, parsley, common bean, date-palm, black pepper, poplars, primrose, apricot, cherries, peach, nectarine, Japanese plum, European pear, common oak, radish, blackcurrant, red currant, roses, blackberry, raspberry, willows, sesame, tomato, eggplant, potato, spinach, lilac, marigold, pyrethrum, dandelion, clovers, wheat, blueberries, grapevine, maize, zinnia			Europe (Belarus, Belgium, Czechia, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Poland, Portugal, Russia, Spain, Ukraine, United Kingdom) North America (Bermuda, Canada, Cuba, Guatemala, Mexico, Saint Vincent and the Grenadines, United States) South America (Argentina, Brazil, Colombia, Peru) Oceania (Futuna islands)					
Candidatus Phytoplasma sudamericanum 16SrIII-V	witches'-broom	Passionfruit, closely related to clover ash strain	stem		Rio Pernambuco, Brazil,	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Papaya leaf curl Guangdong virus		Papaya, passionfruit, bell pepper, tobacco	Systemic infection		Asia (South Korea, Taiwan)	LOW	MEDIUM	MEDIUM	MEDIUM	MEDIUM
Papaya leaf curl Guandong virus		Papaya, passionfruit, bell pepper, tobacco	Systemic infection		Asia (South Korea, Taiwan)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Maracuja mosaic Tobamovirus	Maracuja mosaic virus	Passionfruit, tomato, tobacco, cucumber, quinoa	Systemic infection		North America (United States) South America (Brazil, Peru)	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

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