

Industry Biosecurity Plan for the Lychee Industry

Version 1.0 September 2011



Plant Health
AUSTRALIA





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In referencing this document, the preferred citation is:

Plant Health Australia (2011) *Industry Biosecurity Plan for the Lychee Industry (Version 1.0)*.
Plant Health Australia. Canberra, ACT.

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Acknowledgements

The *Industry Biosecurity Plan for the Lychee Industry* was coordinated by Plant Health Australia (PHA) and developed through a partnership approach using government and industry resources and expertise.

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



Know-how for Horticulture™



Australian Government
Department of Agriculture, Fisheries and Forestry



Department of Primary Industries



Queensland Government



Department of Agriculture and Food



Government of South Australia
Primary Industries and Resources SA



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Northern Territory Government

Endorsement

The *Industry Biosecurity Plan for the Lychee Industry* (Version 1.0) was formally endorsed by the lychee industry (through the Industry Biosecurity Group and the Australian Lychee Growers' Association Ltd) in July 2011, and the Australian Government and all state and territory governments (through the Plant Health Committee) in August 2011.

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List of acronyms

ALGA	Australian Lychee Growers' Association
APVMA	Australian Pesticides and Veterinary Medicines Authority
AQIS	Australian Quarantine and Inspection Service
AS/NZS	Australian Standard/New Zealand Standard
BA	Biosecurity Australia
DAFF	Department of Agriculture, Fisheries and Forestry
DAFWA	Department of Agriculture and Food, Western Australia
DEEDI	Department of Employment, Economic Development & Innovation, Qld
DPI NSW	Department of Primary Industries, New South Wales
DPI Vic	Department of Primary Industries, Victoria
DPIPWE	Department of Primary Industries, Parks, Water and Environment, Tasmania
DQMAWG	Domestic Quarantine and Market Access Working Group
EPP	Emergency Plant Pest
EPPRD	Emergency Plant Pest Response Deed
FFEZ	Fruit Fly Exclusion Zone
FSANZS	Food Standards Australia New Zealand
IBG	Industry Biosecurity Group
IBMP	Industry Best Management Practice
ICON	AQIS Import Conditions Database
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IRA	Import Risk Analysis
ISPM	International Standards for Phytosanitary Measures
NAQS	Northern Australian Quarantine Strategy
NTDR	Northern Territory Department of Resources
OCPPO	Office of the Chief Plant Protection Officer
PHA	Plant Health Australia
PIRSA	Primary Industries and Resources South Australia
QA	Quality Assurance
SARDI	South Australian Research and Development Institute
SPS	Sanitary and Phytosanitary
TST	Threat Summary Table
WTO	World Trade Organisation

Note: The definition of a pest as adopted by the International Plant Protection Convention (any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products) is used throughout this plan.

INTRODUCTION

Introduction

Plant Health Australia

Plant Health Australia (PHA) is a public company, with members including the Australian Government, all state and territory governments, and a range of plant industry organisations. The company was formed to address high priority plant health issues, and to work with all its members to develop an internationally outstanding plant health management system that enhances Australia's plant health status and the sustainability and profitability of plant industries.

Australian Lychee Growers' Association Ltd

The Australian Lychee Growers' Association (ALGA) is the national peak body that represents all lychee growers in Australia. ALGA represents over 250 lychee growers whose farms extend down the east coast of Australia for over 2,500 kilometres from Cooktown in Far North Queensland to Coffs Harbour in NSW. ALGA initiates and oversees the promotion, research, export market access and the agri-political issues that will ensure the long term sustainable future of the Australian lychee industry.

Need for biosecurity plans

Australia's geographic isolation and lack of shared land borders have, in the past, provided a degree of natural protection from exotic threats. Australia's national quarantine system also helps to prevent the introduction of harmful exotic threats to plant industry. Rapid increases in overseas tourism, imports and exports, mail and changing transport procedures (e.g. refrigeration and containerisation of produce), as well as the potential for pests to enter via natural routes, mean that relying on these quarantine measures is not enough.

Biosecurity planning provides a mechanism for the lychee industry, government and other relevant stakeholders to actively determine pests of highest priority, analyse the risks they pose and put in place procedures to reduce the chance of pests becoming established, and minimise the impact if a pest incursion occurs.

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, negotiate access to new overseas markets, and reduce the social and economic costs of pest incursions on both growers and the wider community.

The definition of a **pest** used in this document covers all insects, mites, snails, nematodes, pathogens (diseases) and weeds that are injurious to plants, plant products or bees. **Exotic pests** are those not currently present in Australia. **Endemic pests** are established within Australia.

The Emergency Plant Pest Response Deed

The Emergency Plant Pest Response Deed (EPPRD) has been negotiated between the government and industry members of PHA to cover the management and funding arrangements of eradication responses to Emergency Plant Pest (EPP) incidents. The EPPRD came into effect on October 26, 2005 and is a formal legally binding agreement between PHA, the Australian Government, all state and territory governments and 26 plant industry signatories (not yet ALGA). The EPPRD is based on the following key principles:

- cost minimisation for all parties
- reimbursement to growers whose crops or property are directly damaged or destroyed as a result of implementing an approved Response Plan
- early detection and response
- ensuring rapid responses to exotic pests - excluding weeds in the first instance
- ensuring decisions to eradicate are based on appropriate criteria (must be technically feasible and cost beneficial)
- an industry commitment to biosecurity and risk mitigation and a government commitment to best management practice
- cost sharing/payment of eligible costs
- an Agreed Limit for cost sharing (calculated as 2% of local value of production for one year of the Affected Industry Party or as defined in Schedule 14 of the EPPRD). The Agreed Limit can be exceeded with the agreement of Affected Parties.
- an effective industry/government decision-making process
- a limit in scope (to only cover exotic pest threats relevant to PHA Member Industries).

For further information on the EPPRD, including copies of the EPPRD, a Fact Sheet or frequently asked questions, visit www.planthealthaustralia.com.au/epprd.

Background on the lychee industry

The Australian lychee industry is a relatively new industry and small by Australian agricultural standards with an estimated 250 growers, with most producers cultivating less than 4000 trees. Production is spread along the east coast of Australia from Cooktown in far north Queensland to Coffs Harbour in northern NSW. Volume production concentrations are in the regions of Sunshine Coast, Bundaberg, Rockhampton, Mackay, Ingham, Tully and the Atherton Tablelands (around 95% of production is based in Qld). Backyard trees or small plantings also exist in most other states in Australia, but without commercial prospects.

The Australian lychee industry is unique in having the longest lychee production season in the world. Due to the introduction of earlier and later fruiting varieties, and the extensive production zones from tropical to temperate climates, the industry produces fruit from October in Far North Queensland to early April in Northern NSW.

Currently eight varieties of lychees are grown in Australia with the small-seeded varieties able to attract a price premium; as does the North Queensland early-season production. Bosworth 3 (B3, syn. Kwai May Pink) is a small-medium seeded variety developed in Australia that makes up 55% of Australian lychee production. Other major varieties in order of market volume are: Tai So, Wai Chee, Fay Zee Siu (syn Feizixiao), Salathiel, Souey Tung, Sah Keng and Kaimana. New varieties are being sourced through an industry and government funded selection program plus imports of elite overseas cultivars. These are expected to take six to ten years before being freely available on the market.

Current production is estimated at upward of 3000 tonnes (made up of 2500 tonnes of leviabile product and 500 tonnes estimated sold direct at farm-gate/roadside. The farm-gate value of the industry (2007) was estimated at \$AUD15 million based on an average farm-gate return of \$5/kg.

Table 1. Summary of estimated market segments (2007)

Market	Proportion	Tonnage
Roadside sales	15%	450 t
Export	12%	360 t
Major chains	25%	750 t
Independent retailers	48%	1440 t
Total production	100%	3000 t

The bulk of the domestic market is supplied by independent growers, though two marketing groups do exist: United Lychee Marketing Authority (ULMA), which markets the “Sun Lychee” brand, has allied growers in all growing regions and is growing in size and influence; and Top Crop, which operates out of north Queensland. As yet, there appears to be no commercial domestic processing activity.

An estimated 85-90% of production is consumed domestically and sold primarily in the major metropolitan markets of Sydney, Melbourne and Brisbane. Exports are primarily to Hong Kong (40%), Singapore and Europe; with the UK, Canada and Tahiti being smaller markets. Lychees are currently imported from China and Thailand seasonally to Australian production, but the quality tends to be poor relative to the Australian product.

What is industry biosecurity planning?

Industry biosecurity is the protection from risks posed by exotic pests through actions such as exclusion, eradication, and control. Effective industry biosecurity relies on all stakeholders, including government agencies, industry, and the public (Figure 1). The components of the plant industry biosecurity continuum have been identified and described in PLANTPLAN. A summary of the incursion management plan from PLANTPLAN (2010) has been summarised in Figure 2.

Figure 1. Industry biosecurity: a shared responsibility

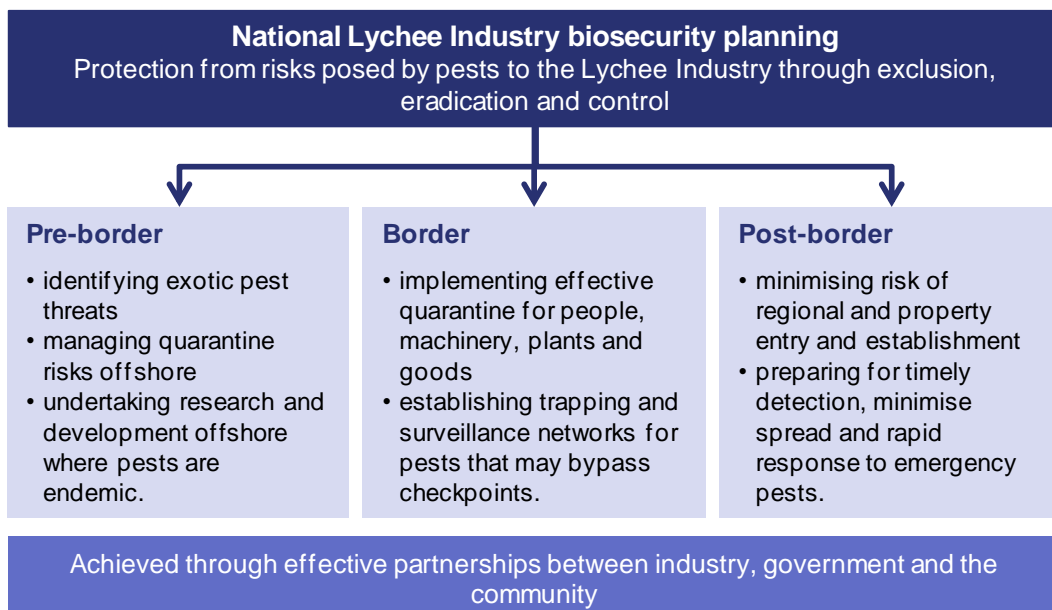
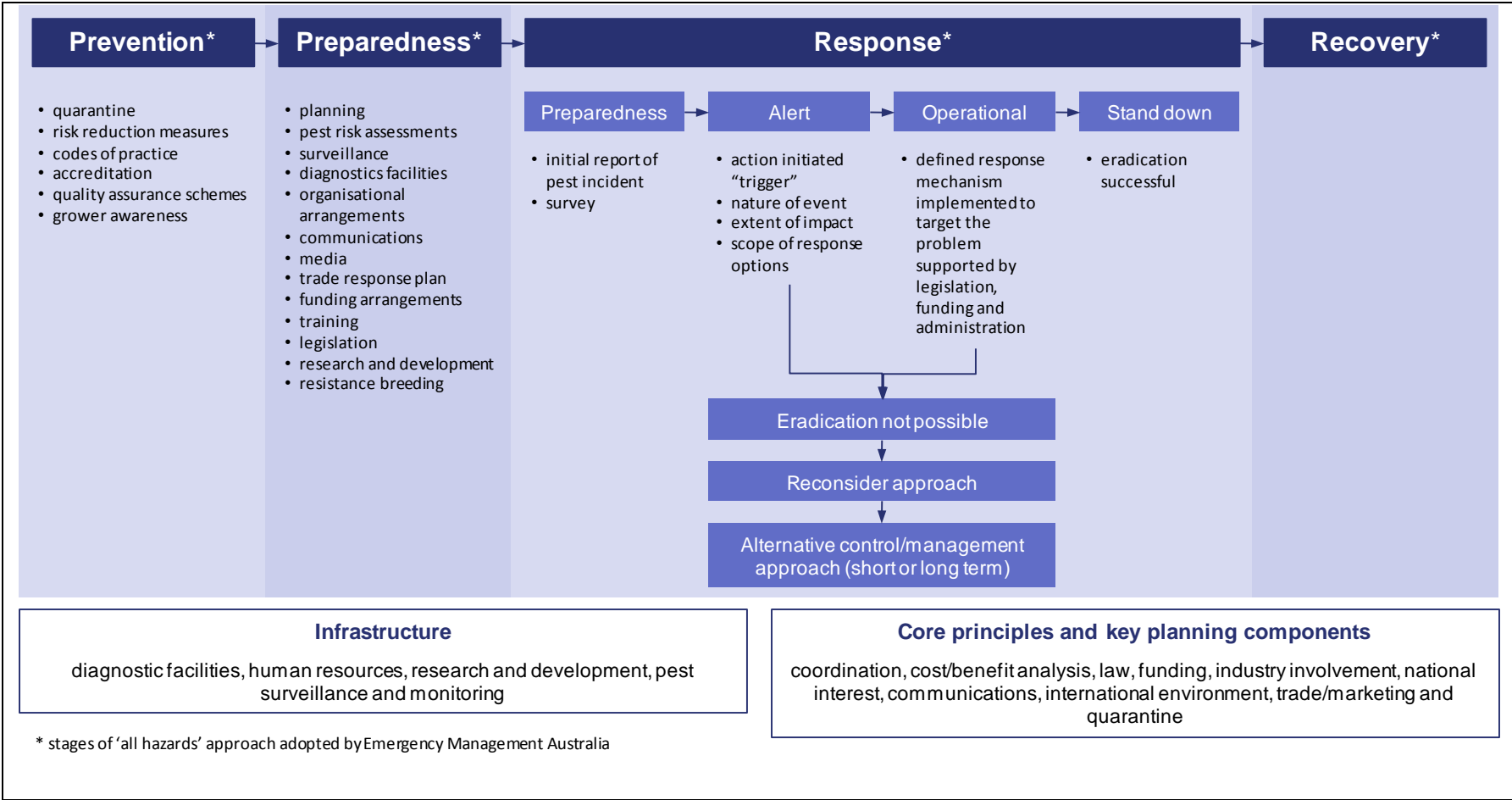


Figure 2. Summary of incursion management for plant industries according to PLANTPLAN (2010)



With the assistance of the ALGA, an Industry Biosecurity Group (IBG), coordinated by PHA, was formed to work on the development of a national biosecurity plan for the lychee industry. The IBG includes representatives from ALGA, as well as representatives from relevant state/territory agriculture agencies, the Australian Government, and PHA (Table 2).

Table 2. Members of the lychee IBG

Name	Organisation
Fiona Giblin	Department of Employment, Economic Development & Innovation (DEEDI)
Lindy Coates	DEEDI
Terry Campbell	DEEDI
Tony Cooke	DEEDI
Yan Diczbalis	DEEDI
Ian Groves	Australian Lychee Growers Association (ALGA)
Frank Bosnic	ALGA
Ruth Huwer	Department of Primary Industries (DPI), New South Wales
Jo Slattery	Plant Health Australia (PHA)
Terry Rose	PHA

Key steps in the development of the lychee IBP included:

- identifying and documenting key threats to the lychee industry
- confirming an agreed emergency plant pest priority list
- documenting appropriate pest risk reviews
- documenting pest-specific contingency plans for high priority pests
- documenting the roles and responsibilities of stakeholder groups

Document overview

The biosecurity package developed for the Australian lychee industry focuses on a number of key areas.

Threat identification, pest risk reviews, and incursion management funding arrangements

Guidelines are provided for the identification and categorisation of biosecurity threats through a process of qualitative risk assessment. The primary goal is to coordinate identification of exotic pest threats that could impact on productivity, sustainability, and marketability and to assess their potential impacts. This plan strengthens risk assessment work already being done both interstate and overseas. Pest risk reviews have been included for individual pests where available. Key lychee biosecurity threats are detailed in threat summary tables (TSTs; Appendix 1), along with the plant pest threat priority list (the top ranked threats to the lychee industry).

Risk mitigation plan

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. These include:

- surveillance, awareness and training activities
- exclusion activities
- propagation of high health status planting materials
- destruction of crop residues
- control of vectors
- control of alternative hosts and weeds
- produce transport procedures
- use of warning and information signs
- use of dedicated equipment when working in high risk areas
- restricting the use of high risk vehicles during high risk times
- reporting suspect pests to appropriate authorities
- including farm biosecurity in Industry Best Management Practice (IBMP) and Quality Assurance (QA) schemes

Contingency plans and response management procedures

PHA has developed PLANTPLAN, a generic emergency response plan for the Australian plant industries. This plan details the procedures required and the organisations responsible in the event of an incursion of an emergency plant pest. Pest-specific contingency plans may be developed as a result of the pest threats identified in this plan.

Review processes

With the support of PHA, the IBG is responsible for reviewing this plan on a 3-4 year basis.

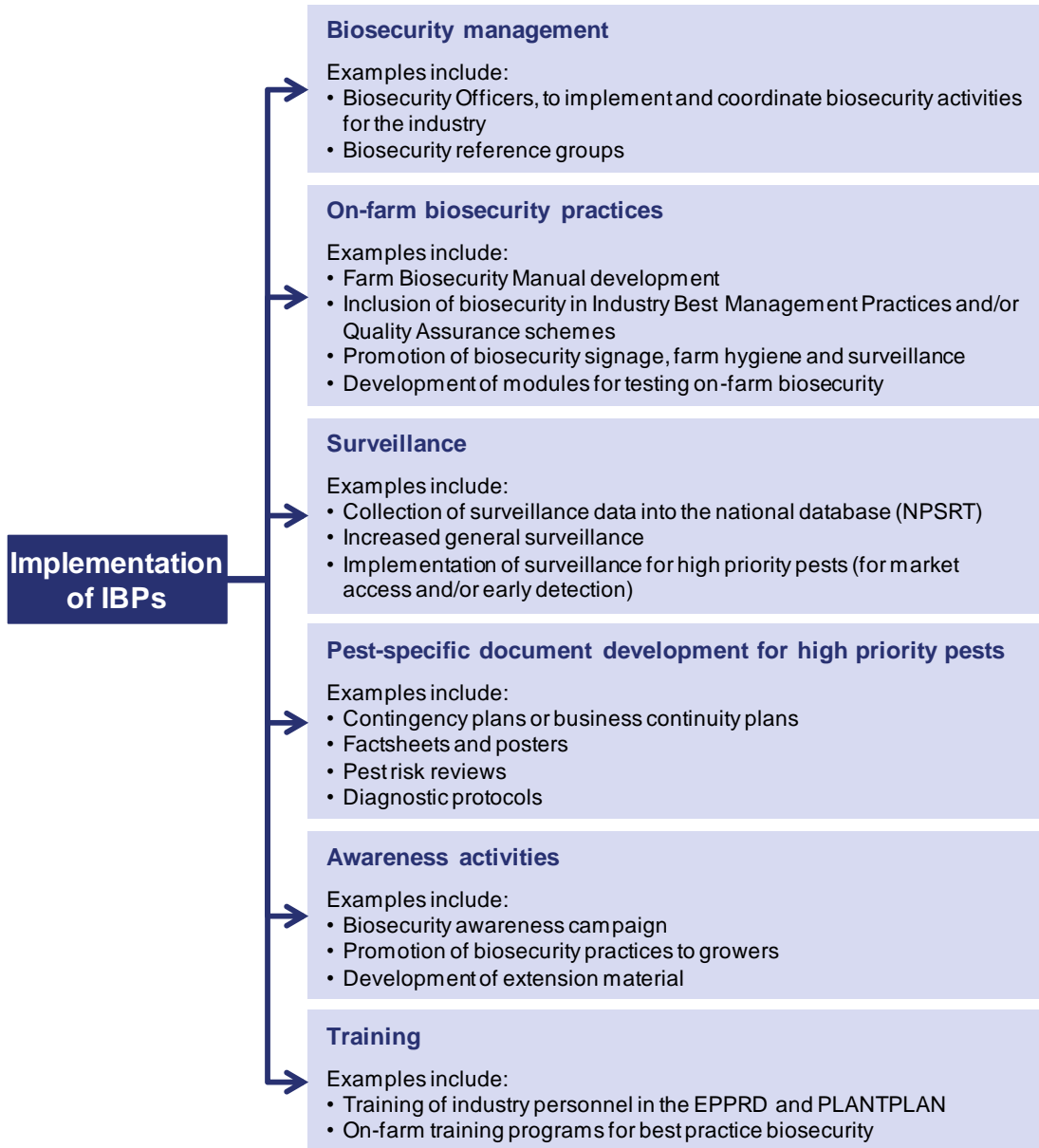
The review process will be used to determine:

- strategies to maximise the adoption of recommended practices
- where further improvements can be made
- revisions/updates to the plan
- where resources should be allocated to improve the plan

Biosecurity implementation

The lychee IBP provides a framework for the implementation of biosecurity practices within the industry. Currently a range of biosecurity practices are undertaken within the lychee industry and these are outlined in the Risk Mitigation chapter (page 35). Further implementation within the framework of the IBP, such as those practices outlined in Figure 3, should be investigated to increase preparedness in the industry.

Figure 3. Potential biosecurity implementation activities within the framework of the IBP



Through the review of the lychee IBP, a list of biosecurity action items to be considered by stakeholders in the industry has been developed (Table 3). This list is intended to provide proposed or potential biosecurity priorities for the lychee industry that are gaps in the current activities listed in the Risk Mitigation section of the IBP. Future versions of this document will contain information on the progress made on the listed items.

Table 3. Biosecurity action items identified by the lychee industry

Action item	Details
Awareness material	Identify and produce appropriate awareness material that raise awareness of the importance of biosecurity and the main exotic pest threats to the lychee industry for distribution to growers
Investigate whether a levy is appropriate	Industry investigate the pros and cons of signing the EPPRD and requirements for establishing an Emergency Plant Pest Response levy
Research on key pests	Risk analysis for lychee stink bugs and diagnostic protocols for high priority pests that do not have protocols at present (e.g. Lychee witches' broom disease).
Development of pest-specific contingency plans	Develop pest specific contingency plans for high priority pests
Research on Threat Summary Tables	Undertake review of the current Threat Summary Tables to complete information on risk ratings for pests where gaps occur and update the high priority pest list if required
Investigate need for emergency registration of chemicals for high priority pests	Identification of chemical control requirements for high priority pests. If needed, prepare emergency chemical registrations.

**THREAT
IDENTIFICATION, PEST
RISK REVIEWS, AND
INCURSION
MANAGEMENT
FUNDING
ARRANGEMENTS**

Introduction – threat identification and incursion management

This section identifies high risk exotic pest threats to the 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 lychee industry.

Emergency plant pests (EPPs) are defined as those that meet one or more of the following criteria:

- a) It is a **known exotic plant pest**, the economic consequences of an incident of which would be **economically or otherwise harmful** for Australia, and for which it is considered to be in the regional or national interest to be free of the plant pest
- b) It is a **variant form of an established plant pest** which can be distinguished by appropriate investigative and diagnostic methods, and which if established in Australia, would have a regional or national impact
- c) It is a **serious plant pest of unknown or uncertain origin** which may, on the evidence available at the time, be an entirely new plant pest, and which if established in Australia would have an adverse economic impact regionally and or nationally
- d) It is a **plant pest of potential economic importance** to the area endangered thereby and **not yet present** there or widely distributed and being officially controlled, but is occurring in such a fulminant incursion form, that an emergency response is required to ensure that there is not either a large scale epidemic of regional or national significance or serious loss of market access.

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

Identification of high risk 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.

Threat identification

Information on biosecurity threats to the lychee industry described in this document came from a combination of:

- past records
- existing industry protection plans
- relevant experience
- 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, although the issue of weeds may be revisited through future reviews of this plan.

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 (TSTs; Appendix 1) present a list of potential plant pest threats to the 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 TSTs were identified through a process of qualitative risk assessment and are listed in Table 4.

Description of terms used in pest risk tables

The descriptions below relate to terms in Table 4 and Table 6.

Life form legend

Btle	Beetles (weevils etc.) (COLEOPTERA)
Bug	Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers (HEMIPTERA)
Fly	Flies and Midges (DIPTERA)
Fun	Fungi
Lep	Butterflies and moths (LEPIDOPTERA)

Entry potential

Negligible	Probability of entry is extremely low given the combination of factors including the distribution of the pest source, management practices applied, low probability of pest survival in transit
Low	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 or certain given the combination of factors described above
Unknown	Pest entry potential is unknown or very little of value is known

Establishment potential

Negligible	The pest has no potential to survive and become established
Low	The pest has the potential to survive and become established in approximately one third or less of the range of hosts. 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 no potential for natural spread
Low	The pest has potential for natural spread locally
Medium	The pest has potential for natural spread throughout a physiographic region
High	The pest has potential for natural spread to all production areas
Unknown	Spread potential is unknown or very little of value is known

Economic impact

Negligible	There is no impact on yield, host longevity, production costs or storage
Low	There is minor impact on standing crop and little effect on stored product
Medium	There is moderate impact on crops, but host mortality is rare, storage losses may occur
High	There is severe impact on standing crop, with significant host mortality and/or storage losses
Extreme	There is extreme impact on standing crop, with extreme host mortality and/or storage losses
Unknown	The economic potential of the pest is unknown or very little of value is known

Lychee industry high priority plant pest threat list

Table 4 provides an overview of the top ranked threats to the lychee industry. Further details on each pest along with the basis for the likelihood ratings are provided in the threat summary tables (Appendix 1). Assessments may change given more detailed research, and the priority list will be reviewed with the Biosecurity Plan on a 3-4 year basis. An explanation of the method used for calculating the overall risk can be found on the PHA website¹.

Table 4. Lychee industry high priority plant pest threat list

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Lychee longicorn beetle	Btle	<i>Aristobia tetsudo</i>	Lychee	Branches, trunk	Medium	High	High	High	High
Lychee fruit borer	Lep	<i>Conopomorpha litchiella</i>	Lychee, longan	Fruit, branches	Medium	High	High	High	High
Brown blight	Fun	<i>Peronophythora litchii</i>	Lychee	Fruit, flowers, leaves	High	High	High	High	High
Longan witches' broom disease	Unknown ²		Lychee, longan	Leaves, flowers	High	High	High	High	High
Oriental fruit fly	Fly	<i>Bactrocera dorsalis</i>	Polyphagous	Fruit	High	High	High	High	High
	Bug	<i>Paradasynus longirostris</i>	Lychee, longan	Fruit, leaves	Low	High	High	High	Medium
Coconut bug	Bug	<i>Pseudotheraptus wayi</i>	Coconut	Fruit, flowers	Low	High	High	High	Medium

¹ Available from www.planthealthaustralia.com.au/go/phau/biosecurity/general-biosecurity-information

² Causal agent uncertain: Phytoplasma or filamentous virus suspected

Current resources for detection and identification of high priority pests

Diagnostic and surveillance capacity for the High Priority Pests (HPPs) of the lychee industry (Table 4) supports Australia's preparedness and ability to respond to them should they be detected. A summary of this capacity is shown in Table 5, which lists the formal active surveillance programs and the status of national diagnostic protocols developed for each of the lychee HPPs.

Development of national diagnostic protocols is managed through the Subcommittee on Plant Health Diagnostic Standards. While diagnostic capacity may exist in Australia in the absence of these documents, an endorsed national diagnostic protocol provides a consistent and agreed diagnostic approach for identifying new pests. Further information on these documents can be found on page 78.

Table 5. Diagnostic protocols and surveillance programs for high priority pests³

Common name	Life form	Scientific name	National diagnostic protocol	Surveillance programs
Lychee longicorn beetle	Btle	<i>Aristobia tetsudo</i>	Not at present	
Oriental fruit fly	Fly	<i>Bactrocera dorsalis</i>	Under development	NAQS pest and disease surveys – Northern Australia DAFF National exotic fruit fly trapping –urban areas and major ports DPI NSW fruit fly exclusion zone trapping – agricultural and major urban areas DEEDI exotic fruit fly trapping – Cape York Peninsula DAFF exotic fruit fly trapping – Torres Strait DPIPWE fruit fly trapping – Tasmanian air and sea ports DAFWA fruit fly trapping – Ord River region
Lychee fruit borer	Lep	<i>Conopomorpha litchiella</i>	Not at present	
	Bug	<i>Paradasynus longirostris</i>	Not at present	
Brown blight	Fun	<i>Peronophythora litchii</i>	Not at present	

³ Information presented has been taken from the National Plant Health Status Report 2008/09 and confirmed or updated through either Plant Health Committee, the Subcommittee on Plant Health Diagnostic Standards, the Surveillance Reference Group or other stakeholders.

Common name	Life form	Scientific name	National diagnostic protocol	Surveillance programs
Coconut bug	Bug	<i>Pseudotheraptus wayi</i>	Not at present	
Longan witches' broom disease	Unknown ⁴		Not at present	

Pests requiring more research

Pests listed in Table 6 have been identified by the lychee industry as a priority for additional research to determine their threat to lychees.

Table 6. Pests identified as priority that require more research

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Longan and lychee witches' broom disease	Unknown ⁵		Lychee, longan	Leaves, flowers	High	High	High	High	High
Longan stink bug	Bug	<i>Tessarotoma javanica</i>	Lychee, longan	Fruit, flowers	Low	Unknown	Unknown	High	Unknown
Lychee stink bug	Bug	<i>Tessarotoma papillosa</i>	Lychee, longan, citrus, plum, peach, pear, olive, banana	Fruit, flowers, stem	Low	Unknown	Unknown	High	Unknown
Stink bug	Bug	<i>Tessarotoma quadrata</i>	Lychee, longan, apple, pear	Fruit, flowers	Low	Unknown	Unknown	High	Unknown

⁴ Causal agent uncertain: Phytoplasma or filamentous virus suspected

⁵ Causal agent uncertain: Phytoplasma or filamentous virus suspected

Pest risk reviews

The assessment of risk posed by exotic pests listed in IBPs is carried out using a pest risk analysis protocol with similarities to that used in Biosecurity Australia (2009). Differences in underlying methodology and in the scope of consideration may result in different risk outcomes between the two protocols. The assessment process used in this IBP was developed in accordance with the International Standards for Phytosanitary Measures (ISPMs) No. 2 and 11 (FAO, 2004; 2007). A summary of the pest risk analysis protocol followed in this IBP is shown in Table 7, and the complete protocol used for pest risk analysis in this IBP can be found on the PHA website⁶. Modifications of the Biosecurity Australia protocol have been made to suit the analysis required in the IBP development process, including, but not limited to:

- **Entry potential:** The determination of entry potential in this IBP takes into account multiple possible pathways for the legal importation of plant material as well as through contamination and the possibility of introduction through natural means such as wind. Therefore the scope is wider than that used by Biosecurity Australia in their Import Risk Analyses, which only consider legal importation of plants or plant commodities.
- **Potential economic impact** of pest establishment in this document only takes into account the impacts on the lychee industry. The Biosecurity Australia Import Risk Analyses have a wider scope, including the effects to all of Australia's plant industries, trade, the environment and public health.
- **Risk potentials and impacts:** The number of categories for describing the entry, establishment and spread, and the potential economic impact in IBPs (see 'Description of terms used in pest risk tables' above) differs in comparison to that used in Biosecurity Australia (2009).

⁶ Available from www.planthealthaustralia.com.au/go/phau/biosecurity/general-biosecurity-information

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

Step 1	Clearly identify the pest	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Assessment based on current system and factors • Negligible, low, medium, high or unknown ratings
Step 3	Assess likely consequences	<ul style="list-style-type: none"> • Primarily based on likely economic impact to industry based on current factors • Negligible, low, medium, high, extreme or unknown ratings
Step 4	Derive overall risk	<ul style="list-style-type: none"> • 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 risk	<ul style="list-style-type: none"> • Risk ratings should be reviewed with the IBP

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 (AS/NZS-4360, 1999).

When a risk assessment is performed, it is important to document the type of analysis used, the level of confidence in the analysis, and any areas where assumptions have been made or where information is limited or unavailable.

Pest risk reviews (PRRs) for key threats to the lychee industry are available for download from the Pest Information Document Database on the PHA website (www.planthealthaustralia.com.au/pidd). New PRRs may be initiated at any time by government or lychee industry stakeholders and submitted to PHA, as may be updated versions of existing PRRs (when new information becomes available). After submission, the PRR will be circulated for review by industry and government technical experts and upon acceptance will be available on the website.

Formal Categorisation of pests for inclusion in the Emergency Plant Pest Response Deed

The following section outlines the EPPRD between all government and most industry members of PHA. The EPPRD aims to manage the impact of Emergency Plant Pests (EPPs) by establishing an industry/government agreement to cover eradication of emergency pests, reducing delays in securing funding, providing industry with greater involvement in eradication efforts, and removing disincentives to report emergency pests. The Australian Lychee Growers' Association (ALGA) is the peak Australian lychee industry body and became a member of Plant Health Australia on 1st September 2010, but is not yet a signatory to the EPPRD.

The EPPRD only covers eradication responses to EPPs when based on an approved EPP Response Plan. Weeds are not covered by the EPPRD at this stage. Under the EPPRD, both industry and government contribute to the total cost of an approved EPP Response with the ratio of contribution based on the Category of the EPP (Table 8). The Category of the EPP is determined by the Categorisation Group and is based on the relative public versus private benefits of eradication of the EPP.

A copy of the EPPRD can be downloaded from the Plant Health Australia website (www.planthealthaustralia.com.au/go/phau/epprd).

Pest categorisation

The EPPRD outlines a mechanism whereby Industry and Government Parties will contribute to the total cost of a response to an EPP Incident based on agreed Categories. These Categories determine the ratio each party will pay, based on the relative public and private benefits of EPP eradication. Four Categories are included in the EPPRD, as outlined in Table 8 and Figure 4.

Categorisation of a pest is done to determine the Parties that are most affected and who will therefore be the beneficiaries of an eradication response. It does not indicate its likelihood of eradication or its overall importance i.e. a pest listed as Category 1 is not deemed to be any more or less important than a pest listed as Category 4.

Pests listed in the HPP threat list (Table 4) may be put forward for categorisation and inclusion in Schedule 13 of the EPPRD. Other pests identified in TSTs or identified via other means as being priority pests, may also be categorised if required. The process for requesting categorisation of a Pest is set out in Schedule 3 of the EPPRD.

Pests that enter Australia, but which have not been formally categorised will be treated as belonging to Category 3 until an appropriate Category has been formally determined.

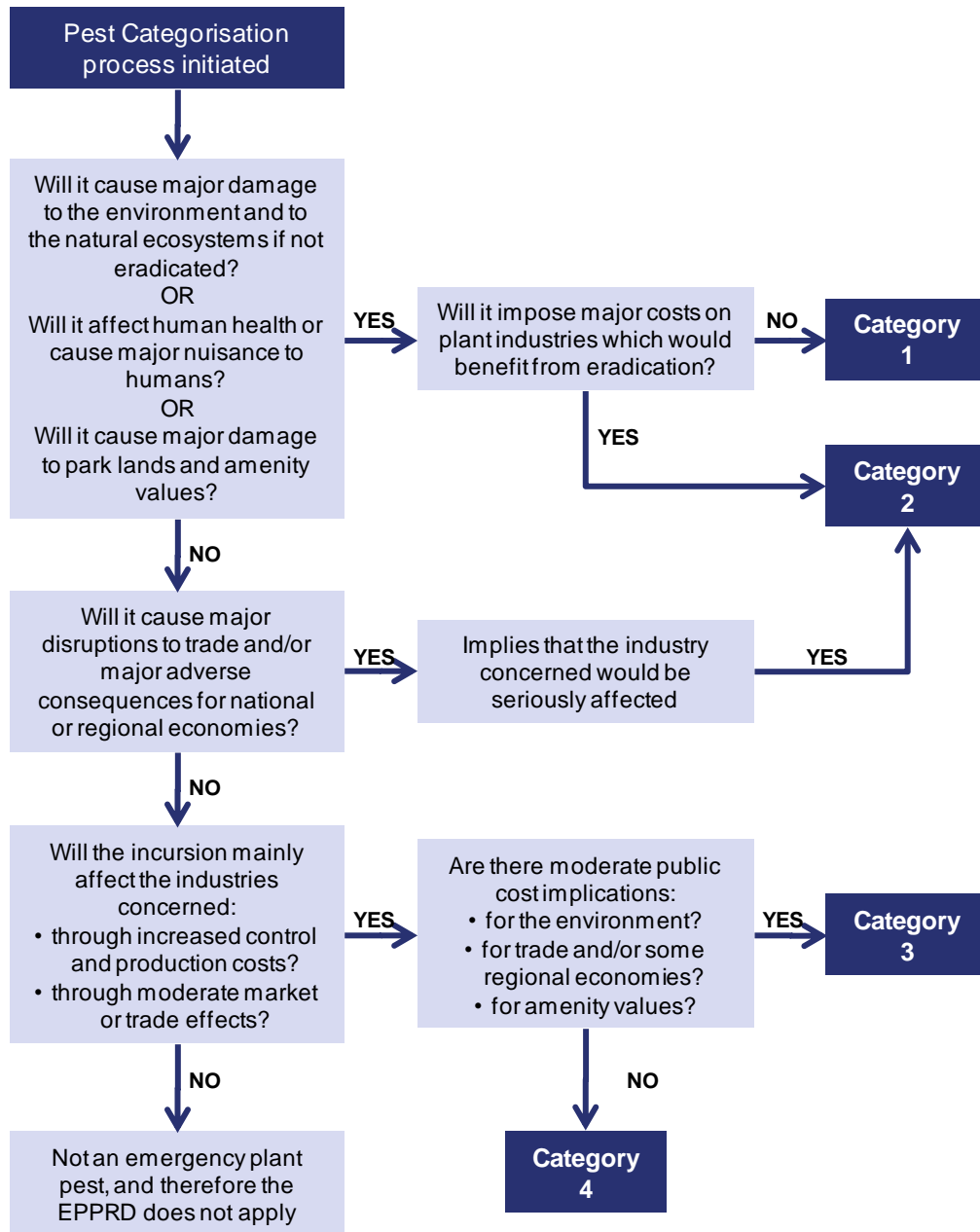
The Categorisation Group will be responsible for determining a cost sharing Category applicable for high priority pests. Only pests meeting the Emergency Plant Pest criteria will be considered for categorisation. Taking into account relevant scientific and other knowledge and experience, the Categorisation Group will consider requests for pest categorisation, re-categorisation or removal from Schedule 13 of the EPPRD. Figure 4 outlines the decision-making process used by the Categorisation Group in deciding pest Categories.

When more than one industry is affected by an EPP, the Categorisation Group will also determine, and when requested, will review the Funding Weight for each industry. Funding Weights provide a means for calculating each industry's Proportional Share of the total industry contribution if a pest affects multiple industry Parties.

Table 8. Cost sharing categories

Category	Description	Funding share
Category 1: Very high public benefits	Pest which if not eradicated would: <ul style="list-style-type: none"> • cause major environmental damage to natural ecosystems; and/or • potentially affect human health or cause a major nuisance to humans; and/or • cause significant damage to amenity flora; and • have relatively little impact on commercial crops. • This category also covers situations where the pest has a very wide range of hosts including native flora and there is considerable uncertainty as to the relative impacts on the different crops. In short, it is almost impossible to properly determine which industries benefit from eradication and to what extent, and in any case, the incursion primarily affects native flora and/or amenity plants, and/or is a major nuisance if not a health risk to humans. 	100% Government
Category 2: High public benefits	Pest which if not eradicated would: <ul style="list-style-type: none"> • cause significant public losses either directly through serious loss of amenity and/or environmental values and/or effects on households or indirectly through very severe economic impacts on regions and the national economy, through large trade losses with flow on effects through the economy; and • also impose major costs on the industries concerned so that these industries would significantly benefit from eradication. 	80% Government 20% Industry
Category 3: Moderate public benefits	Pest which if not eradicated would: <ul style="list-style-type: none"> • primarily harm the industries concerned but there would also be some significant public costs as well (that is, moderate public benefits from eradication). In this case the pest could adversely affect public amenities, households or the environment, and/or could have significant, though moderate trade implications and/or national and regional economic implications. 	50% Government 50% Industry
Category 4: Mostly if not wholly private benefits	Pest which if not eradicated would: <ul style="list-style-type: none"> • have little or no public cost implications and little or no impacts on natural ecosystems. The affected commercial industries would be adversely affected primarily through additional costs of production, through extra control costs or nuisance costs; and • generally there would be no significant trade issues that would affect national and regional economies. 	20% Government 80% Industry

Figure 4. Summarised pest categorisation decision tree



Composition of the Categorisation Group

As described by Part 4 of Schedule 8 of the EPPRD, the membership of the Categorisation Group for each industry will comprise (at a minimum):

- an independent chair from Plant Health Australia
- a standing representative of industry parties
- three technical experts [people with specific expertise in the areas of plant pathology or entomology], one nominated by the Australian Government, one nominated by the states/territories and one nominated by plant industry(s)
- a person with relevant economic expertise including social, trade and regional impact assessment
- a nominee from each plant industry or industries affected by the exotic plant pest being categorised

The Categorisation Group may also seek advice from:

- a person with human health expertise, if a public health risk may exist
- a conservation representative (e.g. Australian Government Department of Environment and Heritage) or
- other relevant members determined by the independent chair

Advisers who have specific expertise may accompany members of the Categorisation Group, but will not be part of the decision-making process.

Categorisation Group composition taken from Part 4 of Schedule 8 of the EPPRD.

Lychee Emergency Plant Pests categorised to date

EPPs for the lychee industry that have received formal pest categorisation (included within Schedule 13 of the EPPRD) are listed in Table 9. For the latest version of Schedule 13, refer to the EPPRD version found at www.planthealthaustralia.com.au/go/phau/epprd.

Table 9. Formal categories for pests of the lychee industry as listed in the EPPRD (as at August 2011)

Scientific name	Common name	Formal Category
<i>Bactrocera dorsalis</i>	Oriental fruit fly	2
<i>Cryptophlebia leucotreta</i>	False codling moth	2

References

AS/NZS-4360 (1999) Risk Management Standards Association of Australia, Strathfield, NSW.

Biosecurity Australia (2009) Draft pest analysis report for '*Candidatus Liberibacter psyllauros*' in fresh fruit, potato tubers, nursery stock and its vector the tomato-potato psyllid. Biosecurity Australia, Canberra.

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 PLAN

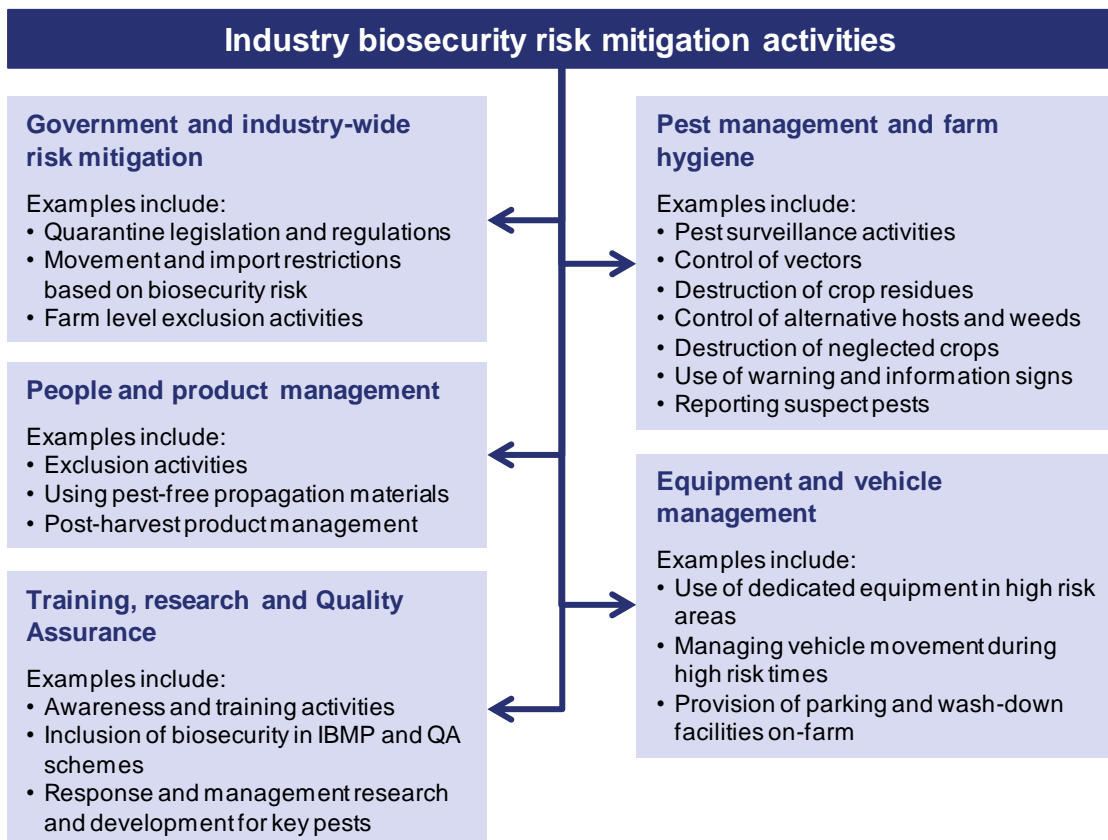
Introduction – risk mitigation

There are a number of strategies that can be adopted to help protect and minimise the risks of exotic and emergency pests under International Plant Protection Convention (IPPC) standards (www.ippc.int/IPPC/En/default.jsp) and Commonwealth and State legislation.

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the lychee industry (Figure 5). Such risk mitigation practices are the responsibility of governments, industry and the community.

A number of key risk mitigation areas are outlined in this guide, along with summaries of the roles and responsibilities of the Australian Government, state/territory governments, and 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 risk. Each grower will need to evaluate the efficacy of each activity for their situation.

Figure 5. Examples of biosecurity risk mitigation activities



Barrier quarantine

Barrier quarantine should be implemented at all levels of the lychee industry including national, state, regional, and orchard levels.

National level – importation restrictions

Responsibility > Australian Government

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 (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 (IRAs) 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 www.daff.gov.au.

The administrative authority for national quarantine is vested in the Australian Quarantine and Inspection Service (AQIS; part of DAFF) under the *Quarantine Act 1908*. Quarantine policies are developed on the basis of an IRA process. This process is outlined in the Import Risk Analysis Handbook 2011 (DAFF, 2011). AQIS maintains barrier quarantine services at all international ports and in the Torres Strait region. The management of quarantine policy, as it relates to the introduction into Australia of fruit, seed, or other plant material, including any lychee material, is the responsibility of AQIS.

The Schedule 5 “Permitted Seeds” list from the *Quarantine Proclamation 1998* is maintained on the Import Conditions (ICON) database at www.aqis.gov.au/icon. ICON 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. There are currently a number of cases for lychee plants or plant parts listed on ICON, as listed in Table 10. For export conditions see the PHYTO database at www.aqis.gov.au/phyto.

The World Trade Organisation (WTO) Sanitary and Phytosanitary Agreement (SPS Agreement) facilitates international trade while providing a framework to protect the human, animal and plant health of WTO members. SPS measures are put in place to minimise negative effects on trade. For plant products these measures are delivered through the International Plant Protection Convention (IPPC) standard setting organisations and collaboration with portfolio industries and exporters. For more information on the IPPC visit www.ippc.int.

Table 10. Import condition summary for lychee listed in ICON (as at April 2011)⁷

Commodity	End use	Import status	Import permit	Additional comments
Lychees – Fresh	Human consumption	Permitted	Required	Condition for import from People’s Republic of China only
Lychees – Fresh	Human consumption	Permitted	Required	Condition for import from Republic of South Africa only
Lychees – Fresh	Human consumption	Permitted	Required	Condition for import from Thailand only
Lychees – Fresh	Human consumption	Prohibited		Condition for import from Taiwan only
Lychees – Frozen fruit (pulp or flesh)	Human consumption	Permitted	Not required	Condition for import from all countries. A quarantine entry must be lodged with each consignment
Lychees – Dried fruit	Human consumption	Permitted	Not required	Condition for import from all countries. A quarantine entry must be lodged with each consignment
<i>Litchi chinensis</i> , <i>L.philippiniensis</i> , <i>L. ramboutan-ake</i> , <i>L. chinensis</i> subsp. <i>philippiniensis</i>	Seed for sowing	Permitted	Not required	Condition for import from all countries. Subject to AQIS inspection and procedures listed in ICON
<i>Litchi chinensis</i> , <i>L.philippiniensis</i> , <i>L. ramboutan-ake</i>	Nursery stock	Permitted	Required	Condition for import from all countries. Material must be grown and disease screened in approved AQIS post entry quarantine facilities

⁷ This is a summary only and should not be used as a substitute for consulting the ICON database or AQIS directly to confirm the details of import conditions and any recent changes

State and regional level – movement restrictions

Responsibility > state/territory government

The ability to control movement of materials that can carry and spread lychee pests is of high importance. Each state has quarantine legislation in place to control the importation of lychee material interstate and intrastate, and to manage agreed pests if an incursion occurs (refer to Table 11). 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 Domestic Quarantine and Market Access Working Group (DQMAWG).

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 lychees can be obtained by contacting your local state or territory agriculture agency directly (see Table 11), or through contacts listed on the DQMAWG website www.domesticquarantine.org.au/go/dqmawg.

The movement of farm vehicles and equipment between states is also restricted because of the high risk of inadvertently spreading pests. Each state has quarantine legislation in place governing the movement of machinery, equipment and other potential sources of pest contamination. Information on farm vehicle and equipment movement restrictions can be obtained by contacting your local state/territory department of agriculture (Table 11).

Table 11. Interstate and interregional movement of plant products – legislation, quarantine manuals and contact numbers

State	Administering authority	Legislation	Links to quarantine manual ⁸	Phone
ACT	Environment ACT (www.environment.act.gov.au)	<i>Plant Disease Act 2002</i>	See NSW conditions	13 22 81
NSW	Department of Primary Industries (www.dpi.nsw.gov.au)	<i>Plant Diseases Act 1924</i>	www.dpi.nsw.gov.au/aboutus/about/legislation-acts	02 9735 9600
NT	Department of Resources (www.nt.gov.au/d/Primary_Industry)	<i>Plant Health Act 2008</i>	www.nt.gov.au/d/Primary_Industry/index.cfm?newscat1=&newscat2=&header=NT%20Quarantine	08 8999 5511
Qld	Biosecurity Queensland, a service of the Department of Employment, Economic Development and Innovation (www.biosecurity.qld.gov.au)	<i>Plant Protection Act 1989</i> <i>Plant Protection Regulation 2002</i>	www2.dpi.qld.gov.au/health/14282	13 25 23
SA	Primary Industries and Resources (www.pir.sa.gov.au)	<i>Plant Health Act 2009</i>	www.pir.sa.gov.au/biosecuritysa/planthealth/legislation/plant_quarantine_standard	08 8168 5200
Tas	Department of Primary Industries, Parks, Water and Environment (www.dpipwe.tas.gov.au)	<i>Plant Quarantine Act 1997</i> <i>Weed Management Act 1999</i>	www.dpipwe.tas.gov.au/quarantine	1300 368 550
Vic	Department of Primary Industries (www.dpi.vic.gov.au)	<i>Plant Health and Plant Products Act 1995</i> <i>Plant Health and Plant Products Regulations 2006</i>	www.new.dpi.vic.gov.au/agriculture/horticulture/moving-plants-products	13 61 86
WA	Department of Agriculture and Food (www.agric.wa.gov.au)	<i>Plant Diseases Act 1914, Plant Diseases Regulations 1989, Bee Keepers Act 1963, Biosecurity and Agricultural Management Act 2007</i> ⁹	www.agric.wa.gov.au/PC_93008.html?s=264556653,Topic=PC_93008	08 9368 3333

⁸ If the link does not work, the relevant documents can be found by going to the department home page and checking the quarantine section of each website

⁹ Will replace *Plant Diseases Act 1914* and *Plant Diseases Regulations 1989*. Implementation soon to be underway.

New South Wales

Information on pre-importation inspection, certification and treatment requirements may be obtained from DPI NSW Regulatory Services by phone 1800 084 811.

At present a Fruit Fly Exclusion Zone (Tri-State FFEZ) is in operation, encompassing certain fruit-growing areas of New South Wales, Victoria and South Australia, including the Murrumbidgee Irrigation Area, Murray Valley, Goulburn Valley, Sunraysia and the Riverland. A map of the FFEZ can be found at fruitfly.net.au/fruit-fly-exclusion-zone. It is illegal to take fresh fruit into the FFEZ, and those who fail to dispose of fruit before entering this area face minimum \$200 on-the-spot fines. Roadside signs are in place to warn motorists of the FFEZ entry requirements. Random roadblocks are also used to enforce the FFEZ requirements. Further information on the FFEZ can be found at www.fruitfly.net.au.

Northern Territory

Administrative authority for regional quarantine in the Northern Territory is vested in the Department of Resources under the *Plant Health Act 2008*. Plant import requirements and notifiable pests are gazetted under this Act. The Act enables quarantine areas to be declared and inspectors appointed to carry out wide ranging control and/or eradication measures.

For more information refer to the DoR website (www.nt.gov.au/d).

Queensland

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Queensland may be obtained from the Biosecurity Queensland (a service of DEEDI) website (www2.dpi.qld.gov.au/health/14282). Further details can be obtained from the DEEDI Customer Service Centre using the email form on the website www.dpi.qld.gov.au/31_88.htm, or phone 13 25 23 (cost of a local call within Queensland) or for interstate callers phone 07 3404 6999, or 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 may be obtained from PIRSA Biosecurity SA- Plant Health by phone (08) 8168 5200 or fax (08) 8207 7844. Further information can be found at www.pir.sa.gov.au/biosecuritysa/planthealth.

Tasmania

Tasmania has national and international recognition for area freedom status for Fruit Fly. Quarantine Tasmania (DPIPWE) conducts pest and disease surveys to meet legislative and market access requirements which include a program of inspecting more than 900 fruit fly

traps that are deployed throughout the State. This Area Freedom Status has resulted in market access for Tasmanian fruit to several countries.

General and specific import conditions apply to the importation of fruit or plant material into Tasmania to prevent the introduction of pests and diseases into the State. These import conditions are outlined in the Plant Quarantine Manual (www.dpipwe.tas.gov.au/quarantine).

Victoria

Information on pre-importation inspection, certification and treatment requirements may be obtained from the DPI Customer Service Centre by phone 136 186. Further information is available at <http://new.dpi.vic.gov.au/agriculture/horticulture>.

Western Australia

The lead agency for agricultural biosecurity in Western Australia is the Department of Agriculture and Food (DAFWA). All plant material (including fruit) of any species entering Western Australia is required to pass through quarantine.

WA is free of a number of pests that are present elsewhere in Australia and maintain freedom from Queensland fruit fly. Some regions of WA, such as the Ord River Irrigation Area maintain freedom from Mediterranean fruit fly. For further information on fruit movement requirements into Western Australia, or into the Ord River Irrigation Area, contact Quarantine Western Australia (08) 9334 1800 or fax (08) 9334 1880.

Orchard level – exclusion activities

Responsibility > state/territory government, industry/growers and nursery operators

A significant risk of spreading pests onto orchards 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 orchard level, as this will reduce the probability of an incursion and increase the probability of early detection. This should in turn reduce the likelihood of a costly incident response, thereby reducing costs to industry, government and the community.

One major way this can be achieved is through management of industry biosecurity at the orchard level using exclusion practices. Further detail on potential strategies is included in the Orchard Biosecurity section (page 54). This could be used as a reference source for developing extension material for promoting good farm hygiene.

Nurseries and retailers – ‘hitch-hikers’

Responsibility > state/territory government, industry/growers and nursery operators

Nurseries and retail outlets, including chain stores, can be the primary distributors of lychee nursery material in a region. It is vital to ensure that pests are not introduced into new areas as ‘hitch-hikers’ on nursery material.

Produce transporters and purchasers for retail outlets (e.g. Woolworths, Bunnings) must obtain advice from state quarantine authorities before moving lychee material between regions or interstate. Advice in all states is available free of charge from the Domestic Quarantine website (www.dqmag.org.au).

Nursery stock should be labelled in a manner that allows the source to be identified for trace-back purposes. Where pest or disease symptoms are found on nursery stock it is important to identify the causal agent. New or unfamiliar pests should be reported for identification (see Reporting Suspect Pests section on page 69).

Good nursery hygiene practices help to prevent pest spread. The Nursery and Garden Industry Australia (NGIA) Nursery Industry Accreditation Scheme (NIASA) and similar schemes provide guidelines for nursery owners and growing media suppliers for maintaining hygiene standards. Examples of relevant nursery hygiene practices include training of staff to recognise pest and disease symptoms, controlling pests in nursery crops, and sterilisation of growing media and equipment. Information on NIASA can be obtained from the NGIA (www.ngia.com.au) or the Nursery and Garden industry office in your state.

Surveillance

Surveys enhance prospects for early detection, minimise costs of eradication and are necessary to meet the treaty obligations of the WTO Sanitary and Phytosanitary Agreement (SPS) with respect to the area freedom status of the Australian mainland.

The SPS agreement gives WTO members the right to impose SPS measures to protect human, animal and plant life and health provided such measures do not serve as technical barriers to trade. In other words, for countries, such as Australia, that has signed the SPS Agreement, imports of food, including fresh fruit and vegetables, can only be prohibited on proper, science-based quarantine grounds. The agreement also stipulates that appropriate surveillance and monitoring are necessary to support claims of area freedom. This is termed “evidence of absence” data and is used to provide support that we have actively looked for pests and not found them.

There are currently no international standards for structured pest surveys. Their planning and implementation depends on the risk involved, the resources available, and the requirements of trading partners (particularly when Australia wishes to access overseas markets). The intensity and timing of surveys also depend on the spread characteristics of the pest and the costs of eradication.

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

Industry personnel can provide very effective general surveillance as part of their normal management procedures, provided individuals are aware of what to look for and of reporting procedures (i.e. ‘passive surveillance’). 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.

Currently PHA is undertaking a program to more accurately define the roles and responsibilities of different government and industry stakeholders in surveillance for pests. Changes to this section of the document may need to be made when the biosecurity plan is reviewed.

National surveillance programs

Responsibility > Australian Government, industry (national associations)

AQIS maintains barrier quarantine services at all international ports and in the Torres Strait region. AQIS 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).

State surveillance programs

Responsibility > state/territory governments, industry/growers and nursery operators

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

The state agriculture department is responsible for:

- planning and auditing surveillance systems
- coordinating surveillance activities with those of industry and interstate groups
- provision of diagnostic services
- providing field diagnosticians for special field surveillance
- surveillance of non-commercial sites
- liaising with industry members
- developing communication, training and extension strategies with industry
- carrying out training
- reporting to all interested parties (AQIS, national bodies, trading partners and industry)

Various pest surveillance programs are managed by AQIS and the state/territory agriculture departments, some of which are described.

New South Wales

NSW DPI carries out surveillance targeting fruit flies in and around the Tri-State FFEZ in south western New South Wales. Surveys in all three member states of the Tri-State FFEZ follow national codes of practice for the management of Queensland fruit fly and Mediterranean fruit fly. Random roadblocks are also used within the FFEZ to ensure travellers do not carry host material into the area.

Queensland

AQIS, through the NAQS program, carries out general exotic pest and disease surveillance along the far northern coastal regions of Queensland. NAQS surveys target lychees among a range of other potential host plants for exotic pests and diseases. NAQS also maintains and monitors a network of traps in the Torres Strait and Northern Cape York Peninsula area targeting exotic fruit fly species (Weinert, 2002). Community awareness materials, highlighting target pests, are provided through the NAQS “Top Watch” awareness campaign.

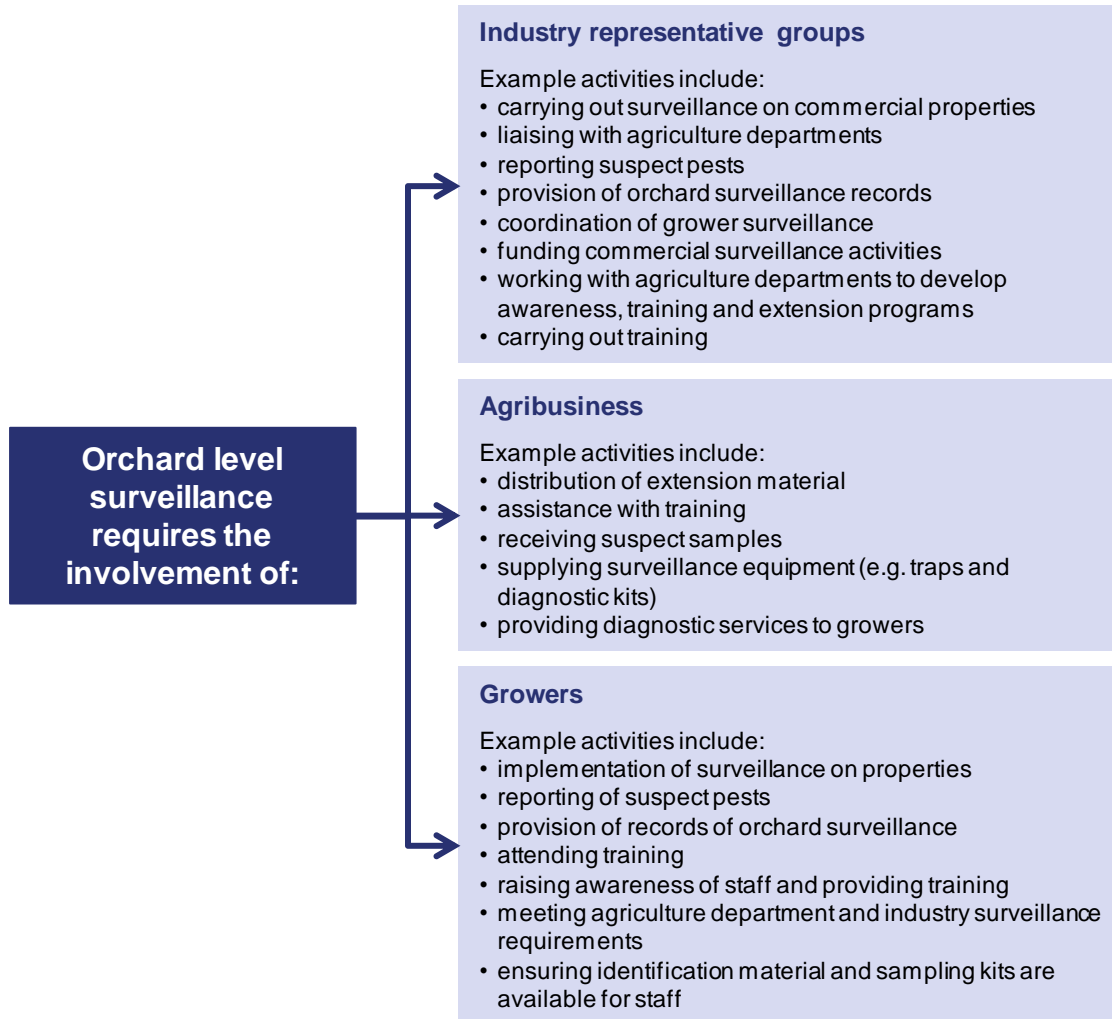
Biosecurity Queensland also carries out surveillance in the northern areas of Queensland, including Cape York Peninsula, the Torres Strait Islands, the Gulf of Carpentaria region, and urban areas. They target pests that occur in Papua New Guinea and South East Asia, but are absent in Australia. Two major surveys are carried out each year. Biosecurity Queensland also publishes and distributes community awareness materials to encourage reporting of exotic pests. Further information is available from the DEEDI web site at www.dpi.qld.gov.au/26.htm.

Orchard and nursery surveillance activities

Responsibility > industry/growers and nursery operators

Orchard level surveillance 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 6. Conducting regular surveys of orchards and nurseries provides the best chance of spotting new pests early and implementing eradication or management responses.

Figure 6. Examples of orchard level surveillance activities



Nurseries operating to NIASA guidelines are required to monitor pest activity in the nursery, effectively control pests, and keep a pest management record diary.

Training

A key component of emergency plant pest preparedness is ensuring suitable and effective training for people involved in responding to emergency plant pest incursions. Effective training is the responsibility of both government and industry.

PHA’s national training program for EPP preparedness

The PHA national training program is a program for industry and government personnel who have roles and responsibilities as members of the various committees under PLANTPLAN, the national emergency response plan for the plant industries. This includes training for Industry Liaison Officers and Industry Liaison Coordinators.

Training programs will help ensure personnel involved in responding to emergency plant pests are proficient and have the skills required to effectively perform their duties.

Additionally, training material on biosecurity awareness has been developed that is available to all PHA members to assist raising awareness of biosecurity issues (Table 12). This is targeted at industry leaders, agricultural consultants/extension officers, growers and the general community.

Table 12. Training materials from PHA’s National Training Program for EPP preparedness¹⁰

Training/briefing material available
Consultative Committee on Emergency Plant Pests
Domestic Quarantine and Market Access Working Group
National Management Group
Industry Liaison Officer/Coordinator
PLANTPLAN incursion response roles - various
Biosecurity awareness (industry leaders, consultants/extension officers, growers, community)
EPPRD awareness training
PHA Biosecurity On-line Training (BOLT)

¹⁰ Refer to the PHA website for the most up-to-date information, or contact PHA for further details

Awareness

Early reporting enhances the chance of effective control and eradication. Awareness activities (such as the postcard shown in Figure 7) raise the profile of biosecurity and exotic pest threats to the 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 agency.

Figure 7. Postcard from Plant Health Australia's Plant Health Awareness campaign



High priority plant pest threat-related documents

Pests listed in Table 4 have been identified as high priority threats to the lychee industry by members of the IBG. 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

In addition to the fact sheets listed in Table 21, the websites listed below (Table 13) contain information on pests across most plant industries, including the lychee industry.

Table 13. Sources of information on high priority pest threats for the lychee industry

Source	Website
Department of Agriculture, Forestry and Fisheries (DAFF)	www.daff.gov.au
Pest and Disease Image Library (PaDIL)	www.padil.gov.au
DEEDI exotic plant pests and disease list	www.dpi.qld.gov.au/26_6460.htm
University of California Statewide IPM Program	www.ipm.ucdavis.edu/EXOTIC/exoticpestsmenu.html
Secretariat of the Pacific Community (SPC)	www.spc.int/pacifly

Further information/relevant web sites

A range of government and grower organisation details and websites are provided below (Table 14) for persons seeking further information on lychee industry biosecurity.

Table 14. Relevant sources of further biosecurity information for the lychee industry

	Website/email	Phone	Address
National			
Australian Lychee Growers' Association	www.australianlychee.com.au welchtd@bigpond.com	(07) 4939 7032	262 Preston Road Adelaide Park via Yeppoon, QLD 4703
Australian Quarantine and Inspection Service	www.aqis.gov.au	(02) 6272 3933	18 Marcus Clarke St Canberra, ACT 2601
Australian Government Department of Agriculture, Fisheries and Forestry	www.daff.gov.au	(02) 6272 3933	GPO Box 858 Canberra, ACT 2601
Plant Health Australia	www.planthealthaustralia.com.au biosecurity@phau.com.au	(02) 6215 7700	Suite 1, 1 Phipps Cl Deakin, ACT 2600
New South Wales			
Department of Primary Industries	www.dpi.nsw.gov.au	1800 808 095	Locked Bag 21 Orange NSW 2800
Queensland			
Biosecurity Queensland, part of the Department of Employment, Economic Development and Innovation	www.dpi.qld.gov.au callweb@deedi.qld.gov.au	13 25 23	80 Ann Street Brisbane, QLD 4000

	Website/email	Phone	Address
Northern Territory			
Department of Resources	www.nt.gov.au/d/Primary_Industry info.drdpifr@nt.gov.au	(08) 8999 5511	Berrimah Farm, Makagon Road Berrimah, NT 0828
South Australia			
Primary Industries and Resources	www.pir.sa.gov.au www.pir.sa.gov/customer_enquiry_form	(08) 8226 0222	GPO Box 1671 Adelaide SA 5001
Biosecurity SA-Plant Health	www.pir.sa.gov.au/biosecuritysa/planthealth	(08) 8168 5200	33 Flemington Street Glenside SA 5065
South Australian Research and Development Institute	www.sardi.sa.gov.au sardi@sa.gov.au	(08) 8303 9400	2b Hartley Grove Urrbrae SA 5064
Tasmania			
Department of Primary Industries, Parks, Water and Environment	www.dpipwe.tas.gov.au BPI.Enquiries@dpiwpe.tas.gov.au	1300 368 550	GPO Box 44, Hobart, TAS 7001
Victoria			
Department of Primary Industries	www.dpi.vic.gov.au	1800 084 881	Plant Biosecurity and Product Integrity, Private bag 15, Ferntree Gully Delivery Centre, Vic 3156
Western Australia			
Department of Agriculture and Food	www.agric.wa.gov.au enquiries@agric.wa.gov.au	08 9368 3333	DAFWA 3 Baron-Hay Court South Perth WA 6151

Orchard biosecurity

Introduction and outline

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 lychees that Australia does not have.

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

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

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

- managing the movements of vehicles and farm equipment
- movement of people
- use of warning and information signs
- visiting overseas farms/orchards – what to watch out for when you return
- quality and hygiene Best Management Practices
- use high health status nursery stock
- chemical and biological control measures
- control of vectors
- destruction of crop residues and
- orchard biosecurity checklist

Selection and preparation of appropriate plant material

Bottom line Using high health nursery trees reduces the pest load and improves orchard biosecurity

Responsibility > Australian Government (national border control), state/territory government (intra- and interstate border controls), industry/growers and nursery operators

Lychee trees and propagation material should not be distributed without screening for pests. Infected planting material can be the main source of spread for some serious pests. Material from infected plants may appear healthy, so the outward appearance of planting material cannot be regarded as a reliable indicator of pest status. Soil carried on plants can harbour pathogens or pests, such as fungal spores or nematodes.

No certified sources of propagation material are currently available so it is important to obtain material from a reputable source. Because most trading of plant material is from grower to grower some precautions are required to minimise the chance of spreading pests. Current recommended practice is to double dip propagation material in an approved chemical, primarily to reduce the spread of mites. However, with regulations on the use of pesticides constantly changing, contacting ALGA for the latest information is strongly recommended.

Selecting appropriate cultivars

Bottom line Growers should investigate all variety and cultivar option available at the time of planting or replanting

Responsibility > State and territory governments, industry/growers and nursery operators

Cultivar selection is a very important aspect of orchard production as the investment in the trees is long term. Factors that need to be taken into account include fruit quality for the end use, suitability to the climate of the specific region and potentially tolerance or resistance to certain pests. As these factors are so variable and situation specific, it is advisable that the grower investigate all variety and cultivar option available at the time of planting or replanting. Whilst DEEDI has undertaken breeding efforts in the past, most cultivar improvement at present occurs through private importation of new overseas material (e.g. from China). ALGA's website www.australianlychee.com.au has links to resources that may assist growers in the process of cultivar selection.

Chemical control measures

Bottom line Appropriate training and advice on safe chemical use should be obtained prior to chemical control of pests

Responsibility > industry, drawing on advice from government and non-government research agencies

Chemical control programs may be required during crop growth to control pests or may be required around the orchard to control weeds or volunteers that may harbour pests. A planned and effective monitoring and pest management program, prepared in consultation with an IPM consultant and/or your local Department of Primary Industries officers will minimise the impact of pests on your crop.

Orchardists, their staff and contractors undertaking chemical control measures are required by law to complete certain training in an accredited course, depending upon the state in question.

Agriculture departments should identify and list suitable chemical control measures for high priority exotic pests, and submit advance applications for the emergency registration of any necessary chemicals that may be unavailable. The Australian Pesticides and Veterinary Medicines Authority (APVMA) is the national authority responsible for registration and deregistration of chemicals and can be contacted by phone on (02) 6210 4701. The APVMA Permit Section deals specifically with emergency registrations for chemicals. Further information can be obtained from the APVMA web site (www.apvma.gov.au).

Control of vectors

Bottom line Vectors, such as insects, people and machinery, can increase the spread of some pathogens, especially viruses and bacteria

Responsibility > industry/growers and nursery operators, drawing on advice from government and non-government research agencies

Many viruses and some bacteria require a vector to provide a means of dispersal. Biological vectors can include invertebrates such as insects and mites, nematodes, fungi, birds and people, and non-biological vectors such as machinery can also serve as vectors of plant pathogens. The activity and mobility of the vector determines the rate and distance of dispersal. Some insects may not be vectors but can increase the severity or facilitate the spread of pathogen.

Inspection and cleaning of vehicles, machinery and equipment (such as pruning tools) helps to prevent pest spread, as does cleaning of footwear and restricting unnecessary people movements around the orchard. Consideration should also be given to the control of known vectors of plant pathogens when new disease incursions are likely. In these cases, management of the vector will enable management of the pathogen.

The use of chemicals to control vectors can have a number of potentially adverse effects on the production and marketing of lychees including residues on produce that may limit market access, and chemical resistance that may develop in target pests.

IPM practices, such as the use of natural enemies and pheromone traps, can be effective methods of controlling vectors and managing the threat of insecticide resistance. Advice on IPM and control of lychee pests can be obtained from your local state/territory agriculture department.

Control of alternative hosts

Bottom line Pest management protocols can be enhanced through the control of alternative hosts

Responsibility > industry/growers, drawing on advice from government and non-government research agencies

Control of Weeds

Weed species are significant biosecurity problems in their own right as well as acting as alternative hosts of some agricultural or horticultural pests. Where this is so, weed control practices can significantly contribute to limiting the survival of pests and reducing the potential for incursions. Some alternative hosts may not be weeds. Details of any alternative hosts will be included in pest specific contingency plans for high priority lychee pests (see Contingency Planning section of this plan on page 72).

Control of ornamentals

Ornamental plants that are present around the cropping areas are of concern as they can harbour disease inoculum and insect pests, which can become established in subsequent crops. Strategies for the containment or destruction of ornamentals should be adopted depending on the pest involved. Specific advice should be sought from the relevant state/territory agriculture department.

Destruction of crop residues

Bottom line Proper management of crop residues reduces the pest load on your next crop

Responsibility > industry/growers, drawing on advice from government and non-government research agencies

The removal of fallen fruit and leaves and pruning residues from the orchard can reduce the over seasoning of some pests in the orchard and the initial pest load the following season. Protocols for the destruction or treatment of affected crop material should be developed for high risk pests.

Around 90% of lychee orchards are pruned annually, creating large volumes of orchard waste. Burning residues (including pruned material) is currently the recommended practise for minimising the build-up and spread of pests. This is particularly important for the control of Longicorn beetles in some growing areas.

Neglected orchards and volunteer plants

Bottom line Reduce the ability of pests to spread and establish through the removal of neglected plants

Responsibility > government, industry/growers

Neglected orchards and volunteer plants potentially pose a high biosecurity risk to the lychee industry, as they may allow pests to multiply, become established and spread.

Control of derelict orchards and feral plants should be proactive to reduce the risk of establishment and spread, thus taking the pressure off the frontline of border protection if an incursion does occur. If no action is taken with regard to the removal of these plants, the task will get progressively larger until it reaches a level of impossibility.

In general the problem is caused by some members of the community and not by industry. The industry is strongly supportive of the need for this host burden to be removed.

Suspected neglected or volunteer plants should be reported to one of the authorities listed in Table 15. After reporting, appropriate steps may be taken by the relevant authority to ensure the neglected plants do not carry pests or pose a risk to nearby or adjacent orchards. Table 15 also provides a summary of the actions that may be carried out in each state under relevant legislation.

Table 15. Authorities responsible for dealing with neglected, feral or volunteer plants

State	Authority	Legislation	Actions enabled
NSW	DPI	<i>Plant Diseases Act 1924 – Order 54</i>	The <i>Plant Diseases Act 1924</i> provides powers to quarantine and require owners to treat diseased plants. The Act gives the officers the power to destroy neglected trees.
Qld	DEEDI	<i>Plant Protection Act 1989</i> and associated regulations	The Queensland Department of Employment, Economic Development and Innovation has no particular powers on neglected orchards, unless they are infested with a declared pest.
SA	PIRSA	<i>Plant Health Act 2009</i>	There is no provision under SA's <i>Plant Health Act 2009</i> for control of neglected orchards unless a declared pest or disease has been detected in the orchard or in the near vicinity and specified action or removal is required by Ministerial Notice.
Tas	DPIPWE	<i>Plant Quarantine Act 1997</i>	Though there are no specific legislative provisions to deal with neglected orchards, Quarantine Tasmania advise that neglected orchards should be reported to the Department of Primary Industries, Parks, Water and Environment, or the State Grower Industry representative. Neglected orchards may be removed if they present a risk to adjacent orchards by harbouring populations of pests or diseases on the "Annual List of List A and List B Pests and Diseases". Copies of these lists are available on request from Quarantine Services, Tasmania.
Vic	DPI	<i>Plant Health and Plant Products Act 1995</i>	Under the <i>Plant Health and Plant Products Act 1995</i> , if an inspector knows or reasonably suspects that any plant or plant product is affected by any plant pest or disease on any land, and he or she reports it to the Secretary, a notice may be issued requiring that the owner or occupier control, eradicate or destroy the affected plants or plant produce.
WA	DAFWA	<i>Plant Diseases Act 1914, Biosecurity and Agricultural Management Act 2007</i> ¹¹	Neglected production plants in Western Australia can be removed or destroyed if required, under order by the Minister.
NT	NTDR	<i>Plant Health Act 2008</i>	Notification can be made to owners of neglected crops requiring them to rectify the situation within a reasonable period, with failure to do so making them liable to prosecution. Under a notice from the Chief Inspector, neglected plants may be destroyed and any costs incurred recovered.

Growers wishing to remain anonymous when reporting suspected neglected or feral crops may report through their local or national grower association (for contact details refer to Table 19, page 76).

¹¹ Will replace *Plant Diseases Act 1914*. Implementation soon to be underway.

Post-harvest handling and produce transport procedures

Bottom line Pest spread off-property can be reduced through providing appropriate wash-down facilities for machinery and equipment and checking for pest activity in the orchard. Produce identification systems provide a mechanism for tracing pests following an incursion

Responsibility > industry/growers, drawing on advice from government and non-government research agencies

Vehicles that are used to harvest or to transport lychees, particularly if moving between orchards, should be cleaned to remove soil and plant matter. This will help to minimise the risk of pest spread. For this purpose, all orchards should have access to a high pressure wash down facility that is associated with a concrete or tarmac pad.

It is preferable that wash down facilities are located on the property, or failing this, close to the property. At a minimum wash down facilities should be located within the same region as the property. Detergent based disinfectants should be considered. Water draining from the wash down facility should not be directed back into fields or the orchard irrigation water supply.

Growers should maintain effective pest monitoring and management programs. This includes keeping records of pest incursions and the control measures used. Receivers should be informed of the source of the produce and whether the material has come from an area experiencing a pest incursion.

Restrictions may be placed on the introduction or movement of lychees by individual states or territories, for example, specifying the use of certain transport routes, container types or consignment management procedures. If proposing to move lychees within or between quarantine areas, or between states, transporters should first check with state authorities to find out which regulations apply (see Barrier Quarantine section, page 37).

Identification and tracing system will assist in tracing produce consignments to their source if they are found to be contaminated with an exotic pest. Consignments should be clearly marked with the grower's name or code, and a batch identification mark (date or other code). Growers should maintain a record of the source and destination of each batch, and identify separate growing areas on a property map.

Post-harvest handling and produce transport procedures that minimise the risk of pest movement should be developed further and promoted within the industry.

Up-to-date advice on movement restrictions must always be sought before moving lychee plant material and products. This can be obtained from the Domestic Quarantine website (www.dqmag.org.au), or enquiries can be made directly to your local state or territory agriculture agency.

Use of warning and information signs

Bottom line Warning signs tell visitors to your property that you have biosecurity measures in place so as to minimise the spread of pests

Responsibility > industry/growers

Place warning and information signs on the entrances and gates of properties (where practicable) to help inform visitors of the biosecurity practices in place, and reminds personnel that orchard biosecurity is a priority. Signs should also include up-to-date contact details for people to gain further information. Visitors to the area may not be aware of relevant biosecurity protocols.

All people entering the property should have a clear view of any informative signs. Signs should contain simple messages (e.g. do not enter the property without prior approval, use wash down facilities for cleaning vehicles and machinery). An example biosecurity sign is shown in Figure 8.

Figure 8. Example biosecurity warning and information sign



Managing the movement of vehicles and orchard equipment

Bottom line Vehicles and orchard equipment can carry a range of pests, especially in attached soil or plant debris. Preventing spread of plant and soil debris, by washing down machinery or denying access to dirty machinery, can prevent pest introductions onto your property.

A high risk of spreading pests comes from movements of people, machinery and equipment between regions and orchards. This risk can be reduced by ensuring plant material and soil that may harbour pests is not moved to other properties or regions.

This deals only with movements between orchards and growing regions. For interstate or international movements of farm equipment and vehicles, contact your state/territory agriculture department (Table 11) or AQIS, respectively.

Movement of vehicles and equipment between orchards and between regions can potentially spread pests. Vehicles (including cars and orchard equipment such as harvest bins and tractors) can carry soil and soil-borne pathogens (especially when muddy) and plant debris may have weed seeds or may carry pests (including pathogens or insects).

While it is not always practical to stop these movements on and off your orchard, a number of measures can be used to reduce spread of pests by this route. Possible strategies are outlined below:

- visually inspect machinery and equipment (e.g. harvest bins, trucks and any other equipment) for signs of soil or plant material before it comes onto the property
- clean soil, plant or other debris from equipment or vehicles (especially equipment used on crops directly) prior to entering the property and deny access to any equipment that does not meet your standards
- use high-pressure wash down facilities (ideally with a concrete or tarmac pad for cleaning vehicles and equipment), not allowing wash down runoff to enter the farm or irrigation sources. For hedging equipment, the use of bleach as well as high pressure water is recommended.
- restrict movements of vehicles and people (where possible) during high-risk periods. This may include avoiding moving vehicles and machinery, particularly when roads are wet and muddy
- consider assigning certain equipment (including clothing, tools and footwear) to be used in pest infected areas only. This means that the equipment used in infected properties or areas is not reused in clean areas – and *vice versa*
- provide a designated parking area at the front of the property

- transport visitors, contractors, employees and government officials using vehicles based permanently on the property

National controls

Responsibility > Australian Government

The Australian Government is responsible for the inspection of machinery and equipment being imported into Australia. Administrative authority for national quarantine is vested in AQIS under the *Quarantine Act 1908*. Any machinery or equipment being imported into Australia must meet quarantine requirements. If there is any uncertainty, contact AQIS on (02) 6272 3933 or 1800 020 504, or visit the website at www.aqis.gov.au.

State controls

Responsibility > state/territory government

Each state has quarantine legislation in place governing the movement of machinery, equipment and other potential sources of pest contamination (Table 11). A summary of the movement restrictions can be found in Table 16 with additional information available in quarantine manuals (Table 11) and on the Domestic Quarantine website (www.dqmwag.org.au).

Table 16. State/territory restrictions on movement of machinery and equipment

State	Authority	Legislation	Control procedures
NSW	NSW DPI	<i>Plant Diseases Act 1924</i>	Restrictions apply to movement of machinery that may have come into contact with potato cyst nematodes, or grapevine phylloxera.
Qld	DEEDI	<i>Plant Protection Act 1989</i>	Restrictions apply to the entry of machinery and equipment. Contact the Biosecurity Queensland Customer Service Centre on (07) 3404 6999.
SA	PIRSA	<i>Plant Health Act 2009</i>	Restrictions apply relating to freedom from soil and plant material for used agricultural machinery.
Tas	DPIPWE	<i>Plant Quarantine Act 1997</i>	Requirements regarding the inspection and cleaning of machinery coming to Tasmania are covered by the <i>Plant Quarantine Act 1997</i> (Section 55), Sections 2.6 to 2.8 of the <i>Plant Quarantine Manual Tasmania</i> , and the <i>Weed Management Act 2000</i> . Machinery and equipment must be free from soil, plant trash, plants, declared weed seeds and other declared diseases or organisms.
Vic	Vic DPI	<i>Plant Health and Plant Products Act 1995</i>	Restrictions apply to movement of machinery into or within Victoria to prevent spread of pests and diseases of interest e.g. fire ants, potato cyst nematodes or phylloxera.

State	Authority	Legislation	Control procedures
WA	DAFWA	<i>Plant Diseases Act 1914 and Regulations, 1989, Biosecurity and Agricultural Management Act 2007</i> ¹²	Machinery and equipment entering the state is subject to inspection on arrival and must be free from soil and plant material. A movement permit must be obtained.
NT	NTDR	<i>Plant Health Act 2008</i>	Restrictions are in place to control movement of machinery, equipment and persons from gazetted quarantine areas.

Orchard/regional activities

Responsibility > industry/growers

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

Suggested practices for minimising pest spread at the orchard level include:

- ensuring that all visitors to the orchard report directly to the office on arrival
- checking that machinery, vehicles, and equipment (e.g. trailers, crates, bins) entering or leaving properties are free of soil and crop debris
- visually inspecting machinery and equipment before it comes onto the property and denying access to any equipment that does not meet biosecurity standards
- restricting movements of vehicles and people (if possible) during high risk periods. This may include avoiding moving vehicles and machinery, particularly when roads are wet and muddy
- wash and disinfect equipment used in high risk areas to avoid transferring pests and diseases to other areas of the orchard
- ensuring all visitors and employees are aware of the importance of keeping footwear and clothing free from loose dirt and vegetable matter before entering or leaving the property
- providing wash down facilities for both machinery and people (e.g. high pressure hose with a concrete or tarmac pad, scrubbing brushes and footbaths)
- providing a designated parking area and transporting visitors, contractors, employees and government officials using vehicles based permanently on the property
- minimising unnecessary entry of vehicles from outside the orchard and movements of vehicles around the orchard (especially when the soil is wet)

¹² Will replace *Plant Diseases Act 1914* and *Plant Diseases Regulations 1989*. Implementation soon to be underway.

- reporting all suspected exotic pests to your relevant agriculture department or the Exotic Plant Pest Hotline (1800 084 881)

Movement of people

Bottom line People can also carry pests, particularly on boots and clothing. Inform people of your biosecurity measures and provide hygiene options such as foot baths to minimise pest spread via visitors.

Movement of people between orchards and between regions can also potentially spread pests, especially on muddy boots and clothing that has been worn in another orchard. While it is not practical to stop movements of people on and off your orchard, a number of measures can be used to reduce spread of pests by this route. Possible strategies are:

- ensure all visitors to your property report directly to your office or house on arrival
- ensure all visitors and employees are aware of the importance of keeping footwear and clothing free from loose dirt and plant matter before entering or leaving the property
- supply footwear or footbaths (with a scrubbing brush) to avoid spread of soil or mud, containing a strong cleansing solution such as 'Farmcleanse' detergent
- use signs to alert people that biosecurity measures need to be undertaken and to report to the office/house
- brief staff, contractors and visitors on your orchard hygiene measures
- undertake biosecurity/quarantine training for employees and other personnel
- be aware if your visitors have recently arrived from overseas

Visiting overseas farms/orchards – what to watch out for when you return

Bottom line Production regions overseas may have devastating pests that Australia does not have – before returning, wash your clothes, boots and hair, and declare your visit to quarantine!

When visiting production regions and orchards overseas that may have pests not present in Australia, care should be taken not to inadvertently introduce these pests into Australia. Prior to returning from a visit, individuals should thoroughly wash all clothing and footwear used during the visit as well as their hair, which may carry bacterial and fungal spores. Also, any visits to farms (including orchards) should be declared on re-entry documentation as required.

Including orchard biosecurity in Industry Best Management Practice and Quality Assurance schemes

Bottom line Growing lychees following Best Management Practice and Quality Assurance schemes ensures high quality produce and reductions in pest impact and spread

Responsibility > industry/growers and nursery operators

For orchard level protection from pests, the following orchard biosecurity (orchard hygiene) measures are recommended:

- cleaning and sterilising pruning equipment. Annual pruning of trees has the potential to spread disease throughout and between lychee properties
- using only pest-free high health status true to type nursery stock
- seeking advice from the state/territory agriculture department before transporting plant material between growing regions or interstate
- inspecting all incoming vehicles and equipment for signs of contaminated soil or plant material and enforcing biosecurity standards
- using high pressure wash down facilities associated with a concrete or tarmac pad for cleaning vehicles and equipment, with treatment and disposal of effluent away from plants and irrigation sources
- disposing of orchard/nursery waste away from established trees or propagating areas
- undertaking a biosecurity/quarantine education and training program for employees and related personnel
- having a planned, effective monitoring and pest management program
- erecting informative signs at the entrance of the property which outline the basic biosecurity requirements for all visitors
- reporting all suspect diseased plants and pests to the local state/territory agriculture department, for identification
- minimising vehicle movement around the orchard
- including supplier information with produce consignments and maintaining source and destination records
- training staff in effective use of relevant chemicals
- disposing of unwanted plants and reporting neglected crops and volunteer plants to the local state/territory agriculture department
- managing visitor movement around the orchard by using vehicles which remain on the property, and supplying footwear or footbaths
- keeping public sales and tourist activities separate from the orchard area

Including such measures in Industry Best Management Practice (IBMP) and Quality Assurance (QA) schemes will strengthen the ability to rapidly detect, control and eradicate exotic pest incursions in the lychee industry before extensive damage occurs. BMP and QA schemes that cover some of the above biosecurity measures are listed in Table 17. At present, around 80% of lychee growers are 'Freshcare' accredited.

Table 17. Lychee industry IBMP and QA schemes

Scheme	Key areas of biosecurity relevance
Freshcare Code of Practice	Freshcare is the industry-owned, national, on-farm food safety program for the fresh produce industry. Freshcare links food safety on farm to the quality and food safety programs of the other members of the fresh produce supply chain.
Codex HACCP	HACCP certification provides a recognised endorsement of food safety excellence.
SQF 2000 for packers and processors & SQF 1000 for producers	The Safe Quality Food (SQF) Codes provide primary producers (SQF 1000) and food manufacturers, retailers, agents and exporters (SQF 2000) with a food safety and quality management certification program that is tailored to their requirements and enables suppliers to meet regulatory, food safety and commercial quality criteria. The SQF Codes are owned and managed by the Food Marketing Institute of the USA
Woolworths Quality Assurance Standard (WQA)	WQA is focussed on both quality and safety of all products supplied. All Trade Partners that are suppliers of Fresh Food or Private Label products to Woolworths are required to attain certification to the Woolworths Quality Assurance (WQA) Standard, in addition to existing regulatory or voluntary audits that may be currently in place.

Pollination services and biosecurity

Bottom line Encouraging good hive biosecurity practices provides benefits to beekeepers and growers, and protects the honey and pollination-dependent industries

Responsibility > industry/growers and nursery operators

The pollination services used by orchardists bring a contractor with special biosecurity considerations onto your property. Through the pollination process, bees moving between plants provide a mechanism for the spread of plant pests. These can also be spread between regions when hives are moved. In addition, there are a number of key biosecurity threats to bees¹³. The highest priorities are the Varroa mites (*Varroa destructor* and *V. jacobsoni*).

Lychee producers should expect hive providers to:

- check the health of any newly purchased bees, including asking for a venter declaration of health status

¹³ Pest threats to honeybees are not included in the treat summary table of this IBP. These will be assessed through the Honeybee IBP when developed.

- specifically check bees and brood for signs of disease
- maintain strong hives that are not susceptible to pest attack
- avoid placing hives in proximity to rubbish tips
- avoid placing hives near abandoned hives, as these are more likely to be diseased
- avoid placing hives near abandoned orchards which might have pests that can be carried on bees
- regularly inspect bees for unusual behaviour
- isolate captured swarms for six months to ensure they are free from pests before adding them to the main apiary
- check swarms for unusual bees as they may be an exotic bee species
- ensure all hives are registered and branded so there is no confusion about ownership

Working together to reduce biosecurity threats, lychee producers and hive producers should:

- ensure a clean water source is available for bees
- ensure all orchard and hive equipment is cleaned between uses
- wash and disinfect hands before and after handling hives
- ensure boots and clothing are free from plant material, soil, insects and other pests before entering and leaving orchards or handling hives
- minimise the number of people that visit hives
- prevent vehicles from driving close to hives
- secure honey stores and sticky frames so robbing bees cannot gain access
- check hives when monitoring the orchard and report and unexplained decline in bee numbers, crawling or dead bees near hive entrances or any unusual bee behaviour
- advise your hive provider of any intended use of chemicals that might be harmful to bees

Orchard biosecurity checklist

Use this checklist to do a quick biosecurity assessment of your property, and see sections of this document for further detail on each point.

Farm biosecurity checklist	Yes	No
Do you have information signs placed at the entry gate to demonstrate your hygiene/biosecurity measures?		
Do you maintain secure boundary fences?		
Do you provide movement controls (people and vehicles) and wash down areas/footbaths to prevent spread of pests onto your property?		
Do you have designated parking for visitors?		
Do you provide on-property transport for visitors?		
Has visiting machinery been cleaned correctly?		
Do you use high health nursery stock?		
Do you ensure that your and staff are adequately trained in the correct use of pesticides?		
Do you provide biosecurity training and awareness for orchard staff?		
Do you use quality assurance and/or best management practice systems?		
Have you sought advice from a farm consultant in developing and implementing your orchard's biosecurity plan?		
Have you been to an overseas farm or a suspect area? Wash your clothes, boots and hair, and declare your international visit to quarantine!		

Further information in relation to orchard biosecurity can be found at the farm biosecurity website (www.farmbiosecurity.com.au).

Reporting suspect pests



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

Reporting an exotic plant pest carries serious implications and should be done only via the Exotic Plant Pest Hotline. Careless use of information, particularly if a pest has not been confirmed, can result in extreme stress for individuals and communities, and possibly damaging and unwarranted trade restrictions.

If you suspect a new pest, call the Exotic Plant Pest Hotline on 1800 084 881

Calls to the Exotic Plant Pest Hotline will be forwarded to an experienced person in the department of agriculture from the state of origin of the call, who will ask some questions about what you have seen and may arrange to collect a sample. Every report will be taken seriously, checked out and treated confidentially.

In some states and territories, the Exotic Plant Pest Hotline only operates during business hours. Where this is the case, and calls are made out of hours, callers should leave a message including contact details and staff from the department of agriculture will return the call the following business day.

Some lychee pests are notifiable under each state or territory's quarantine legislation. The complete list of notifiable pests can be downloaded from the PHA website¹⁴; however, each state's list of notifiable pests are subject to change over time so contacting your local state/territory agricultural department (details in Table 11) will ensure information is up to date. Landowners and consultants have a legal obligation to notify the relevant state/territory agriculture department of the presence of those pests within a defined timeframe (Table 18).

Table 18. *Timeframe for reporting of notifiable pests as defined in state/territory legislation*

State/territory	Notifiable pest must be reported within
NSW	24 hours
NT	24 hours
Qld	24 hours
SA	Immediately
Tas	As soon as possible
Vic	Without delay
WA	24 hours

Suspect material should not generally be moved or collected without seeking advice from the relevant state/territory department, as incorrect handling of samples could spread the pest or render the samples unsuitable for diagnostic purposes. State/territory agriculture department officers will usually be responsible for sampling and identification of pests.

¹⁴ Available from www.planthealthaustralia.com.au/go/phau/biosecurity/general-biosecurity-information

References

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

CONTINGENCY PLANS AND RESPONSE MANAGEMENT PROCEDURES

Introduction – emergency response

Gathering information, developing procedures, and defining roles and responsibilities during an emergency can be extremely difficult. To address this area, PHA coordinated the development of PLANTPLAN, a national set of incursion response guidelines for the plant sector, detailing procedures required and the roles and responsibilities of all parties involved in an incursion response.

Following PLANTPLAN, a set of threat-specific contingency plans will be developed to cover the key exotic pests to the lychee industry. These pests are detailed in the high priority plant pest threat list (Table 4) and have been identified through a process of qualitative risk assessment. Information will be provided on the host range, symptoms, biology and epidemiology of each pest, along with guidelines for general and targeted surveillance programs, diagnosis, and control. These documents are designed to assist with the development of response plans and will be used in conjunction with the emergency response guidelines in PLANTPLAN.

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

PLANTPLAN

PLANTPLAN provides a description of the general procedures, management structure and information flow system for the handling of a plant pest emergency at national, state/territory and district levels. This includes the operations of the control centres, principles for the chain of responsibility, functions of sections and role descriptions. PLANTPLAN is a general manual for use by all jurisdictions for all plant pest emergencies.

PLANTPLAN is regularly reviewed and updated to ensure it provides the best possible guidance to plant industries and governments in responding to serious plant pests. The most recent version of PLANTPLAN can be downloaded from the PHA website (www.planthealthaustralia.com.au/plantplan).

Current response management procedures

Following the detection of a suspect exotic plant pest, the relevant state agency should be immediately notified directly or through the Exotic Plant Pest Hotline. Within 24 hours of the initial identification, the agency, through the State Plant Health Manager, will inform the Office of the Chief Plant Protection Officer (OCPPO) which will notify other relevant Australian Government Departments and relevant state agencies and industry representatives (process outlined in Figure 9). Following the detection or reporting of the pest, the relevant state/territory agriculture agency may collect samples of a suspect pest and seek a positive identification. If the pest is suspected to be an exotic pest (not yet present in Australia), the general process is as outlined in Figure 10.

Figure 9. Suspect exotic plant pest detection reporting flowchart

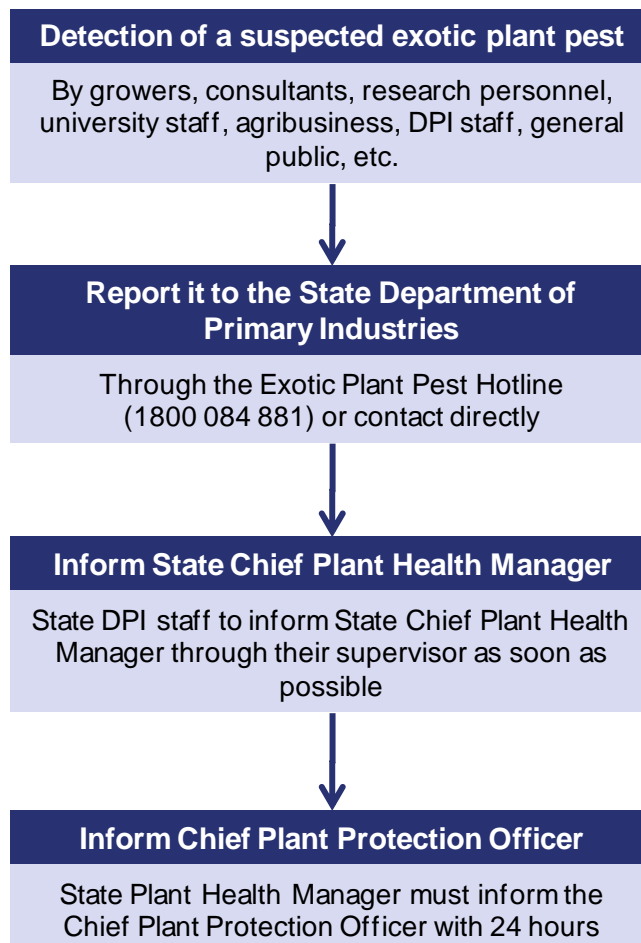
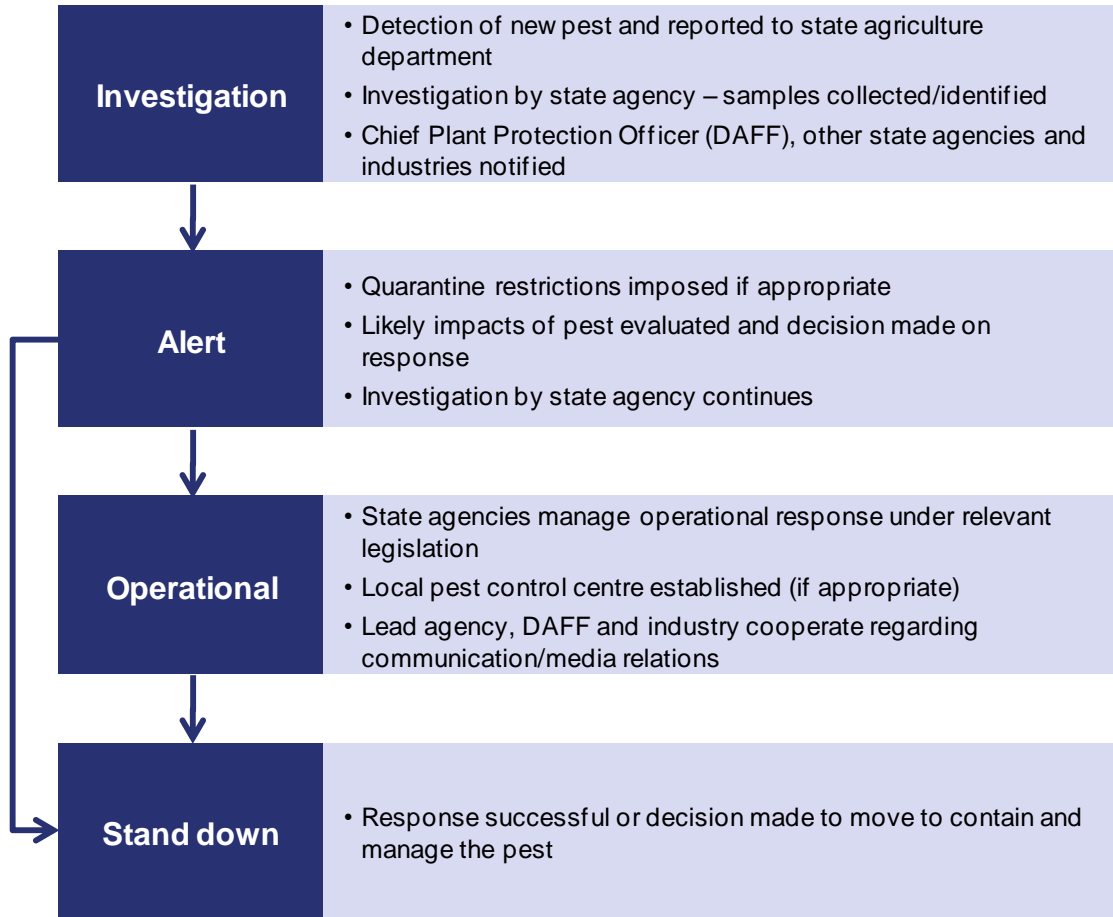


Figure 10. General decision making and communication chain for a plant pest emergency response



If the pest is considered potentially serious, then the relevant state/territory agriculture department may adopt precautionary measures. These measures, depending on the pest, may include:

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

If an exotic plant pest is confirmed, technical and economic considerations are reviewed, and a decision made on whether to eradicate, contain or do nothing about the incursion (depending on the feasibility of the response and likely costs and impacts of the pest). Under the EPPRD all decisions are made by Committees with government and industry representation.

During this investigation/alert period, the affected area will be placed under quarantine until a decision is made on whether to eradicate or control the pest. Once a decision has been made on a suitable response, efforts enter the operational phase. Eradication or control methods used will vary according to the nature of the pest involved and infested material will be destroyed where necessary. All on ground response operations are undertaken by the relevant state department(s) in accord with relevant state/territory legislation.

In the stand down phase, all operations are wound down. Where a plant pest emergency was not confirmed, those involved will be advised that the threat no longer exists. Where an eradication or management/control campaign has taken place, quarantine measures will be finalised and reviewed.

Industry specific response procedures

Industry communication

In the event of a pest incursion affecting the lychee industry, ALGA will be the key industry contact point and will have responsibility for relevant industry communication and media relations (see PLANTPLAN for approved communications during an incursion). ALGA should be contacted immediately (Table 19) to ensure those appropriate delegate/s are secured for meetings of the Consultative Committee or National Management Group.

Close cooperation is required between relevant government bodies and industry in regards to the effective management of a pest response and media/communication issues. Readers should refer to PLANTPLAN for further information.

Table 19. Contact details for Australian Lychee Growers' Association

Website	www.australianlychee.com.au
Street address	262 Preston Road Adelaide Park via Yeppoon QLD 4703
Telephone	07 4939 7032
Fax	07 4939 7032
Email	welchtd@bigpond.com
Contacts	Denise Welch Executive Officer

Counselling and support services

Provision for counselling and advice on financial support for growers is made available through various agencies as listed in Table 20. Up-to-date information relating to mental health can be found at <http://www.health.gov.au/mentalhealth>. Local providers of counselling services can be found through contacting your local state or territory agriculture agency (Table 11) or your growers association (Table 19).

Table 20. *Counselling and financial counselling services*

Organisation	Contact
Lifeline	<p>13 11 14 (24 hours) www.lifeline.org.au</p> <p>Anyone can call Lifeline. The 13 11 14 service offers a counselling service that respects everyone's right to be heard, understood and cared for. We also provide information about other support services that are available in communities around Australia.</p>
Mensline	<p>1300 789 978 (24 hours) www.menslineaus.org.au</p> <p>Mensline Australia is a dedicated service for men with relationship and family concerns.</p>
Kids Help Line	<p>1800 551 800 (24 hours) www.kidshelpline.com.au</p> <p>Kids Help Line is Australia's only free, confidential and anonymous, telephone and online counselling service specifically for young people aged between 5 and 25.</p>
BeyondBlue	<p>1300 224 636 www.beyondblue.org.au</p> <p>Beyondblue is an independent, not-for-profit organisation working to increase awareness and understanding of depression, anxiety and related substance-use disorders throughout Australia and reduce the associated stigma</p>
Centrelink	<p>1800 050 585 (Farm Assistance) 13 23 16 (Drought Assistance Hotline) www.centrelink.gov.au</p> <p>The Exceptional Circumstances Relief Payment (ECRP) is delivered by Centrelink on behalf of the Department of Agriculture, Fisheries and Forestry. The payment provides assistance to farmers living in 'exceptional circumstances' affected areas who are having difficulty meeting family and personal living expenses.</p>

Organisation	Contact
Rural Financial Counselling Service	<p>1800 686 175 (free call for referral to your nearest Rural Financial Counselling Service provider)</p> <p>www.daff.gov.au/agriculture-food/drought/rfcs</p> <p>Rural financial counsellors can:</p> <ul style="list-style-type: none"> • help clients identify financial and business options • help clients negotiate with their lenders • help clients adjust to climate change through the Climate Change Adjustment Program, identify any advice and training needed and develop an action plan • help clients meet their mutual obligations under the Transitional Income Support program • give clients information about government and other assistance schemes • refer clients to accountants, agricultural advisers and educational services • refer clients to Centrelink and to professionals for succession planning, family mediation and personal, emotional and social counselling.
DEEDI Farm Financial Counselling Service	<p>13 25 23 DEEDI Call Centre</p> <p>DEEDI financial counsellors can:</p> <ul style="list-style-type: none"> • help clients identify financial and business options • help clients negotiate with their lenders • give clients information about government and other assistance schemes • refer clients to accountants, agricultural advisers and educational services • refer clients to Centrelink and to professionals for succession planning, family mediation and personal, emotional and social counselling

Pest-specific emergency response and information documents

As part of the implementation of the IBP, pest-specific information and emergency response documents, such as fact sheets, contingency plans, pest risk reviews and diagnostic protocols should be developed over time for all medium to high risk pests listed in the TSTs (Appendix 1). Currently, a number of documents have been developed for pests of the lychee industry (Table 21) and are available for download from the Pest Information Document Database at www.planthealthaustralia.com.au/pidd.

Table 21. Pest-specific information documents for the lychee industry¹⁵

Common name	Scientific name	Fact sheet	Pest risk review
Oriental fruit fly	<i>Bactrocera dorsalis</i>	✓	✓
Nettle caterpillar	<i>Parasa lepida</i>		✓
Asian gypsy moth	<i>Lymantria dispar</i>	✓	✓
Melon fly	<i>Bactrocera cucurbitae</i>		✓

Threat-specific contingency plans

Over time, threat-specific contingency plans will be completed for the exotic threats identified in the high priority plant pest list (Table 4). To date, no contingency plans have been produced for the lychee industry. As plans are developed they will be uploaded onto the PHA website (www.planthealthaustralia.com.au/pidd).

The guideline for development of threat-specific contingency plans¹⁶, prepared by Dr Peter Merriman and Dr Simon McKirdy will be used as a basis for developing these plans.

National diagnostic standards for priority plant pest threats

National diagnostic standards have been commissioned for a number of exotic/emergency plant pests. These protocols would be used nationally in the event of an incursion, thus ensuring a rapid response and nationally consistent test results that are directly comparable. However, given the rapid development of improved molecular diagnostic techniques, these protocols need to be regularly reviewed and updated.

The development and endorsement of these protocols is managed by the Subcommittee on Plant Health Diagnostic Standards (SPHDS). Diagnostic standards that have been formally nationally endorsed are available on the SPHDS website (www.daff.gov.au/sphds). Prior to endorsement, completed draft protocols are made available on the pest information document database (www.planthealthaustralia.com.au/pidd). Further information diagnostic standards and their endorsement process can be found on the SPHDS website.

¹⁵ Copies of these documents are available from www.planthealthaustralia.com.au/pidd

¹⁶ Available from www.planthealthaustralia.com.au/go/phau/biosecurity/general-biosecurity-information

APPENDIX 1: THREAT SUMMARY TABLES

Lychee industry threat summary tables

The information provided in the threat summary tables (invertebrates, Table 22 and pathogens, Table 23) is an overview of exotic plant pest threats to the lychee industry. Summarised information on entry, establishment and spread potentials and economic consequences of establishment are provided where available. Pests under official control¹⁷ or eradication may be included in these tables where appropriate. However, lychee pests that are endemic but regionalised within Australia are not covered by IBPs, but may be assessed in state biosecurity plans. Assessments may change given more detailed research, and will be reviewed with the biosecurity plan.

Additional information on a number of the pests listed in the TSTs can be found in pest-specific information documents (Table 21). An explanation of the method used for calculating the overall risk can be found on the PHA website¹⁸.

Description of terms

The descriptions below relate to terms in the TSTs (Table 22 and Table 23). Full descriptions of the risk rating terms can be found on page 22.

Life form legend

Btle	Beetles, weevils, etc. (COLEOPTERA)
Bug	Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers (HEMIPTERA)
Fly	Flies and Midges (DIPTERA)
Fun	Fungus
Hym	Ants and wasps (HYMENOPTERA)
Iso	Termites (ISOPTERA)
Lep	Butterflies and moths (LEPIDOPTERA)
Loc	Grasshoppers and locusts (ORTHOPTERA)
Mite	Mites e.g. spider and gall mites (ACARI)
Nem	Nematode
Thri	Thrips (THYSANURA)
Vir	Viruses and viroids

¹⁷ Official control defined in ISPM No. 5 as the active enforcement of mandatory phytosanitary regulations and the application of mandatory procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests

¹⁸ Available from www.planthealthaustralia.com.au/go/phau/biosecurity/general-biosecurity-information

Invertebrates

Table 22: Lychee invertebrate threat summary table.

Common name	Life form	Scientific name	Primary hosts	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Chinese rose beetle	Btle	<i>Adoretus sinicus</i>	Polyphagous	Leaves	LOW	NEGLIGIBLE	LOW	NEGLIGIBLE	NEGLIGIBLE
Rose beetle	Btle	<i>Adoretus versutus</i>	Polyphagous; Lychee, bean, papaw, cashew, wattle, taro, ginger, sugar cane, cocoa, grape, roses	Leaves	MEDIUM	MEDIUM	MEDIUM	HIGH ¹⁹	MEDIUM
Citrus brownbanded tortrix	Lep	<i>Adoxophyes cyrtosema</i>	Lychee	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Apple peel tortricid ²⁰	Lep	<i>Adoxophyes orana</i>	Apple, European pear, apricot, quince, blackcurrant, raspberry, peach, roses	Whole plant leaves, growing points, flowers, and fruits.	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Citrus black fly ²¹	Bug	<i>Aleurocanthus woglumi</i>	Citrus	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Leaf-eating caterpillar	Lep	<i>Anisodes illepidaria</i>	Lychee, mango	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Cupreous chafer	Btle	<i>Anomala cuprea</i>	Polyphagous; Lychee, beans, groundnut, sweet potato, grape	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Large green chafer beetle	Btle	<i>Anomala cupripes</i>	Soyabean, potato, clove, cowpea, maize	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Longicorn beetle ²²	Btle	<i>Anoplophora chinensis</i> ²³	Polyphagous; Lychee, citrus	Trunk	MEDIUM	HIGH	HIGH	HIGH	HIGH
	Btle	<i>Anoplophora maculata</i>	Lychee, citrus	Branches, shoots	MEDIUM	HIGH	HIGH	HIGH	HIGH
	Nem	<i>Aorolaimus helicus</i>	Lychee	Roots	LOW	LOW	LOW	LOW	NEGLIGIBLE

¹⁹ High economic impact on lychee, ornamentals such as rose and hibiscus, cocoa seedlings, ginger and grape (CABI, 2011)

²⁰ Synonyms: Smaller tea tortrix, Summer fruit tortrix

²¹ Synonyms: Spiny citrus whitefly

²² Synonyms: Black and white citrus longhorned beetle

²³ Synonym: *Anoplophora malasiaca*

Common name	Life form	Scientific name	Primary hosts	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Nem	<i>Aphelenchus maximus</i>	Lychee, mango	Roots	LOW	LOW	LOW	LOW	NEGLIGIBLE
	Nem	<i>Aphelenchus sparsus</i>	Lychee	Roots	LOW	LOW	LOW	LOW	NEGLIGIBLE
Chafer beetle	Btle	<i>Apogonia cribricollis</i>	Polyphagous; Coffee, cocoa, sweet potato, African oil palm	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Lychee longicorn beetle ²⁴	Btle	<i>Aristobia testudo</i>	Lychee, guava	Branches	MEDIUM	HIGH	HIGH	HIGH	HIGH
Atlas moth	Lep	<i>Attacus atlas</i>	Lychee, mango, avocado, guava, water apple, citrus	Leaves	MEDIUM	HIGH	HIGH	UNKNOWN ²⁵	UNKNOWN
Longan diaspidid scale	Bug	<i>Aulacaspis longanae</i>	Longan, lychee	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Melon fly	Fly	<i>Bactrocera cucurbitae</i>	Polyphagous; Lychee, cucumber, mango, guava, papaya	Fruit	HIGH	HIGH	HIGH	MEDIUM	MEDIUM
Oriental fruit fly	Fly	<i>Bactrocera dorsalis</i>	Polyphagous; Lychee, longan, avocado, carambola, papaw, mango, rambutan	Fruit	HIGH ²⁶	HIGH ²⁷	HIGH ²⁸	HIGH ²⁹	HIGH
Tea looper	Lep	<i>Biston suppressaria</i>	Polyphagous; Lychee, tea, mango, guava	Leaves	LOW	LOW	LOW	LOW ³⁰	NEGLIGIBLE
Natal fruit fly	Fly	<i>Ceratitis rosa</i>	Polyphagous; Lychee, cashew, papaw, citrus, grape	Fruit	LOW	HIGH	MEDIUM	MEDIUM	LOW
Horned wax scale	Bug	<i>Ceroplastes pseudoceriferus</i>	Malabar ebony, lychee, mango	Leaves, flowers	LOW	MEDIUM	MEDIUM	UNKNOWN	UNKNOWN

²⁴ Synonyms: Turtleneck beetle

²⁵ *Attacus atlas* is not considered a major pest but in some localities and during some years, it may reach pest status

²⁶ The major risk is from the import of fruit containing larvae, either as part of cargo, or through the smuggling of fruit in airline passenger baggage or mail (CABI, 2003)

²⁷ Wide host range (CABI, 2003)

²⁸ Adult flight and the transport of infected fruit are the major means of movement and dispersal to previously un-infested areas. Many *Bactrocera* spp. can fly 50-100 km (Fletcher, 1989)

²⁹ Damage levels can be anything up to 100% of unprotected fruit (CABI, 2003)

³⁰ High economic impact on tea

Common name	Life form	Scientific name	Primary hosts	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Citrus locust	Loc	<i>Chondracris rosea</i>	Polyphagous; Citrus, rice, soyabean, sweet potato, lychee, tea, rambutan, cotton	Leaves, stems and growing tips	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
	Nem	<i>Clavilenchus similis</i>		Roots	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Leaf roller	Lep	<i>Cnesteoboda celligera</i>	Lychee, mango, rambutan, lac tree	Leaf	LOW	UNKNOWN	UNKNOWN	LOW	NEGLIGIBLE - LOW
	Lep	<i>Comoritis albicapilla</i>	Lychee	Trunk	LOW	LOW	LOW	LOW - MEDIUM	NEGLIGIBLE – VERY LOW
Lychee fruit borer	Lep	<i>Conopomorpha sinensis</i>	Lychee, longan	Trunk, branches	MEDIUM	HIGH	HIGH	HIGH	HIGH
Termites	Iso	<i>Coptotermes</i> spp.	Polyphagous; Coffee, citrus, fig, sugarcane, sweet potato, lychee, mango, rubber, coconut, eucalyptus	Trunks, roots	HIGH	MEDIUM	MEDIUM	MEDIUM - HIGH ³¹	LOW - MEDIUM
Carpenter moths	Lep	<i>Cossus</i> spp.	Polyphagous; Lychee, longan	Trunks, branches	LOW	LOW	LOW	LOW	NEGLIGIBLE
	Btle	<i>Cratopus angustatus</i>	Citrus, lychee	Leaves, flowers, fruit, roots	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
	Btle	<i>Cratopus humeralis</i>	Citrus, lychee	Leaves, flowers, fruit, roots	LOW	UNKNOWN	UNKNOWN	LOW	NEGLIGIBLE - LOW
Ring nematode	Nem	<i>Criconemoides complexus</i>	Lychee, pineapple, mango	Roots	LOW	LOW	LOW	UNKNOWN	UNKNOWN
Litchi moth	Lep	<i>Crociosema litchivora</i>	Lychee	Flowers	LOW	LOW	LOW	MEDIUM	VERY LOW
Koa seedworm	Lep	<i>Cryptophlebia illepada</i>	Lychee, koa, macadamia, mango	Fruit	LOW	HIGH	HIGH	MEDIUM	LOW
False codling moth	Lep	<i>Cryptophlebia leucotreta</i>	Polyphagous; Lychee, pineapple, carambola, cotton	Leaves, fruit	LOW	LOW	HIGH ³²	MEDIUM	LOW
	Lep	<i>Cryptophlebia peltastica</i>		Fruit	LOW	HIGH	HIGH	MEDIUM	LOW

³¹ High economic impact in plantation forests

³² Pheromone trials conducted in Australia 2002

Common name	Life form	Scientific name	Primary hosts	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Leaf midge	Fly	<i>Dasineura</i> spp.		Leaves	LOW	UNKNOWN	UNKNOWN	MEDIUM	NEGLIGIBLE - LOW
Mite	Mite	<i>Disella litchii</i>	Lychee	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
	Thri	<i>Dolichothrips indicus</i>	Lychee	Flowers	MEDIUM	UNKNOWN	UNKNOWN	LOW	NEGLIGIBLE - LOW
Leaf-eating caterpillar	Lep	<i>Dudusa synopla</i>	Lychee, rambutan, lac tree	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Thrips	Thri	<i>Ernothrips lobatus</i>	Lychee, longan	Leaves, shoots	LOW	LOW	LOW	LOW	NEGLIGIBLE
	Lep	<i>Gatesclarkeana erotias</i>	Lychee, carambola, tea, mango, lantana	Leaves, stems	LOW	LOW	LOW	LOW	NEGLIGIBLE
Mopane worms	Lep	<i>Gonimbrasia belina</i>	Lychee, radiata pine	Leaves	LOW	UNKNOWN	UNKNOWN	LOW	NEGLIGIBLE - LOW
Leaf-eating caterpillar	Lep	<i>Gymnoscelis imparatalis</i>	Lychee, longan, cinnamon, shaddock, mango, rambutan, pinwheelflower	Leaves, flowers	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Ring nematode	Nem	<i>Hemicriconemoides mangiferae</i> ³³	Polyphagous; Lychee, papaw, pineapple, longan, mango, cassava	Roots	MEDIUM	LOW	LOW	MEDIUM - HIGH	VERY LOW - LOW
Leaf roller	Lep	<i>Homona difficilis</i>	Lychee, longan, rambutan	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Green weevil ³⁴	Btle	<i>Hypomeces squamosus</i>	Polyphagous	Above ground	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Bark borer	Lep	<i>Indarbela dea</i> ³⁵	Lychee, jackfruit, casuarina, longan, pineapple	Trunk, branches	LOW	UNKNOWN	UNKNOWN	LOW-MEDIUM	NEGLIGIBLE - LOW
	Lep	<i>Indarbela quadrinotata</i>		Trunk, branches	LOW	UNKNOWN	UNKNOWN	LOW-MEDIUM	NEGLIGIBLE - LOW
Bark borer	Lep	<i>Indarbela tetraonis</i>	Lychee, cashew nut, citrus, jackfruit, guava	Trunk, branches	LOW	UNKNOWN	UNKNOWN	LOW-MEDIUM	NEGLIGIBLE - LOW

³³ High economic impact when in combination with *Xiphinema brevicolle* (Cabi, 2011)

³⁴ Synonyms: Gold-dust beetle, Gold-dust weevil

³⁵ Synonyms: *Lepidarbela dea*, *Arbela dea*

Common name	Life form	Scientific name	Primary hosts	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Lac insect	Bug	<i>Kerria lacca</i>	Polyphagous; Lychee, longan, mango, northern black wattle, gum arabic tree, white siris, sickle bush, jujube	Leaves	LOW	LOW	LOW	MEDIUM	VERY LOW
Mango shield scale	Bug	<i>Kilfia acuminata</i>	Polyphagous; Mango, lychee, citrus, carambola, ginger, avocado	Stems, leaves	MEDIUM	UNKNOWN	UNKNOWN	LOW ³⁶	NEGLIGIBLE - LOW
Sugarcane white grub	Btle	<i>Lepidiota stigma</i>	Sugarcane, maize, cassava, coffee	Below ground, seedlings	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Leaf midge	Fly	<i>Litchiomyia chinensis</i>	Lychee	Leaves	LOW	UNKNOWN	UNKNOWN	LOW	NEGLIGIBLE - LOW
Needle nematode	Nem	<i>Longidorus litchii</i>	Lychee	Roots	LOW	UNKNOWN	UNKNOWN	LOW	NEGLIGIBLE - LOW
Asian gypsy moth	Lep	<i>Lymantria dispar</i>	Polyphagous	Leaves, flowers	HIGH	HIGH	HIGH	HIGH	HIGH
Pink gypsy moth	Lep	<i>Lymantria mathura</i>	Polyphagous; Lychee, chestnut, mango, oaks	Leaves, flowers	HIGH	MEDIUM	MEDIUM	UNKNOWN	UNKNOWN
	Lep	<i>Lymantria xyliina</i>	Polyphagous; Lychee, longan, camellia, casuarina, guava, castor bean, weeping willow, sweet potato, turf grasses	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Asiatic garden beetle	Btle	<i>Maladera castanea</i>	Polyphagous; Lychee, longan	Leaves, flowers, fruit	LOW	LOW	MEDIUM	LOW	NEGLIGIBLE
Leaf-eating caterpillar	Lep	<i>Miresa albipuncta</i>	Lychee, longan, rambutan, cacao, Indian jujube	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Green stink bug	Bug	<i>Nezara antennata</i>	Lychee, longan, soyabean, Phaseolus (bean), black gram	Leaves, flowers, fruit	LOW	MEDIUM	MEDIUM	MEDIUM	LOW
Formosan subterranean termite	Iso	<i>Odontotermes formosanus</i>	Lychee, tea, coffee, sugarcane	Roots, stems	LOW	LOW	LOW	LOW ³⁷	NEGLIGIBLE
Leafroller	Lep	<i>Olethreutes leucaspis</i>	Lychee, longan	Leaves	LOW	UNKNOWN	UNKNOWN	LOW - MEDIUM	NEGLIGIBLE - LOW

³⁶ Medium economic impact on citrus

³⁷ Medium economic impact on sugarcane

Common name	Life form	Scientific name	Primary hosts	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Leafroller	Lep	<i>Olethreutes praecedens</i>	Lychee	Leaves, flowers, fruit	LOW	LOW	UNKNOWN	LOW	NEGLIGIBLE - LOW
Spider mites	Mite	<i>Oligonychus spp.</i> ³⁸		Leaves	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
		<i>Oligonychus bicolor</i> ³⁹	Polyphagous; Lychee, grape						
		<i>Oligonychus litchi</i>	Polyphagous; Lychee, mango, grape, peach						
		<i>Oligonychus thelytokus</i>	Polyphagous; Lychee, mango, cotton, rose, azalea						
Avocado red mite		<i>Oligonychus yothersi</i> ⁴⁰	Polyphagous; Lychee, papaya, mango, coffee, castor bean						
Cocoa tussock moth	Lep	<i>Orgyia postica</i>	Polyphagous	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Tussock moth	Lep	<i>Orgyia turbata</i>	Polyphagous	Leaves	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Flower chafer	Btle	<i>Oxycetonia jucunda</i>	Lychee, longan, citrus, apple, pear	Fruit, flowers	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
	Bug	<i>Paradasynus longirostris</i>	Lychee, longan	Fruit, leaves	LOW	HIGH	HIGH	HIGH	MEDIUM
Nettle caterpillar	Lep	<i>Parasa lepida</i>	Polyphagous	Leaves	MEDIUM	HIGH	HIGH	UNKNOWN	UNKNOWN
Stubby root nematode	Nem	<i>Paratrichodorus nanus</i>	Polyphagous	Roots	MEDIUM	UNKNOWN	UNKNOWN	MEDIUM	UNKNOWN
Apple parlatoria ⁴¹	Bug	<i>Parlatoria cinerea</i> ⁴²	Polyphagous	Branches, stems, flowers, fruit	MEDIUM	UNKNOWN	UNKNOWN	UNKNOWN ⁴³	UNKNOWN
Daikon leaf beetle ⁴⁴	Btle	<i>Phaedon brassicae</i>	Polyphagous	Leaves	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

³⁸ Little information exists on impacts of individual species. Entry, establishment and spread potentials likely to be similar for *Oligonychus* species, however economic impact could differ.

³⁹ Synonym: *Tetranychus bicolor*

⁴⁰ Synonym: *Tetranychus yothersi*

⁴¹ Synonym: Tropical grey chaff scale

⁴² Synonym: *Parlatoria pseudopyri*

⁴³ Economic impact high on citrus, unknown on lychee

⁴⁴ Synonym: Brassica leaf beetle

Common name	Life form	Scientific name	Primary hosts	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Cabbage flea beetle ⁴⁵	Btle	<i>Phyllotreta striolata</i>	Cauliflowers, brussel sprouts, cabbage	Underground (larvae), leaves (adults)	MEDIUM	MEDIUM	MEDIUM	LOW	VERY LOW
Flower eating caterpillar	Lep	<i>Pingasa ruginaria</i>	Lychee, longan	Leaves, flowers	LOW	LOW	LOW	UNKNOWN	UNKNOWN
Mealybug	Bug	<i>Planococcus litchi</i>	Lychee, longan, rambutan, loquat, sugar apple	Fruit, leaves, branches	MEDIUM	HIGH	HIGH	LOW	LOW
Scarab beetle	Btle	<i>Popillia mutans</i>	Lychee, longan	Leaves, flowers, fruit	LOW	MEDIUM	LOW - MEDIUM	LOW - MEDIUM	NEGLIGIBLE - LOW
Scarab beetle	Btle	<i>Popillia quadriguttata</i>	Polyphagous; Lychee, longan, peach, pear, corn	Leaves, flowers, fruit	LOW	MEDIUM	MEDIUM	LOW - MEDIUM	VERY LOW - LOW
White spotted flower chafer ⁴⁶	Btle	<i>Potosia brevitarsis</i>	Polyphagous ; Lychee, grape, corn, sunflower, peach	Flowers, fruit	LOW	MEDIUM	MEDIUM	MEDIUM - HIGH ⁴⁷	LOW - MEDIUM
	Btle	<i>Proctophana tomentosa</i>	Lychee	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Scarab beetle	Btle	<i>Protaetia nitididorsis</i>	Lychee, longan	Fruit	LOW	MEDIUM	MEDIUM	LOW - MEDIUM	VERY LOW - LOW
Comstock mealybug	Bug	<i>Pseudococcus comstocki</i>	Polyphagous; Lychee, longan, citrus, coffee, apple, pear, banana, stone fruit	Whole plant, leaves, stems, fruit	MEDIUM	MEDIUM	MEDIUM	LOW ⁴⁸ - MEDIUM	VERY LOW - LOW
Coconut bug	Bug	<i>Pseudotheraptus wayi</i>	Coconut	Fruit, flowers	LOW	HIGH	HIGH	HIGH	MEDIUM
Indigo flash	Lep	<i>Rapala varuna orseis</i>	Lychee, rambutan, red ash	Flowers, leaves	LOW	LOW	LOW	UNKNOWN	NEGLIGIBLE - LOW
Bark borer	Lep	<i>Salagena</i> sp.	Lychee	Branches	LOW	LOW	LOW	LOW	NEGLIGIBLE
	Nem	<i>Scutylechus quadrifer</i>	Lychee	Roots	LOW	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN

⁴⁵ Synonyms: Striped flea beetle, Turnip flea beetle, Yellow striped flea beetle

⁴⁶ Synonym: Flower beetle

⁴⁷ High economic impact on grape and corn

⁴⁸ Low to medium economic impact on apple, pear and citrus. Low economic impact on banana.

Common name	Life form	Scientific name	Primary hosts	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
	Lep	<i>Sphecosesia litchivora</i>	Lychee, longan	Leaves	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Lychee leaf roller	Lep	<i>Statherotis discana</i>	Lychee, longan, rambutan, carambola	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Leaf roller	Lep	<i>Statherotis leucaspis</i>	Lychee, longan, rambutan	Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Longan stink bug	Bug	<i>Tessarotoma javanica</i>	Lychee, longan	Fruit, flowers	LOW	UNKNOWN	UNKNOWN	HIGH	UNKNOWN
Lychee stink bug	Bug	<i>Tessarotoma papillosa</i>	Lychee, longan, citrus, plum, peach, pear, olive, banana	Fruit, flowers, stems	LOW	MEDIUM	MEDIUM	HIGH	MEDIUM
Stink bug	Bug	<i>Tessarotoma quadrata</i>	Lychee, longan, apple, pear	Fruit, flowers	LOW	UNKNOWN	UNKNOWN	HIGH	UNKNOWN
Spider mite	Mite	<i>Tetranychus mexicanus</i>	Polyphagous; Papaya, cotton, lychee, passionfruit, citrus	Leaves	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	MEDIUM - HIGH
Leaf-eating looper	Lep	<i>Thalassodes falsaria</i>	Lychee, longan, mango, rambutan, shaddock, langsat, lac tree	Leaves, flowers	LOW	MEDIUM	MEDIUM	LOW	VERY LOW
Scale	Bug	<i>Thysanoflorinia leei</i>	Lychee	Leaves, stems	LOW	LOW	LOW	LOW	NEGLIGIBLE
Stubby root nematode	Nem	<i>Trichodorus monhystera</i>	Lychee	Roots	LOW	LOW	LOW	LOW	NEGLIGIBLE
Stunt nematode	Nem	<i>Tylenchorhynchus nudus</i>	Lychee, kentucky bluegrass, bush honeysuckle, red clover, sorghum	Roots	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Citrus root nematode	Nem	<i>Tylenchus</i> spp. ⁴⁹	Lychee	Roots	LOW	UNKNOWN	UNKNOWN	LOW	UNKNOWN
Coffee carpenter ⁵⁰	Lep	<i>Zeuzera coffeae</i>	Polyphagous; Lychee, longan, grape, walnut, tea, coffee, cotton, apple, cassava, avocado, citrus	Stems, branches	LOW	UNKNOWN	UNKNOWN	LOW ⁵¹	NEGLIGIBLE - LOW

⁴⁹ *T. butteus*, *T. cylindricollis*, *T. exiguus*, *T. fusiformis*, *T. parvissimus*

⁵⁰ Synonyms: Carpenter worm, Cocoa pod and stem borer, Coffee leopard moth, Red branch borer, Red coffee borer, Red twig borer, Tea stem borer

⁵¹ Medium economic impact on walnut and grape

Pathogens

Table 23. Lychee pathogen threat summary table

Common name	Life form	Scientific name	Primary host	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Armillaria root rot	Fun	<i>Armillaria tabescens</i> , <i>A. mellea</i> and <i>A. socialis</i>		Roots	LOW - MEDIUM	LOW	LOW	LOW	NEGLIGIBLE
Black mildew	Fun	<i>Meliola eupaniae-majoris</i>		Fruit, flowers, leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Brown blight ⁵²	Fun	<i>Peronophythora litchii</i>	Lychee	Fruit, flowers, leaves	HIGH	HIGH	HIGH	HIGH	HIGH
Leaf blight	Fun	<i>Pestalotiopsis pauciseta</i>		Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Sooty mould	Fun	<i>Phaeosaccardinula javanica</i>		Leaves	LOW	LOW	LOW	LOW	NEGLIGIBLE
Fruit blotch and leaf blight	Fun	<i>Phomopsis longanae</i>		Fruit, leaves	LOW - MEDIUM	LOW - MEDIUM	LOW	LOW	NEGLIGIBLE
Longan and lychee witches' broom disease	Unknown ⁵³		Lychee, longan	Inflorescence, leaves	HIGH	HIGH	HIGH	HIGH	HIGH
Rust	Fun	<i>Uredo nephelii</i>		Leaves	MEDIUM - HIGH	HIGH	HIGH	MEDIUM	MEDIUM - HIGH

⁵² Synonyms: Fruit rot, Downy blossom blight, Downy blight

⁵³ Causal agent uncertain: Phytoplasma or filamentous virus suspected

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