Australian Government

Department of Agriculture, Fisheries and Forestry

Longan and lychee fruit from the People's Republic of China and Thailand

Draft Import Risk Analysis Report

Part A

August 2003

Foreword

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GLOSSARY OF TERMS AND ABBREVIATIONS

ALGA	Australian Lychee Growers Association
ALOP	appropriate level of protection
ARD	Thailand Agricultural Regulatory Division of the Department of Agriculture, Thailand
AQIS	Australian Quarantine and Inspection Service
AQSIQ	State General Administration for Quality Supervision and Inspection and Quarantine of the People's Republic of China
Area	an officially defined country, part of a country or all or parts of several countries
Biosecurity Australia	an agency within the Australian Government Department of Agriculture, Fisheries and Forestry
China	The People's Republic of China
CIQ	China Inspection and Quarantine
Contaminating pest	a pest that is carried by a commodity and, in the case of plants and plant products, does not infest those plants or plant products
Control (of a pest)	suppression, containment or eradication of a pest population
DAWA	Department of Agriculture Western Australia
DOA	Department of Agriculture, Thailand
Endangered area	an area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss
Entry (of a pest)	movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled
Entry potential	likelihood of the entry of a pest
Establishment	the perpetuation, for the foreseeable future, of a pest within an area after entry

Establishment potential	likelihood of the establishment of a pest
FAO	Food and Agriculture Organisation of the United Nations
FDACS	China State Department of Agriculture and Consumer Services
Fresh	not dried, deep-frozen or otherwise conserved
Hitchhiker pest	see contaminating pest import
ICA	Interstate Certification Assurance
ICON	AQIS Import Conditions database
Introduction	entry of a pest resulting in its establishment
Introduction potential	likelihood of the introduction of a pest
IPPC	International Plant Protection Convention, as deposited in 1951 with FAO in Rome and as subsequently amended
IRA	import risk analysis
ISPM	International Standard for Phytosanitary Measures
LAA	Longan Association of Australia
National Plant Protection Organisation	official service established by a government to discharge the functions specified by the IPPC
Non-quarantine pest	pest that is not a quarantine pest for an area
Official	established, authorised or performed by a National Plant Protection Organisation
Official control (of a regulated pest)	the active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests
OIE	International Office of Epizootics
Pathway	any means that allows the entry of spread of a pest
PBPM	Plant Biosecurity Policy Memorandum

Pest	any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products
Pest categorisation	the process for determining whether a pest has or has not the characteristics of a quarantine pest or those of a regulated non-quarantine pest
Pest free area	an area in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained
Pest risk analysis	the process of evaluating biological or other scientific evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it
Pest risk assessment	determination of whether a pest is a quarantine pest and evaluation of its introduction potential
Pest risk assessment (for quarantine pests)	evaluation of the probability of the introduction and spread of a pest and of the associated potential consequences
Pest risk management	the decision-making process of reducing the risk of introduction of a quarantine pest
Pest risk management (for quarantine pests)	evaluation and selection of options to reduce the risk of introduction and spread of a pest
Phytosanitary measure	any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests
Phytosanitary regulation	official rule to prevent the introduction and/or spread of quarantine pests, by regulating the production, movement or existence of commodities or other articles, or the normal activity of persons, and by establishing schemes for phytosanitary certification
PQPM	Plant Quarantine Policy Memorandum
PRA	pest risk analysis

PRA area	area in relation to which a pest risk analysis is conducted
QDPI	Queensland Department of Primary Industries
Quarantine pest	a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled
Regulated non-quarantine pest	a non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable consequence and which is therefore regulated within the territory of the importing contracting party
SAIQ	State Administration for Entry and Exit Inspection and Quarantine of the People's Republic of China
Spread	expansion of the geographical distribution of a pest within an area
Spread potential	likelihood of the spread of a pest
SPS	Sanitary and Phytosanitary
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures
WTO	World Trade Organisation

EXECUTIVE SUMMARY

This *Draft Import Risk Analysis (IRA) Report* contains the following:

- information on the background to this IRA, Australia's framework for quarantine policy and import risk analysis, the international framework for trade in plants and plant products, and Australia's current policy for the importation of fresh longan and lychee;
- an outline of the methodology and results of pest categorisation, risk assessment and risk management;
- draft quarantine import conditions for fresh longan and lychee fruit from China and Thailand;
- further steps in the IRA process; and
- a summary of stakeholder comments received on the Technical Issues Paper and Biosecurity Australia's response.

The risk assessment identified ten arthropod pests as requiring risk management measures to reduce the risk to an acceptable level.

This draft IRA Report concludes that the risks associated with the importation of fresh longan and lychee fruit from China and Thailand can be managed by applying a combination of risk management measures and operational maintenance systems, specifically:

- registration of export orchards and packinghouses;
- option of cold disinfestation treatment/vapour heat treatment for *Bactrocera cucurbitae* and *B. dorsalis* (fruit flies);
- option of cold disinfestation treatment/approved orchard control program and inspection for freedom from *Conopomorpha sinensis* (litchi fruit borer);
- inspection for freedom from mealybugs and soft scales;
- pre-export inspection by the National Plant Protection Organisation (NPPO);
- packing, labelling and storage;
- phytosanitary certification by the NPPO; and
- on-arrival quarantine clearance by AQIS.

Details of these proposed risk management measures, including their objectives, are provided within this draft IRA report. Details are also provided on how these measures may be implemented through the draft import conditions. Biosecurity Australia invites comments on the technical and economic feasibility of the proposed risk management measures and import conditions. In particular, comments are sought on their appropriateness and any alternatives that stakeholders consider would achieve the identified objectives.

To assist the reader in considering this draft IRA report, it is presented in two separate parts. Part A includes key components of the risk assessment, the proposed risk management measures, the draft import conditions and a summary of the stakeholder comments on the Technical Issues Paper and Biosecurity Australia's response. Part B contains detailed technical components of the risk assessment.

BIOSECURITY FRAMEWORK

INTRODUCTION

This section outlines:

- The legislative basis for Australia's biosecurity regime
- Australia's international rights and obligations
- Australia's Appropriate Level of Protection
- Import risk analysis
- Policy determination

AUSTRALIAN LEGISLATION

The *Quarantine Act 1908* and its subordinate legislation, including the *Quarantine Proclamation 1998*, are the legislative basis of human, animal and plant biosecurity in Australia.

Some key provisions are set out below.

Quarantine Act: Scope

Sub section 4 (1) of the *Quarantine Act 1908* defines the scope of quarantine as follows.

> *In this Act, quarantine includes, but is not limited to, measures:*
>
> *for, or in relation to:*
>
> *(i) the examination, exclusion, detention, observation, segregation, isolation, protection, treatment and regulation of vessels, installations, human beings, animals, plants or other goods or things; or*
>
> *(ii) the seizure and destruction of animals, plants, or other goods or things; or*
>
> *(iii) the destruction of premises comprising buildings or other structures when treatment of these premises is not practicable; and*
>
> *having as their object the prevention or control of the introduction, establishment or spread of diseases or pests that will or could cause significant damage to human beings, animals, plants, other aspects of the environment or economic activities.*

Section 5D of the *Quarantine Act 1908* covers the level of quarantine risk.

> *A reference in this Act to a level of quarantine risk is a reference to:*
>
> *(a) the probability of:*

(i) a disease or pest being introduced, established or spread in Australia or the Cocos Islands; and

(ii) the disease or pest causing harm to human beings, animals, plants, other aspects of the environment, or economic activities; and

(b) the probable extent of the harm.

Section 5D of the *Quarantine Act 1908* includes harm to the environment as a component of the level of quarantine risk.

Environment is defined in Section 5 of the *Quarantine Act 1908,* in that it:

> *includes all aspects of the surroundings of human beings, whether natural surroundings or surroundings created by human beings themselves, and whether affecting them as individuals or in social groupings.*

Quarantine Proclamation

The *Quarantine Proclamation 1998* is made under the under the *Quarantine Act 1908*. It is the principal legal instrument used to control the importation into Australia of goods of quarantine (or biosecurity) interest. The Proclamation empowers a Director of Quarantine to grant a permit to import.

Section 70 of the *Quarantine Proclamation 1998* sets out the matters to be considered when deciding whether to grant a permit to import:

> *Things a Director of Quarantine must take into account when deciding whether to grant a permit for importation into Australia*
>
> *(1) In deciding whether to grant a permit to import a thing into Australia or the Cocos Islands, or for the removal of a thing from the Protected Zone or the Torres Strait Special Quarantine Zone to the rest of Australia, a Director of Quarantine:*
>
> *(a) must consider the level of quarantine risk if the permit were granted; and*
>
> *(b) must consider whether, if the permit were granted, the imposition of conditions on it would be necessary to limit the level of quarantine risk to one that is acceptably low; and*
>
> *(ba) for a permit to import a seed of a kind of plant that was produced by genetic manipulation -- must take into account any risk assessment prepared, and any decision made, in relation to the seed under the Gene Technology Act; and*
>
> *(c) may take into account anything else that he or she knows that is relevant.*

Development of Biosecurity Policy

As can be seen from the above extracts, the legislation establishes the concept of the level of biosecurity (quarantine) risk as the basis of decision-making under Australian quarantine legislation.

Import risk analyses are a significant contribution to the information available to the Director of Animal and Plant Quarantine - a decision maker for the purposes of the Quarantine Proclamation. Import risk analysis is conducted within an administrative process – known as the IRA process (described in the *IRA Handbook*[1])

The purpose of the IRA process is to deliver a policy recommendation to the Director of Animal and Plant Quarantine that is characterised by sound science and by transparency, fairness and consistency. The key elements of the IRA process are covered in "Import Risk Analysis" below.

AUSTRALIA'S INTERNATIONAL RIGHTS AND OBLIGATIONS

It is important that import risk analysis conforms to Australia's rights and obligations as a WTO Member country. These rights and obligations derive principally from the World Trade Organization's *Agreement on the Application of Sanitary and Phytosanitary Measures* (SPS Agreement), although other WTO agreements may also be relevant. Specific international guidelines on risk analysis developed under the International Plant Protection Convention (IPPC) and by the Office International des Epizooties (OIE) are also relevant.

The SPS Agreement recognises the right of WTO Member countries to determine the level of sanitary and phytosanitary protection they deem appropriate, and to take the necessary measures to achieve that protection. Sanitary (human and animal health) and phytosanitary (plant health) measures typically apply to trade in or movement of animal and plant based goods within or between countries. The SPS Agreement applies to measures that may directly or indirectly affect international trade and that protect human, animal or plant life or health from pests and diseases or a Member's territory from a pest.

The SPS Agreement provides for the following:

- The right of WTO Member countries to determine the level of sanitary and phytosanitary protection (its appropriate level of protection, or ALOP) they deem appropriate;

1 Biosecurity Australia (2003) *Import Risk Analysis Handbook*. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra

- An importing Member has the sovereign right to take measures to achieve the level of protection it deems appropriate to protect human, animal or plant life or health within its territory;
- An SPS measure must be based on scientific principles and not be maintained without sufficient scientific evidence;
- An importing Member shall avoid arbitrary or unjustifiable distinctions in levels of protection, if such distinctions result in discrimination or a disguised restriction on international trade;
- An SPS measure must not be more trade restrictive than required to achieve an importing Member's ALOP, taking into account technical and economic feasibility;
- An SPS measure should be based on an international standard, guideline or recommendation where these exist, unless there is a scientific justification for a measure which results in a higher level of SPS protection to meet the importing Member's ALOP;
- An SPS measure conforming to an international standard, guideline or recommendation is deemed to be necessary to protect human, animal or plant life or health, and to be consistent with the SPS Agreement;
- Where an international standard, guideline or recommendation does not exist or where, in order to meet an importing Member's ALOP, a measure needs to provide a higher level of protection than accorded by the relevant international standard, such a measure must be based on a risk assessment; the risk assessment must take into account available scientific evidence and relevant economic factors;
- Where the relevant scientific evidence is insufficient, an importing Member may provisionally adopt SPS measures on the basis of available pertinent information. In such circumstances, Members shall seek to obtain the additional information necessary for a more objective assessment of risk and review the SPS measure accordingly within a reasonable period of time;
- An importing Member shall accept the measures of other countries as equivalent, if it is objectively demonstrated that the measures meet the importing Member's ALOP.

AUSTRALIA'S APPROPRIATE LEVEL OF PROTECTION (ALOP)

The SPS Agreement defines the concept of an 'appropriate level of sanitary or phytosanitary protection (ALOP)' as the level of protection deemed appropriate by the WTO Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory.

Like many other countries, Australia expresses its ALOP in qualitative terms. Australia's ALOP, which reflects community expectations through government policy, is currently expressed as providing a high level of sanitary or phytosanitary protection aimed at reducing risk to a very low level, but not to zero.

ALOP can be illustrated using a ‘risk estimation matrix’ Table 1. The cells of this matrix describe the product of likelihood[2] and consequences — termed ‘risk’. When interpreting the risk estimation matrix, it should be remembered that, although the descriptors for each axis are similar (‘low’, ‘moderate’, ‘high’ etc), the vertical axis refers to *likelihood* and the horizontal axis refers to *consequences*.

Table 1. Risk estimation matrix

Likelihood of entry, establishment or spread	Negligible impact	Very low	Low	Moderate	High	Extreme impact
High likelihood	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Moderate	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Low	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk	High risk
Very low	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk
Extremely low	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk
Negligible likelihood	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk

Consequences of entry, establishment or spread

The band of cells in Table 1 marked ‘very low risk’ represents Australia’s ALOP, or tolerance of loss.

Risk Management and SPS Measures

Australia’s plant and animal health status is maintained through the implementation of measures to facilitate the importation of products while protecting the health of people, animals and plants.

Australia bases its national measures on international standards where they exist and where they deliver the appropriate level of protection from pests and diseases. However, where such standards do not achieve Australia’s level of biosecurity protection, or relevant standards do not exist, Australia exercises its right under the SPS Agreement to take appropriate measures, justified on scientific grounds and supported by risk analysis.

[2] The terms “likelihood” and “probability” are synonymous. “Probability” is used in the *Quarantine Act 1908* while “likelihood” is used in the WTO SPS Agreement. These terms are used interchangeably in this IRA Report.

Australia's approach to addressing requests for imports of animals, plants and their products, where there are biosecurity risks, is, where appropriate, to draw on existing sanitary and phytosanitary measures for similar products with comparable risks. However, where measures for comparable biosecurity risks have not previously been established, further action would be required to assess the risks to Australia and determine the sanitary and phytosanitary measures needed to achieve Australia's ALOP.

IMPORT RISK ANALYSIS

Description

In animal and plant biosecurity, import risk analysis identifies the pests and diseases relevant to an import proposal, assesses the risks posed by them and, if those risks are unacceptable, specifies the measures that could be taken to reduce those risks to an acceptable level. These analyses are conducted via an administrative process (described in the *IRA Handbook*) that involves, among other things, notification to the WTO, consultation and appeal.

Undertaking IRAs

Biosecurity Australia may undertake an IRA if:

> there is no relevant existing biosecurity measure for the good and pest/disease combination; or
>
> a variation in established policy is desirable because pests or diseases, or the likelihood and/or consequences of entry, establishment or spread of the pests or diseases could differ significantly from those previously assessed.

Environment and human health

When undertaking an import risk analysis, Biosecurity Australia takes into account harm to the environment as part of its assessment of biosecurity risks associated with the potential import.

Under the *Environment Protection and Biodiversity Conservation Act 1999*, Environment Australia may assess proposals for the importation of live specimens and their reproductive material. Such an assessment may be used or referred to by Biosecurity Australia in its analyses.

Biosecurity Australia also consults with other Commonwealth agencies where they have responsibilities relevant to the subject matter of the IRA, e.g. Food Standards Australia New Zealand (FSANZ) and the Department of Health and Ageing.

The IRA Process in summary

The process consists of the following major steps:

Initiation**:** This is the stage where the identified need for an IRA originates.

Scheduling and Scoping**:** At this stage, Biosecurity Australia considers all the factors that affect scheduling. Consultation with States, Territories and other Commonwealth agencies is involved. There is opportunity for appeal by stakeholders at this stage.

Risk Assessment and Risk Management**:** Here, the major scientific and technical work relating to risk assessment is performed. There is detailed consultation with stakeholders.

Reporting**:** Here, the results of the IRA are communicated formally. There is consultation with States and Territories. The Executive Manager of Biosecurity Australia then delivers the biosecurity policy recommendation arising from the IRA to the Director of Animal and Plant Quarantine. There is opportunity for appeal by stakeholders at this stage.

POLICY DETERMINATION

The Director of Animal and Plant Quarantine makes the policy determination, which is notified publicly.

METHOD FOR PEST RISK ANALYSIS

The technical component of an IRA for plants or plant products is termed a ‘pest risk analysis’, or PRA. Biosecurity Australia conducts PRA in accordance with the International Standard for Phytosanitary Measure (ISPM) 11 *Pest Risk Analysis for Quarantine Pests.* A summary of the requirements of ISPM 11 is given in this section plus descriptions of the methodology used to meet these requirements in this IRA. This summary is given to provide a description of the methodology used for this IRA and to provide a context for the technical information that is provided later in this document.

A PRA comprises three discrete stages

- Stage 1: initiation of the PRA
- Stage 2: risk assessment
- Stage 3: risk management

The *initiation* of a risk analysis involves the identification of the pest(s) and pathways of concern that should be considered for analysis. *Risk assessment* comprises pest categorisation, assessment of the probability of introduction and spread, and assessment of the potential consequences (including environmental consequences). *Risk management* describes the evaluation and selection of options to reduce the risk of introduction and spread of a pest.

STAGE 1: INITIATION

The aim of the initiation stage is to identify the pest(s) and pathways (e.g. commodity imports) which are of quarantine concern and should be considered for risk analysis in relation to the identified PRA area. This PRA was initiated by a proposal from CIQ and subsequently DOA to export fresh longan and lychee fruit from China and Thailand into Australia for human consumption.

STAGE 2: PEST RISK ASSESSMENT

The process for pest risk assessment can be broadly divided into three interrelated steps:

- pest categorisation
- assessment of the probability of introduction and spread
- assessment of potential consequences (including environmental consequences).

Pest risk assessment needs to be only as complex as is technically justified by the circumstances. ISPM 11 allows a specific PRA to be judged against the principles of necessity, minimal consequence, transparency, equivalence, risk analysis, managed risk and non-discrimination.

Pest categorisation

Pest categorisation is a process to examine for each pest whether the criteria in the definition of a quarantine pest are satisfied. That is, whether the pests identified in Stage 1 (Initiation of the PRA) are 'quarantine pests' or not.

The categorisation of a pest as a quarantine pest includes the following primary elements:

- *Identity of the pest*. The identity of the pest should be clearly defined to ensure that the assessment is being performed on a distinct organism, and that biological and other information used in the assessment is relevant to the organism in question. If this is not possible because the causal agent of particular symptoms has not yet been fully identified, then it should have been shown to produce consistent symptoms and to be transmissible.

  The taxonomic unit for the pest is generally species. The use of a higher or lower taxonomic level should be supported by scientifically sound rationale. For levels below the species, this should include evidence demonstrating that factors such as differences in virulence, host range or vector relationships are significant enough to affect phytosanitary status.

  Where a vector is involved, the vector may also be considered a pest to the extent that it is associated with the causal organism and is required for transmission of the pest.
- *Presence or absence in the endangered area*. The pest should be absent from all or part of the endangered area.
- *Regulatory status*. If the pest is present but not widely distributed in the PRA area, it should be under official control or be expected to be under official control in the near future.
- *Potential for establishment and spread in the PRA area*. Evidence should be available to support the conclusion that the pest could become established or spread in the PRA area. The PRA area should have ecological/climatic conditions including those in protected conditions suitable for the establishment and spread of the pest where relevant, host species (or near relatives), alternate hosts and vectors should be present in the PRA area.
- *Potential for consequences in the endangered area*. There should be clear indication that the pest is likely to have an unacceptable consequence (including environmental consequence) in the PRA area.

Pest categorisation was carried out in two stages for this IRA.

In the Technical Issues Paper released in March 2003 (*Technical Issues Paper: Import Risk Analysis (IRA) for the importation of fresh longan and lychee fruit from the People's Republic of China*) a list of pests of longan and lychee was categorised according to the presence or absence of each pest in Australia, and the association of each pest with mature longan or lychee fruit. Where there was any doubt or contention regarding the occurrence of a pest or its association with longan or lychee fruit, that pest was retained on the list of potential quarantine pests.

The second stage of pest categorisation is documented in this report. This stage was based on the categorisation of each pest absent from Australia and associated with longan or lychee fruit according to (a) its potential to become established in Australia, and, (b) the potential for consequences. Categorisation of establishment potential and potential for consequences was dichotomous, and expressed using the terms 'feasible' / 'not feasible', and 'significant' / 'not significant', respectively. A summary of the results of pest categorisation for this IRA is given in the 'Pest Categorisation' section of this document.

Assessment of the probability of introduction and spread

Details on assessing the 'probability of entry', 'probability of establishment' and 'probability of spread after establishment' of a pest are given in ISPM 11. A synopsis of these details is given below, followed by a description of the qualitative methodology used in this IRA.

Pest introduction is comprised of both entry and establishment. Assessing the probability of introduction requires an analysis of each of the pathways with which a pest may be associated from its origin to its establishment in the PRA area. In a PRA initiated by a specific pathway, the probability of pest entry is evaluated for the pathway in question. The probabilities for pest entry with other pathways, if any, need to be investigated as well.

The assessment of probability of spread is based primarily on biological considerations similar to those for entry and establishment.

Probability of entry

The probability of entry of a pest depends on the pathways from the exporting country to the destination, and the frequency and quantity of the pests associated with them. The higher the number of pathways, the greater the probability of the pest entering the PRA area.

Steps identified in ISPM 11 relevant to PRA initiated by a pathway are:

- *Probability of the pest being associated with the pathway at origin* – e.g. prevalence in the source area, occurrence of life stages that would be associated with the commodity, volume and frequency of movement along the pathway, seasonal timing, pest management, cultural and commercial procedures applies at the place of origin.

- *Probability of survival during transport or storage* – e.g. speed and conditions of transport and duration of the lifecycle, vulnerability of the life-stages during transport or storage, prevalence of the pest, commercial procedures applied.
- *Probability of pest surviving existing pest management procedures*.
- *Probability of transfer to a suitable host* – e.g. dispersal mechanisms, whether the imported commodity is sent to few or many destination points in the PRA area, time of year at which import takes place, intended use of the commodity, risks from by-products and waste.

Probability of establishment

In order to estimate the probability of establishment of a pest, reliable biological information (life cycle, host range, epidemiology, survival, etc.) should be obtained from the areas where the pest currently occurs. The situation in the PRA area can then be compared with that in the areas where it currently occurs and expert judgement used to assess the probability of establishment. Examples provided in ISPM 11 of factors to consider are:

- Availability, quantity and distribution of hosts in the PRA area
- Environmental suitability in the PRA area
- Potential for adaptation of the pest
- Reproductive strategy of the pest
- Method of pest survival
- Cultural practices and control measures.

Probability of spread after establishment

In order to estimate the probability of spread of the pest, reliable biological information should be obtained from areas where the pest currently occurs. The situation in the PRA area can then be carefully compared with that in the areas where the pest currently occurs and expert judgement used to assess the probability of spread. Examples provided in ISPM 11 of factors to consider are:

- Suitability of the natural and/or managed environment for natural spread of the pest
- Presence of natural barriers
- The potential for movement with commodities or conveyances
- Intended use of the commodity
- Potential vectors of the pest in the PRA area
- Potential natural enemies of the pest in the PRA area.

Method for evaluating the probability of entry, establishment and spread in this IRA

Evaluation and reporting of likelihoods can be done qualitatively, semi-quantitatively or quantitatively. For qualitative evaluation, likelihoods assigned to steps in the scenarios are categorised according to a descriptive scale – eg 'low', 'moderate', 'high' etc –where no attempt has been made to equate descriptors with numeric values or scores. For semi-quantitative evaluation, likelihoods are given numeric 'scores' (eg. 1, 2, 3), or probabilities and/or probability intervals (eg. 0–0.0001, 0.0001–0.001, 0.001–0.01, 0.01–1). For quantitative evaluation, likelihoods are described in purely numeric terms.

Each of these three approaches to likelihood evaluation has its advantages and constraints and the choice of approach depends on both technical and practical considerations. For this IRA, likelihood was evaluated and reported qualitatively using the terms described in Table 2.

Table 2. Nomenclature for qualitative likelihoods

Likelihood	Descriptive definition
High	The event would be very likely to occur
Moderate	The event would occur with an even probability
Low	The event would be unlikely to occur
Very low	The event would be very unlikely to occur
Extremely low	The event would be extremely unlikely to occur
Negligible	The event would almost certainly not occur

Qualitative likelihoods can be assigned to individual steps in scenarios, or to the probability that the entire scenario will occur. If the likelihoods have been assigned to individual steps then some form of 'combination rule' is needed for calculating the probability that all steps will occur. For this IRA the likelihoods were combined using a tabular matrix, as shown in Table 3.

Table 3. A matrix of 'rules' for combining descriptive likelihoods

	High	Moderate	Low	V. low	E. low	Negligible
High	High	Moderate	Low	V. Low	E. Low	Negligible
Moderate		Low	Low	V. Low	E. Low	Negligible
Low			V. Low	V. Low	E. Low	Negligible
V. low				E. Low	E. Low	Negligible
E. low					Negligible	Negligible
Negligible						Negligible

In this IRA, qualitative likelihoods were assigned to the probability of entry (comprising an importation step and a distribution step), the probability of establishment and the probability of spread. In other IRAs it may be considered relevant to assign qualitative likelihoods to additional steps. This would depend on the complexity of the issue and the information that was available. For example, within the importation step, separate qualitative likelihoods could be assigned to the probabilities that source fruit is infested, that the pest survives packinghouse procedures and that it survives storage and transport.

The procedure for combining likelihoods is illustrated in Table 4. A likelihood is assigned to the probability of importation (low) and the probability of distribution (moderate) then they are combined to give the probability of entry (low). The likelihoods are combined using the 'rules' provided in Table 3. The probability of entry is then combined with the likelihoods assigned to the probability of establishment (high) and probability of spread (very low) to give the overall probability of entry, establishment and spread (very low).

Table 4. Qualitative evaluation of the imported fruit scenario

Step	Qualitative descriptor	Product of likelihoods
Probability of importation	Low	
Probability of distribution	Moderate	
...... ➔ Probability of entry	……….......... ➔	Low
Probability of establishment	High .... ➔	Low
Probability of spread	V. Low	
...... ➔ Probability of entry, establishment and spread	……….......... ➔	V. Low

Assessment of consequences

The basic requirements for the assessment of consequences are described in the SPS Agreement with Article 5.3 stating that

> *"Members shall take into account as relevant economic factors: the potential damage in terms of loss of production or sales in the event of the entry, establishment or spread of a pest or disease; the costs of control or eradication in the territory of the importing Member; and the relative cost-effectiveness of alternative approaches to limiting risks"*

Assessment of consequences is also referred to Annex A of the SPS Agreement in the definition of risk assessment:

> *"The evaluation of the likelihood of entry, establishment or spread of a pest or disease within the Territory of an importing Member according to the sanitary or phytosanitary measures which might be applied, and of the associated potential biological and economic consequences"*

Further detail on assessing these "relevant economic factors" or "associated potential biological and economic consequences" for plant-based analysis is given under the "potential economic consequences" section in ISPM 11[3]. This ISPM separates the consequences into "direct" and "indirect" and provides examples of factors to consider within each. These examples are listed below under the headings where they may be considered in an IRA. This is followed by a description of the methodology used in this IRA.

[3] A revised version of ISPM 11 was released in April 2003. The supplement on analysis of environmental risks endorsed by the ICPM has been integrated into ISPM 11 to produce ISPM No. 11 Rev. 1.

In this IRA, the term “consequence” is used to reflect the “relevant economic factors”/”associated potential biological and economic consequences” and “potential economic consequences” terms as used in the SPS Agreement and ISPM 11 respectively.

Direct pest effects

Plant life or health

Examples from ISPM 11 that could be considered for the direct consequences on plant life or health:

- Known or potential host plants
- Types, amount and frequency of damage
- Crop losses, in yield and quality
- Biotic factors (e.g. adaptability and virulence of the pest) affecting damage and losses
- Abiotic factors (e.g. climate) affecting damage and losses
- Rate of spread
- Rate of reproduction
- Control measures (including existing measures), their efficacy and cost
- Effect of existing production practices
- Environmental effects.

Any other aspects of the environment

Examples from ISPM 11 that could be considered for the direct consequences on any other aspects of the environment:

- Environmental effects *(listed as a general example in ISPM 11)*
- Reduction of keystone plant species
- Reduction of plant species that are major components of ecosystems (in terms of abundance or size), and endangered native plant species (including effects below species level where there is evidence of such effects being significant)
- Significant reduction, displacement or elimination of other plant species.

Indirect pest effects

Eradication, control etc

Examples from ISPM 11 that could be considered for the indirect consequences on eradication, control etc:

- Changes to producer costs or input demands, including control costs
- Feasibility and cost of eradication or containment
- Capacity to act as a vector for other pests

- Resources needed for additional research and advice.

Domestic trade & International trade

Examples from ISPM 11 that could be considered for the indirect consequences on domestic & international trade (the two are considered separately):

- Effects on domestic and export markets, including particular effects on export market access
- Changes to domestic or foreign consumer demand for a product resulting from quality changes.

Environment

Examples from ISPM 11 that could be considered for the indirect consequences on the environment:

- Environmental and other undesired effects of control measures
- Social and other effects (e.g. tourism)
- Significant effects on plant communities
- Significant effects on designated environmentally sensitive or protected areas
- Significant change in ecological processes and the structure, stability or processes of an ecosystem (including further effects on plant species, erosion, water table changes, increased fire hazard, nutrient cycling, etc)
- Effects on human use (e.g. water quality, recreational uses, tourism, animal grazing, hunting, fishing)
- Costs of environmental restoration.

Method for assessing consequences in this IRA

The relevant examples of direct and indirect consequences from ISPM 11 are considered for each of the broad groups (as listed above) and estimates of the consequences are assigned. The broad groups are shown in table form in the 'Risk Assessments for Quarantine Pests' section of this document.

The direct and indirect consequences are estimated based on four geographic levels. The terms 'local', 'district', 'regional' and 'national' are defined as:

Local: an aggregate of households or enterprises — e.g. a rural community, a town or a local government area

District: a geographically or geopolitically associated collection of aggregates — generally a recognised section of a state, such as the 'North West Slopes and Plains' or 'Far North Queensland'

Region: a geographically or geopolitically associated collection of districts —

generally a state, although there may be exceptions with larger states such as Western Australia

National: Australia-wide

The consequence is described as 'unlikely to be discernible', of 'minor significance', significant' or 'highly significant':

- an '*unlikely to be discernible*' consequence is not usually distinguishable from normal day-to-day variation in the criterion;
- an consequence of '*minor significance*' is not expected to threaten economic viability, but would lead to a minor increase in mortality/morbidity or a minor decrease in production. For non-commercial factors, the consequence is not expected to threaten the intrinsic 'value' of the criterion — though the value of the criterion would be considered as 'disturbed'. Effects would generally be reversible;
- a '*significant*' consequence would threaten economic viability through a moderate increase in mortality/morbidity, or a moderate decrease in production. For non-commercial factors, the intrinsic 'value' of the criterion would be considered as significantly diminished or threatened. Effects may not be reversible; and
- a '*highly significant*' consequence would threaten economic viability through a large increase in mortality/morbidity, or a large decrease in production. For non-commercial factors, the intrinsic 'value' of the criterion would be considered as severely or irreversibly damaged.

The values are translated into a qualitative score (A–F) using the schema outlined in Table 5).

Table 5. The assessment of local, district, regional and national consequences

Consequence score	Local	District	Regional	National
F	-	-	-	Highly significant
E	-	-	Highly significant	Significant
D	-	Highly significant	Significant	Minor
C	Highly significant	Significant	Minor	Unlikely to be discernible
B	Significant	Minor	Unlikely to be discernible	Unlikely to be discernible
A	Minor	Unlikely to be discernible	Unlikely to be discernible	Unlikely to be discernible

Level

The overall consequence for each pest was achieved by combining the qualitative scores (A–F) for each direct and indirect consequence using a series of decision rules. These rules are mutually exclusive, and were addressed in the order that they appeared in the list — for example, if the first rule did not apply, the second rule was considered. If the second rule did not apply, the third rule was considered and so on until one of the rules applied:

- Where the consequences of a pest with respect to any direct or indirect criterion is 'F', the overall consequences are considered to be 'extreme'.
- Where the consequences of a pest with respect to more than one criterion is 'E', the overall consequences are considered to be 'extreme'.
- Where the consequences of a pest with respect to a single criterion is 'E' and the consequences of a pest with respect to each remaining criterion is 'D', the overall consequences are considered to be 'extreme'.
- Where the consequences of a pest with respect to a single criterion is 'E' and the consequences of a pest with respect to remaining criteria is not unanimously 'D', the overall consequences are considered to be 'high'.
- Where the consequences of a pest with respect to all criteria is 'D', the overall consequences are considered to be 'high'.
- Where the consequences of a pest with respect to one or more criteria is 'D', the overall consequences are considered to be 'moderate'.
- Where the consequences of a pest with respect to all criteria is 'C', the overall consequences are considered to be 'moderate'.
- Where the consequences of a pest with respect to one or more criteria are considered 'C', the overall consequences are considered to be 'low'.

- Where the consequences of a pest with respect to all criteria are 'B', the overall consequences are considered to be 'low'.
- Where the consequences of a pest with respect to one or more criteria are considered 'B', the overall consequences are considered to be 'very low'.
- Where the consequences of a pest with respect to all criteria is 'A', the overall consequences are considered to be 'negligible'.

STAGE 3: PEST RISK MANAGEMENT

The conclusions from pest risk assessment are used to decide whether risk management is required and if so, the strength of measures to be used. Since zero-risk is not a reasonable option, the guiding principle for risk management is to manage risk to achieve the required degree of safety that can be justified and is feasible within the limits of available options and resources. Pest risk management (in the analytical sense) is the process of identifying ways to react to a perceived risk, evaluating the efficacy of these actions, and identifying the most appropriate options.

Overall risk is determined by the examination of the outputs of the assessments of the probability of entry, establishment or spread and the consequence. If the risk is found to be unacceptable, then the first step in risk management is to identify possible phytosanitary measures that will reduce the risk to, or below, an acceptable level.

ISPM 11 provides details on the identification and selection of appropriate risk management options and notes that the choice of measures should be based on their effectiveness in reducing the probability of introduction of the pest.

Examples given of measures commonly applied to traded commodities include:

- *Options for consignments* – e.g. inspection or testing for freedom, prohibition of parts of the host, a pre-entry or post-entry quarantine system, specified conditions on preparation of the consignment, specified treatment of the consignment, restrictions on end use, distribution and periods of entry of the commodity.
- *Options preventing or reducing infestation in the crop* – e.g. treatment of the crop, restriction on the composition of a consignment so it is composed of plants belonging to resistant or less susceptible species, harvesting of plants at a certain age or specified time of the year, production in a certification scheme.
- *Options ensuring that the area, place or site of production or crop is free from the pest* – e.g. pest-free area, pest-free place of production or pest-free production site.
- *Options for other types of pathways* – e.g. consider natural spread, measures for human travellers and their baggage, cleaning or disinfestation of contaminated machinery.
- *Options within the importing country* – e.g. surveillance and eradication programs.

- *Prohibition of commodities* – e.g. if no satisfactory measure can be found.

The result of the pest risk management procedure will be either that no measures are identified which are considered appropriate or the selection of one or more management options that have been found to lower the risk associated with the pest(s) to an acceptable level. These management options form the basis of phytosanitary regulations or requirements.

Method for pest risk management in this IRA

The unrestricted risk estimate for each pest is determined by combining the overall estimate for 'entry, establishment and spread potential' with the overall expected consequence using a risk estimate matrix (Table 1). The requirement for risk management is then determined by comparing the unrestricted risk estimate with Australia's ALOP. Australia's ALOP is represented in this matrix by the row of cells marked 'very low risk'.

Where the estimate of unrestricted risk does not exceed Australia's ALOP, risk management is not required. Where the unrestricted risk estimate exceeds Australia's ALOP, risk management measures are required to reduce the risk to an acceptable level. Using this risk estimation matrix, risk management measures are required when the unrestricted risk estimate is low, moderate, high or extreme. Risk management measures are not required when the unrestricted risk estimate is very low or negligible.

Risk management measures are identified for each pest as required and are presented in the Risk Management section of this document. The proposed phytosanitary regulations based on these measures are presented in the Proposed Phytosanitary Conditions section of this document.

PROPOSAL TO IMPORT FRESH LONGAN AND LYCHEE FRUIT FROM CHINA AND THAILAND

BACKGROUND

On 28 April 2000, AQIS informed stakeholders through Plant Quarantine Policy Memorandum (PQPM) 2000/05 that it had initiated an IRA for fresh longan and lychee fruit from the People's Republic of China, using the routine process.

Plant Biosecurity Policy Memorandum (PBPM) 2003/08 of 14 March 2003 notified stakeholders of the availability of a technical issues paper for this IRA and invited comments. The technical issues paper included background to the IRA and preliminary results of pest categorisation.

In May 2003, the Department of Agriculture (DOA), Thailand formally requested that Biosecurity Australia consider access for fresh longan and lychee fruit from Thailand and provided a comprehensive technical market access submission, including detailed pest lists.

Biosecurity Australia conducted a preliminary assessment of the pest lists provided by Thailand and concluded that they were sufficiently similar to the Chinese lists to be considered within the existing IRA. PBPM 2003/17 of 23 June 2003 advised stakeholders of the inclusion of Thailand's access request in the IRA on fresh longan and lychee fruit from China. The pest categorisations for longan and lychee from Thailand are provided in Appendix 3 (contained in Part B of this draft IRA report).

ADMINISTRATION

Timetable

The "Further steps in the Import Risk Analysis process" section later in this document lists the steps for completion of this IRA.

Scope

This IRA considers quarantine risks that may be associated with fresh longan and lychee fruit imported from China and Thailand into Australia for human consumption. In the IRA, fresh longan fruit is defined as mature detached fruit or mature fruit on the panicle (fruiting stems 10-15 cm in length and 3-4 mm in diameter (USDA, 1999)) of *Dimocarpus longan*

Lour., and fresh lychee fruit as mature detached fruit of *Litchi chinensis* Sonn., excluding plant parts. The produce will have been cultivated, harvested, packed and transported to Australia under commercial conditions.

AUSTRALIA'S CURRENT QUARANTINE POLICY FOR IMPORTS OF FRESH LONGAN AND LYCHEE FRUIT

International arrangements

Currently, Australia allows the importation of fresh lychee fruit from South Africa.

The import conditions for South African lychees are that the fruit must have been cold treated with the flesh temperature at –0.5°C ± 0.5°C for not less than 24 consecutive days.

A Phytosanitary Certificate containing the following statement must accompany each consignment:

> "*The fruit has been cold treated at -0.5°C for 24 days*".

If live quarantine pests or contaminants are found, the imported consignment must be treated, re-exported or destroyed using an AQIS-approved method.

Further details of the import requirements for lychee from South Africa are available on the ICON website http://www.aqis.gov.au/icon

Australia currently has no quarantine policy for the importation of fresh longan fruit from any country.

Domestic arrangements

The Commonwealth Government is responsible for regulating the movement of plants and plant products into and out of Australia. However, the State and Territory Governments are primarily responsible for plant health controls within Australia. Legislation relating to resource management or plant health may be used by State and Territory Government agencies to control the interstate movement of plants and their products.

The Interstate Certification Assurance (ICA) scheme facilitates interstate trade and is based on documented operational procedures developed between interstate quarantine authorities.

A number of ICAs have specific conditions or restrictions on the interstate movement of fresh longan and lychee fruit within Australia. The main pest of interstate quarantine concern is the Queensland fruit fly (*Bactrocera tryoni*). However, Western Australia (WA) is also concerned about European red mite (*Panonychus ulmi*), melon thrips (*Thrips palmi* Karny) and spiralling whitefly (*Aleuroides dispersus*).

Interstate requirements for longan and lychee are based on the following ICAs:

ICA-01: Post-harvest dipping with dimethoate or fenthion.

ICA-02: Post-harvest flood spraying with dimethoate or fenthion.

ICA-04: Post-harvest fumigation with methyl bromide.

ICA-07: Post-harvest cold treatment.

ICA-13: Unbroken skin condition of approved fruits.

[Broken skin means any crack, split, pulled stem, puncture or other break of skin that penetrates through to the flesh].

An additional ICA applies only to the interstate movement of lychees:

ICA-14: Pre-harvest treatment and inspection of lychees.

For WA, the additional pests of quarantine concern are managed through the following:

- European red mite - QDPI inspection and certification free from the pest.
- Melon thrips - Property freedom.
- Spiralling whitefly - Postharvest methyl bromide fumigation (ICA-04).

THE LONGAN AND LYCHEE INDUSTRIES IN AUSTRALIA

Longans and lychees are produced commercially in New South Wales and Queensland. They are also grown on a smaller scale in the Northern Territory and Western Australia. About 50% of production areas are situated in far north Queensland, 40% are in central and southern Queensland and 10% are in the north coast of New South Wales (Menzel & McConchie, 1998).

Longan

In 2000, annual production of longan was estimated to be 2000 tonnes (LAA, 2000). Longan fruit are harvested in Australia from early January (in north Queensland) to May/early June (in northern NSW).

Lychee

Annual production of lychee in the 2001/02 season was estimated to be 6000 tonnes (ALGA, 2002). In Australia, lychee fruit are harvested from early November to mid-March.

LONGAN AND LYCHEE PRODUCTION IN CHINA

The major Chinese production areas for both longan and lychee fruit are in Guangdong, Fujian and Hainan Provinces and the Guangxi Zhuang Autonomous Region, with minor production in Sichuan, Yunan and Guizhou Provinces (Figure 1).

The main export markets for both Chinese longan and lychee fruit are Hong Kong, Japan, Singapore, Malaysia, Philippines, France and the USA. China imports longan and lychee fruit from Thailand and the Philippines (DOA, 2003a,b).

Longan

In 1999, longan production was approximately 500,000 tonnes (Lu M.Y., pers. comm. 2000).

The harvest period for longan extends from late July to early September (CIQ, 2000).

Lychee

In 1999, 580,000 ha of lychee orchards were cultivated in China, with a record production of 1.26 million tonnes (FAO, 2001). The production of lychee is expected to further increase as more recently established orchards start to produce fruit.

The harvest period for lychee extends from early May to late August, but is mostly concentrated from late May to late July.

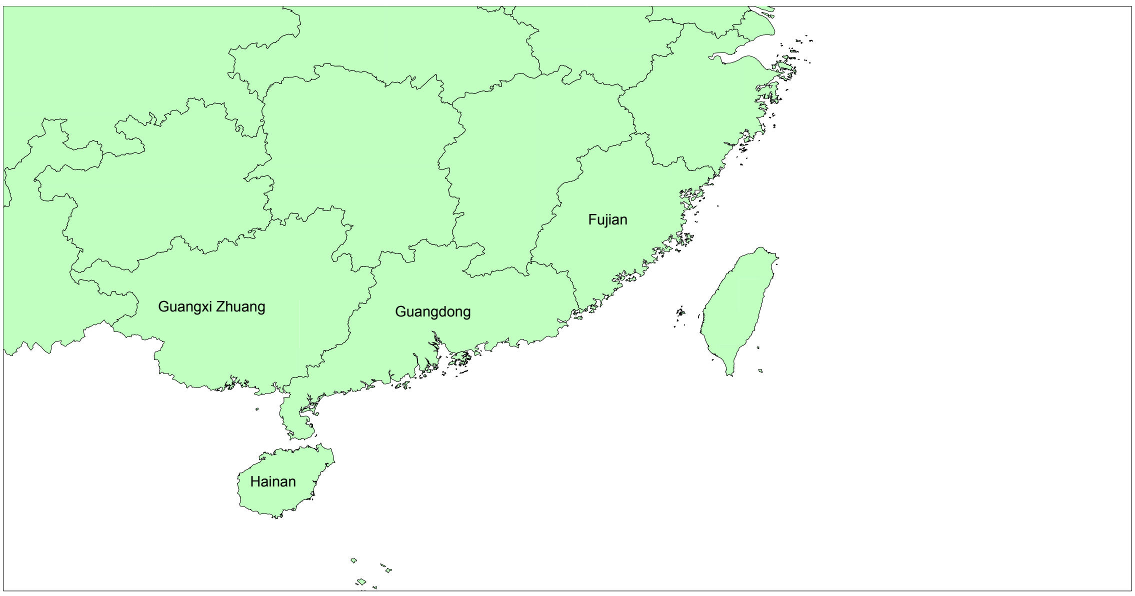


Figure 1. Longan and lychee production areas in China

LONGAN AND LYCHEE PRODUCTION IN THAILAND

Thai farmers currently prefer to grow longan rather than lychee, as longan is considered more profitable. High demand for longan in recent years has pushed longan prices higher than lychee (FAO, 2001).

Longan

In 2000, 52,971 ha of longan orchards were harvested, producing a yield of 358, 420 tonnes. Longan production is concentrated in the upper northern provinces, although cultivation has recently expanded to the eastern and central regions.

Figure 2 shows the major longan production areas in Thailand.

The harvest period for longan occurs earlier in Thailand than China. The Thai longan harvest season is from late June to late August. Fruit maturity is determined by fruit shape, skin colour and taste. Whole panicles of longans are cut with a knife, and trees are usually picked twice, with an interval of 7-10 days. Picked fruit are sorted and graded for size, insect damage and skin blemishes and bunched in a bulk tray. For long-term storage, fruit may be fumigated with SO_2 (DOA, 2003a).

Thailand is currently the largest exporter of longan in the world (DOA, 2003a). In 2000, Thailand exported 168,353 tonnes of fresh, dried and canned longan. The major export markets for Thai longan are Hong Kong, Indonesia, Singapore, Canada, Malaysia and China and the United Kingdom (DOA, 2003a).

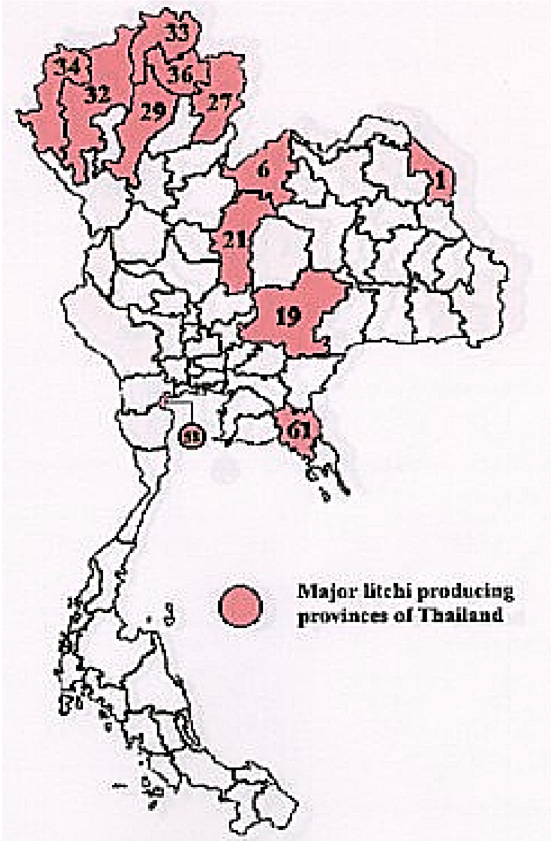
Lychee

Chiang Mai and Chiang Rai in the north, are the major lychee producing provinces in Thailand, and contribute more than 60% of the total acreage. The total area under lychee cultivation in 2000 was 22,937 hectares, with a total production of 81,388 tonnes (DOA, 2003b). The lychee harvest period lasts for three months, from mid-March to mid-June (FAO, 2001).

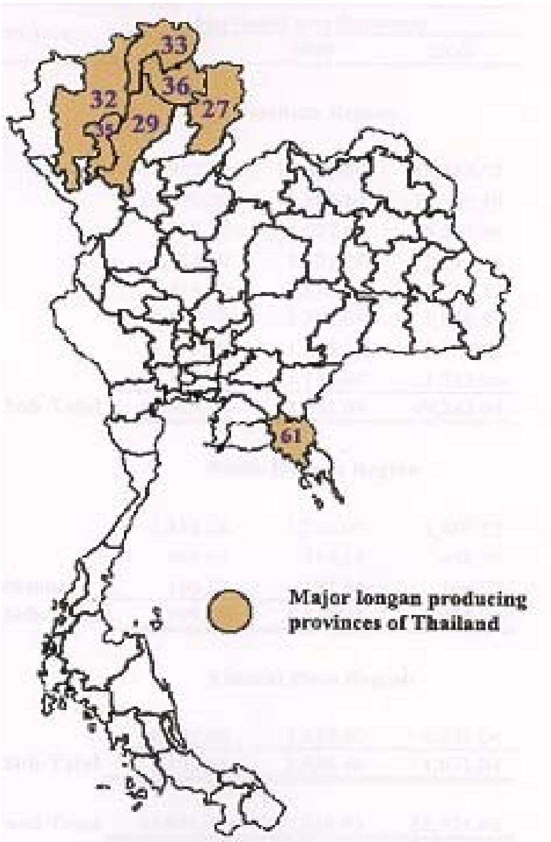
Figure 2 shows the major lychee production areas in Thailand.

The harvest season starts from mid-March in Chanthaburi, followed by Samut Songkhram in early to mid-April and Kanchanaburi in mid-late April. The northern lychee varieties ripen later, from mid-May through to mid-June. Handpicking is the sole harvesting method and picked fruit are usually cooled with ice water before packing to prevent post-harvest loss. SO_2 treatment is often used to stabilise skin colour and prevent fungal growth. Bagging of fruit is also practiced to prevent pest damage (DOA, 2003b).

Thailand exports lychees to Singapore, Malaysia, Hong Kong, Europe and the USA. In 1999, Hong Kong was the largest importer of fresh lychee (8644 tonnes) (FAO, 2001).



1. Nakhon Phanom
6. Loei
19. Nakhon Ratchasima
21. Petchabun
27. Nan
29. Lampang
32. Chiang Mai
33. Chiang Rai
34. Mae Hong Son
36. Phayao
58. Samut Songkhram
61. Chanthaburi



27. Nan
29. Lampang
32. Chiang Mai
33. Chiang Rai
35. Lamphun
36. Phayao
61. Chanthaburi

[Source: DOA, 2003a,b]

Figure 2. Major lychee and longan production areas in Thailand

PEST CATEGORISATION

Details of the pest categorisation for longan and lychee from China and Thailand are presented in Appendix 1 (contained in part B of this draft IRA report). Appendix 1 contains the potential pests (arthropods, nematodes and diseases) associated with longan and lychee from China and Thailand, based on their presence or absence in Australia and whether the potential pest occurs on the pathway under consideration in this IRA (i.e. in association with mature, detached longan fruit or mature longan fruit on the panicle, or mature detached lychee fruit). Plant pests (weeds) were not considered to be potential pests for orchard crops of longan or lychee as the structure of the fruit is not a receptacle for weed seeds. A number of pests listed in Appendix 1 are considered to be present in Australia but absent from Western Australia (based on evidence provided to Biosecurity Australia by the Department of Agriculture Western Australia).

As discussed in the "Background" section, Appendix 3 provides information on the potential pests associated with longan and lychee in Thailand.

Appendix 2 contains the potential pests associated with longan and lychee in China and Thailand based on their potential for establishment and spread in the PRA area and potential for consequences.

The pests assessed as having 'feasible' potential for establishment and spread in the PRA area and having 'significant' potential for consequences, were considered to be quarantine pests (Appendix 2). Table 6 presents a list of the quarantine pests for longan and lychee from China and Thailand. The detailed risk assessments for these quarantine pests are provided in the next section. Information on quarantine pests is provided in Appendix 4 (data sheets) and the risk assessment section.

Table 6. Quarantine pests for longan and lychee from China and Thailand

Scientific name	Common name	Host	Distribution
ARTHROPODA			
Coleoptera (beetles)			
Maladera castanea (Arrow) [Coleoptera: Scarabaeidae]	Asiatic garden beetle	Longan Lychee	China
Oxycetonia jucunda Faldermann [Coleoptera: Scarabaeidae]	Flower chafer	Longan Lychee	China
Popillia mutans Newman [Coleoptera: Scarabaeidae]	Scarab beetle	Longan Lychee	China
Popillia quadriguttata Fabricius [Coleoptera: Scarabaeidae]	Scarab beetle	Longan Lychee	China
Potosia brevitarisis Lewis [Coleoptera: Scarabaeidae]	Flower beetle	Lychee	China
**Protaetia fusca* (Herbst) [Coleoptera: Scarabaeidae]	Mango flower beetle	Longan Lychee	China
Protaetia nitididorsis (Fairmaire) [Coleoptera: Scarabaeidae]	Scarab beetle	Longan Lychee	China
**Xylotrupes gideon* Linnaeus [Coleoptera: Scarabaeidae]	Rhinoceros beetle	Longan Lychee	China
Diptera (true flies; mosquitoes)			
Bactrocera cucurbitae Coquillet [Diptera: Tephritidae]	Melon fly	Lychee	China Thailand
Bactrocera dorsalis (Hendel) [Diptera: Tephritidae]	Oriental fruit fly	Longan Lychee	China Thailand
Hemiptera (aphids; leafhoppers; mealybugs; psyllids; scales; true bugs; whiteflies)			
**Coccus viridis* Green [Hemiptera: Coccidae]	Green coffee scale	Longan Lychee	China Thailand
Drepanococcus chiton [Hemiptera: Coccidae]	Wax scale	Longan	Thailand
**Ferrisia virgata* Cockerell [Hemiptera: Pseudococcidae]	Striped mealybug	Lychee	China Thailand
Nezara antennata Scott [Hemiptera: Pentatomidae]	Green stink bug	Longan Lychee	China
Planococcus lilacinus Cockerell [Hemiptera: Pseudococcidae]	Cacao mealybug	Longan Lychee	China Thailand
Planococcus litchi Cox	Mealybug	Lychee	China

Scientific name	Common name	Host	Distribution
[Hemiptera: Pseudococcidae]			Thailand
Pseudococcus jackbeardsleyi Gimpel & Miller [Hemiptera: Pseudococcidae]	Jack Beardsley mealybug	Lychee	China
**Pulvinaria psidii* (Maskell) [Hemiptera: Coccidae]	Green shield scale	Longan Lychee	China
Tessaratoma papillosa (Drury) [Hemiptera: Pentatomidae]	Litchi stink bug	Longan Lychee	China Thailand
Lepidoptera (butterflies; moths)			
Adoxophyes cyrtosema Meyrick [Lepidoptera: Tortricidae]	Citrus brown-banded tortrix	Longan Lychee	China
Adoxophyes orana Fisher von Röeslerstamm [Lepidoptera: Tortricidae]	Summer tortrix	Longan Lychee	China
Conopomorpha sinensis Bradley [Lepidoptera: Gracillariidae]	Litchi fruit borer	Longan Lychee	China Thailand
**Deudorix epijarbas* Moore [Lepidoptera: Lycaenidae]	Lycaenid fruit borer	Longan Lychee	China Thailand
PATHOGENS			
Cylindrocladiella peruviana (Bat., Bez., & Herrera) [Mitosporic fungi: Hyphomycetes]	Cylindrocladiella disease	Longan Lychee	China
Peronophythora litchii Chen ex Ko *et al*. [Pythiales: Pythiaceae]	Lychee brown blight	Lychee	China Thailand
Phomopsis longanae Chi & Jiang [Diaporthales: Valsaceae]	Fruit blotch, branch canker	Longan Lychee	China
**Phytophthora palmivora* [Pythiales: Pythiaceae]	Leaf blight, fruit rot, root rot	Longan Lychee	Thailand
DISEASES OF UNKNOWN AETIOLOGY			
LWBD Mycoplasma like / filamentous virus	Longan witches' broom disease	Longan Lychee	Thailand China

* WA only – this species is a quarantine pest for the State of Western Australia due to its absence from this State.

Changes to pest categorisation

The list of pests in the above table differs from that presented in the Technical Issues Paper. This is due to the inclusion of longan and lychee from Thailand in the IRA, the receipt of additional scientific/technical information, including further information on the status of various species in China and Thailand provided by AQSIQ (2003a,b), DOA (2003a,b) and USDA (1999), as well as a reassessment of available scientific literature.

Additional pests for further consideration

Biosecurity Australia agrees that technically justified regional freedoms be taken into account during the IRA process. For this reason, one mealybug species (*Ferrisia virgata*), two soft scale species (*Coccus viridis* and *Pulvinaria psidii*), two scarab beetles (*Protaetia fusca* and *Xylotrupes gideon*), one fruit borer (*Deudorix epijarbas*) and one pathogen (*Phytophthora palmivora*) were added to the list of quarantine pests, as these pests are present in Australia, but not in Western Australia (DAWA, 2003).

The mealybug *Planococcus litchi* was added to the list of quarantine pests as additional information indicates that it is associated with lychee fruit in China and Thailand (Ben-Dov, 1994). The fruit fly *Bactrocera cucurbitae* was also added to the list of quarantine pests as it has been reported to be associated with lychee fruit (Waite & Hwang, 2002) and has been recorded in both China and Thailand (CABI, 2002).

The leaf roller *Adoxophyes cyrtosema* was added to the list of quarantine pests, as a reassessment of literature suggests that it can be associated with the fruit pathway (AQSIQ, 2003a; Waite & Hwang, 2002).

Pests removed from further consideration

The following 31 arthropod species were removed from the list of pests for further consideration, as Biosecurity Australia concluded after reassessment that they were not associated with fresh longan or lychee fruit in Thailand or China. Fifteen of these arthropod pests were listed in the technical issues paper as requiring further consideration due to their association with longan fruit panicles. However, after a reassessment of the literature, Biosecurity Australia considers that these pests are associated with longan stems, branches or bark, but not the fruiting panicle (fruiting stems 10-15 cm in length and 3-4 mm in diameter) (USDA, 1999).

Acari: *Agistemus exsertus* and *Amblyseius similiovalis* are both predatory mite species (AQSIQ, 2003b) and therefore, Biosecurity Australia does not consider that they may be present on the fruit pathway.

Aceria dimocarpi is mainly associated with new leaves and shoots of longan in China. It has been recorded only on young, developing fruit, but not mature fruit in China (AQSIQ, 2003b).

Echinopsis fukiensis is only associated with the bark of longan trees in China (Fan & Chen, 1996).

Coleoptera: The longicorn beetle *Anoplophora chinensis* is associated with the roots, stems, trunks and branches of longan trees in China (CIQ, 2000; Tan *et al*., 1998), while *Aristobia testudo* is associated with the bark and stems (Waite & Hwang, 2002).

Hemiptera: *Aulacaspis longanae* has been reported as being present only on the leaves of longan and lychee in China (AQSIQ 2003a,b). *Aleurocanthus woglumi* is occasionally recorded on lychee in China and also only attacks the leaves (AQSIQ, 2003a,b).

Lawana imitata is associated with branches and stems of longan in China (CIQ, 2000; Tan *et al*., 1998), while *Pyrops candelaria* has only been recorded on the stems of longan in China (Tan *et al*., 1998).

DOA (2003a) reports that *Kerria lacca* is associated with the stems and branches of longan in Thailand and has never been recorded on fruit. AQISQ (2003a) reports that both this species and *K. greeni* are not present in China and therefore should not be considered further in this IRA.

Pseudococcus comstocki has been recorded in China (ScaleNet, 2001), but there is only one reference stating that it is associated with lychee (CIE, 1975). AQSIQ (2003b) confirms that this mealybug is not associated with lychee.

Ceroplastes ceriferus was removed from Appendix 1 as current literature suggests that this species name is a synonym for *C. pseudoceriferus* (ScaleNet, 2001).

Lepidoptera: There are no records of *Amata lutesfascia* on longan or lychee in China (AQSIQ, 2003b), so this species was not considered further.

Archips asiatica and *A. tabescens* are mainly associated with leaves, young stems and inflorescences of longan and lychee in China (AQSIQ, 2003a). These pests may occasionally attack young fruit, causing premature drop before maturity, so are not considered to be on the fruit pathway. *Archips* spp. are reported on leaves and flowers on longan and lychee in Thailand (Kuroko & Lewvanich, 1993).

Cerace stipatana has been reported as being present only on the leaves of longan and lychee in China (AQSIQ 2003a,b).

The bagworms *Cryptothelea variegata*, *Euproctis taiwana* and *Eumeta japonica* are associated with the leaves, stems, flowers and shoots of longan in China (Li *et al*., 1997; Tan *et al*., 1998). The larvae of *Euproctis scintillans* are mainly associated with new leaves, stems and flowers, but have occasionally been recorded feeding on the young, developing fruit of longan and lychee in China. However, this species has not been recorded on mature fruit (AQSIQ, 2003a).

Homona coffearia is a leaf roller, but has been reported by some authors to be associated with longan and lychee fruit in China (Waite & Hwang, 2002). However, AQSIQ (2003a) reports that this pest attacks young leaves, shoots and developing fruits of longan and lychee, causing the young fruits to drop prematurely before maturity. Furthermore, DOA (pers. comm., 2003) and Kuroko & Lewvanich (1993) both report that *H. coffearia* is only associated with leaves of longan and lychee in Thailand.

Hypatima longanae is mainly associated with leaves, young stems and inflorescences of longan and lychee in China. This pest may occasionally attack young fruit, causing premature drop before maturity (Tan *et al*., 1998; AQSIQ, 2003a).

Parasa lepida is associated with the leaves of lychee in China and Thailand (AQSIQ, 2003b; DOA, 2003a).

Acanthopsyche subteralbatus, *Chalioides kondonis*, *Squamura dea* and *Zeuzera coffeae* are all associated with the stems and trunks of longan in China and/or Thailand (CIQ, 2000; DOA, 2003a; Tan *et al*., 1998; Waite & Hwang, 2002). *Squamura discipuncta* is also associated with the stems of longan in China (Waite & Hwang, 2002). This species was incorrectly named in the technical issues paper as *S. swinhoedispuncta*.

Cryptophlebia illepida was removed from Appendix 1 as current literature suggests that this species name is a synonym for *C. ombrodelta* (AQSIQ, 2003a).

Pathogens: The following two pathogens were removed from the list of pests for further consideration, as Biosecurity Australia concluded after further reassessment that they were not associated with fresh longan or lychee fruit in Thailand or China.

Pestalotiopsis pauciseta is only associated with leaves of longan and lychee in China and Thailand (Zhang & Qi, 1996; DOA, 2000a,b).

There is no evidence that lychee witches' broom exists as a distinct pathogen from longan witches' broom disease (AQSIQ, 2003).

RISK ASSESSMENTS FOR QUARANTINE PESTS

Detailed risk assessments were conducted for quarantine pests identified in the pest categorisation stage. Where pests shared similar biological characteristics, risk assessments were based on groupings of such pests (e.g. fruit flies). The proposed risk management measures were also developed for these groups. Some groups only contain one species but the “group” terminology was used for consistency.

In the context of the scope of this IRA, the risk assessments were conducted on the basis of the occurrence of standard cultivation, harvesting and packing activities involved in the commercial production of longan and lychee e.g. in-field hygiene and management of pests and cleaning and hygiene during packing.

Risk assessments were conducted for the following groups of pests: scarab beetles, fruit flies, mealybugs, soft scales, stink bugs, fruit borers, litchi fruit borer, leaf rollers, cylindrocladiella disease, lychee brown blight, fruit blotch, phytophthora leaf spot and fruit rot and longan witches’ broom disease. As the quarantine pests are not all present in both countries and associated with both commodities (Table 6), each of the risk assessment groups relates to a particular combination of country and commodity. Each risk assessment includes a summary of supporting evidence with each likelihood estimate. More detailed technical information used in the risk assessments is provided in the pest data sheets in Appendix 4 (in Part B of this draft IRA report).

SCARAB BEETLES

Eight species of scarab beetle [Coleoptera: Scarabaeidae] are included in this risk assessment:

Maladera castanea (Arrow) - Asiatic garden beetle

Oxycetonia jucunda Faldermann - citrus flower chafer

Popillia mutans Newman - scarab beetle

Popillia quadriguttata Fabricius - scarab beetle

Potosia brevitarisis Lewis - flower beetle

Protaetia fusca (Herbst) - mango flower beetle

Protaetia nitididorsis (Fairmaire) - scarab beetle

Xylotrupes gideon Linnaeus (syn. *Dynastes gideon* L.) – rhinoceros beetle

Probability of importation

The likelihood that scarab beetles will arrive in Australia with the importation of fresh longan or lychee fruit from China: **Negligible**.

- Scarab beetle larvae generally live in the soil and feed on roots, humus or rotting wood and are not associated with fruit. The adults may feed on leaves, flowers and occasionally fruit (CABI, 2002). AQSIQ (2003b) reports adult scarab beetles occasionally feeding externally on the pericarp of longan and lychee fruit.
- Damage to fruit by scarab beetles causes subsequent rotting (Waite & Hwang, 2002) so infested fruit are unlikely to be packed for export.
- The adults are large (5-7 cm) and easily discernible on the fruit surface (Waite & Hwang, 2002).

Probability of distribution

The likelihood that scarab beetles will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee from China: **Low**.

- Adults are likely to survive storage and transport but are unlikely to be associated with infested waste.
- Adults survive for a relatively long time in the environment and are highly mobile, so are likely to move directly to a suitable host plant.

Probability of entry

The likelihood that scarab beetles will arrive in Australia as a result of trade in fresh longan or lychee fruit from China, and be distributed to the endangered area: **Negligible**.

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Negligible**.

As the probability of entry for scarab beetles is negligible, using the described methodology for risk assessments, the unrestricted risk estimate for these pests can not be above Australia's ALOP. Therefore, it is not necessary to document the remainder of the assessment for these pests.

FRUIT FLIES

Two species of fruit flies [Diptera: Tephritidae] are included in this risk assessment.

Bactrocera dorsalis (Hendel) - Oriental fruit fly

Bactrocera cucurbitae Coquillet – Melon fly

Probability of importation

The likelihood that fruit flies will arrive in Australia with the importation of fresh longan or lychee fruit from China or Thailand: **High**.

- *Bactrocera cucurbitae* is associated with lychee fruit (Waite & Hwang, 2002), while *B. dorsalis* is associated with both longan and lychee fruit (CABI, 2002; Liang *et al*., 1999).
- Females oviposit their eggs through the skin of longan and/or lychee fruit. Fruit flies prefer to lay their eggs in mature, particularly ripened fruit, and several eggs may be laid below the skin of a single fruit. Although both fruit fly species are capable of ovipositing through the skin of lychee, some cultivars have a thicker skin that prevents successful oviposition (Waite & Hwang, 2002).
- Fruit flies often lay their eggs in damaged fruit (AQSIQ, 2003a; Waite & Hwang, 2002), which is unlikely to be packed for export.

- Fruit fly larvae can survive in picked fruit and therefore are likely be present in fruit that is packed for export. As fruit fly eggs are laid internally, infested fruit are not likely to be detected during sorting, packing and inspection procedures.
- It is likely that fruit fly larvae would survive storage and transportation due to their ability to tolerate cold temperatures and the availability of an ample food supply. Adult flies cannot survive more than a few days without feeding.

Probability of distribution

The likelihood that fruit flies will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee from China or Thailand: **High**.

- Fruit infested with eggs and larvae are likely to be distributed throughout Australia for retail sale. Adults, larvae and eggs are likely to be associated with infested waste.
- Fruit flies also have the capacity to complete their development in discarded fruit and transfer to suitable hosts.
- Eggs can develop into larvae within stored fruit, at the point of sale or after purchase by consumers.
- Larvae can develop into adult flies, which are strong fliers (Fletcher, 1989) and able to move directly from fruit into the environment to find a suitable host.

Probability of entry

The likelihood that fruit flies will arrive in Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, and be distributed to the endangered area: **High**.

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that fruit flies will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **Moderate**.

- For pests to establish and spread, a threshold limit must be reached. This threshold limit is the smallest number of pests capable of establishing a colony. One infested fruit is likely to contain many fruit fly larvae e.g. clutch sizes of 3-30 eggs have been recorded for *B. dorsalis* (Fletcher, 1989).
- Surviving female flies must then be successful in locating suitable mating partners and fruiting hosts to lay eggs. The mating behaviour of *B. dorsalis* requires that males gather to form aggregations or leks (Shelly & Kaneshiro, 1991). Females fly to such male aggregations to increase their chances of mating. However, there will be a limited

number of males available to form a lek, therefore reducing the probability of a successful mating. Shelly (2001) reported that *B. dorsalis* females were observed more frequently at larger leks (of 18 males or more). There are likely to be plenty of suitable hosts for fruit fly species around the vicinity of the port of entry and other suburban areas around Australia. *B. cucurbitae* would have similar mating behaviour to *B. dorsalis* as they are species of the same genus.

- There have been two exotic fruit fly incursions in Australia, both of which have been eradicated. *B. papayae* was detected near Cairns, northern Queensland in 1995. The infested area covered 4,500 km^2, some of which is dense tropical rainforest (Allwood, 1995). It was eradicated from Queensland through a $AU35 million eradication program using male annihilation and protein bait spraying (SPC, 2002). This example demonstrates that *Bactrocera* spp. can establish in Australia.

Probability of spread

The likelihood that fruit flies will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **High**.

- Fruit flies possess many characteristics that facilitate successful colonisation. These include their high reproductive rate, longevity of adult flies, broad environmental tolerances and host range of both commercial and wild species that are widespread in Australia.
- The infested area for the *B. papayae* incursion in Australia covered 4500 km^2, some of which is dense tropical rainforest (Allwood, 1995). *B. dorsalis* and *B. cucurbitae* would have a similar capacity to spread in Australia, as they are species of the same genus and have a similar wide host range.

Probability of entry, establishment and spread

The overall likelihood that fruit flies will enter Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Moderate**.

The probability of entry, establishment and spread is determined by combining the likelihoods of entry, establishment and spread using the matrix of ‘rules’ for combining descriptive likelihoods (Table 3).

Consequences

Consideration (direct and indirect) of fruit flies: **High**.

Criterion	Estimate
Direct consequences	
Plant life, health or welfare	D — Fruit flies can cause direct harm to a wide range of plant hosts and are estimated to have consequences of minor significance at the national level.
Any other aspects of the environment	A — There are no known consequences of fruit flies on other aspects of the environment.
Indirect consequences	
Eradication, control etc.	E — A control program would add considerably to the cost of production of the host fruit, costing between $200-900 per ha depending on the variety of fruit produced and the time of harvest (Anon., 1991). In 1995, the *B. papayae* (Papaya fruit fly) eradication program using male annihilation and protein bait spraying cost AUD$35 million (SPC, 2002). Fruit flies are estimated to have consequences of minor significance at the national level.
Domestic trade	D — The presence of fruit flies in commercial production areas will have a significant effect at the regional level due to any resulting interstate trade restrictions on a wide range of commodities.
International trade	D — Fruit flies are regarded as the most destructive horticultural pests in the world. While they can cause considerable yield losses in orchards and suburban backyards, the major consequence facing Australian horticultural industries is the negative effect they have on gaining and maintaining export markets. When the Papaya fruit fly outbreak occurred in north Queensland, the whole of Australia experienced trade effects. Fruit flies are estimated to have consequences of minor significance at the national level.
Environment	A — Pesticides required to control fruit flies are estimated to have consequences that are unlikely to be discernible at the national level and of minor significance at the local level.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **High**.

MEALYBUGS

Four species of mealybugs [Hemiptera: Pseudococcidae] were considered in this risk assessment.

Ferrisia virgata Cockerell – striped mealybug

Planococcus lilacinus Cockerell – Cacao mealybug

Planococcus litchi Cox – litchi mealybug

Pseudococcus jackbeardsleyi Gimpel & Miller - Jack Beardsley mealybug

Probability of importation

The likelihood that mealybugs will arrive in Australia with the importation of fresh longan or lychee fruit from China or Thailand: **High**.

- Mealybugs are known to be associated with longan and lychee in China and Thailand (Waite & Hwang, 2002; Ben-Dov, 1994). *Ferrisia virgata* and *Planococcus litchi* are both associated with lychee in China and Thailand (ScaleNet, 2001; Ben-Dov, 1994), while *Pseudococcus jackbeardsleyi* is associated with lychee fruit in China (ScaleNet, 2001). *Planococcus lilacinus* is associated with both longan and lychee fruit in China and Thailand (ScaleNet, 2001).
- Mealybugs are sessile, small (1.4-3 mm), and often inconspicuous, but may be present in significant populations on fruit (Waite & Hwang, 2002).
- Mealybugs are likely to be present within bunches of fruit, and are likely to be difficult to remove during cleaning, sorting and packing especially at low population levels.
- Mealybugs are likely to survive storage and transportation There is no data for these species, but other pseudococcid species such as *P. affinis*, can survive for up to 42 days at 0°C (Hoy & Whiting, 1997).

Probability of distribution

The likelihood that mealybugs will be distributed to the endangered area as a result of the processing, sale or disposal of fresh longan or lychee fruit from China or Thailand: **Moderate**.

- Adults and crawlers are likely to survive storage and transport and be associated with infested waste. Mealybugs can enter the environment in two ways: adults may be discarded with longan or lychee skin, or crawlers may be blown by wind (Ben-Dov, 1994), or carried by other vectors, from the point of sale or after purchase by consumers. Long-range dispersal would require movement of adults and nymphs with vegetative material. Shorter-range dispersal would occur readily through the random movement of crawlers with wind currents or biological or mechanical vectors.

- Adult female mealybugs would need to be carried onto hosts by vectors such as people or other insects. Adult males are winged but fragile and short-lived and do not persist for more than several days (Mau & Kessing, 2000). Crawlers can be dispersed by wind or other vectors (Rohrbach *et al*., 1998). Because all stages of these pests survive in the environment for some time, they are likely to be transferred to a susceptible host.

Probability of entry

The likelihood that mealybugs will arrive in Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, and be distributed to the endangered area: **Moderate**.

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that mealybugs will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **High**.

- Mealybugs are highly polyphagous and host plants are common in Australia e.g. citrus, mango and pineapple, particularly in the warmer subtropical and tropical regions of Australia.
- Existing control programs (eg. broad spectrum pesticide applications) may be effective against mealybugs on some hosts, but may not be effective on hosts where specific integrated pest management programs are used.
- Mealybugs have a high reproductive rate. Short-tailed mealybugs, e.g. *P. jackbeardsleyi* reproduce sexually, with the female producing 300-600 eggs (Mau & Kessing, 2000). The eggs hatch in around 10 days and the first instars or 'crawlers' disperse to suitable feeding sites on their hosts or new plants. Nymphs are active during the first instar stage and may travel some distance to a new plant where they become sessile for the remaining nymphal (larval) instars (Mau & Kessing, 2000).
- Although mealybugs imported with fruit are likely to be at non-mobile stages, they can be transported to suitable hosts by ants. Adult females can live for several months and produce up to several hundred offspring. Adult males are short-lived (Mau & Kessing, 2000).

Probability of spread

The likelihood that mealybugs will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **High**.

- Tropical or subtropical areas of Australia would be suitable for the spread of mealybugs because they are recorded from such environments.
- Adults and nymphs may be moved within and between plantations with the movement of equipment and personnel, and crawlers may be dispersed by wind (Rohrbach *et al.*, 1988).
- The relevance of natural enemies in Australia is not known.

Probability of entry, establishment and spread

The overall likelihood that mealybugs will enter Australia as a result of trade in fresh longan or lychee from China or Thailand, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Moderate**.

The probability of entry, establishment and spread is determined by combining the likelihoods of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of mealybugs: **Low**.

Criterion	Estimate
Direct consequences	
Plant life, health or welfare	C — Mealybugs can cause direct harm to a wide range of plant hosts and have also been reported as disease vectors (Ben-Dov, 1994). Fruit quality can be reduced by the presence of secondary sooty mould. Mealybugs are estimated to have consequences that are unlikely to be discernible at the national level and of minor significance at the regional level.
Any other aspects of the environment	A — There are no known consequences of these pests on other aspects of the environment.
Indirect consequences	
Eradication, control etc.	B — Programs to minimise the impact of these pests on host plants are likely to be costly and include pesticide applications and crop monitoring. Existing control programs (eg. broad spectrum pesticide applications) may be effective to control mealybugs on some hosts, but may not be effective on hosts where specific integrated pest management programs are used. Mealybugs are estimated to have consequences that are unlikely to be discernible at the national level and of minor significance at the district level.
Domestic trade	B — The presence of these pests in commercial production areas is likely to have a significant effect at the local level due to any resulting interstate trade

	restrictions on a wide range of commodities. These restrictions may lead to a loss of markets, which in turn would be likely to require industry adjustment.
International trade	B – for *Ferrisia virgata*, *Pseudococcus jackbeardsleyi* and *Planococcus litchi* C – for *Planococcus lilacinus* The presence of *Ferrisia virgata*, *Pseudococcus lilacinus* and *Pseudococcus jackbeardsleyi* in commercial production areas of a wide range of commodities (e.g. citrus, mango) can have a significant effect at the local level due to any limitations to access to overseas markets where these pests are absent. These pests are all associated with citrus. Australia exports citrus fruit worth $40-60 million to the USA from the Riverland-Sunraysia-Riverina (R-S-R) area. Extension of this area has also been negotiated for the USA market. Consideration for export of citrus from areas in Queensland and New South Wales to the USA market is also underway. *Ferrisia virgata* and *Pseudococcus jackbeardsleyi* have been reported in the USA (ScaleNet, 2001) and therefore will not be likely to affect citrus trade with the USA if they became established in Australia. *Planococcus lilacinus* does not occur in continental USA and, if it became established in the R-S-R and other possible export areas in Australia, would affect citrus trade with the USA. The USA may reintroduce fumigation for unidentifiable mealybugs or a requirement for pest surveys to verify the absence of mealybugs in export orchards. *Planococcus litchi* has a limited host range and is therefore unlikely to have a significant effect on international trade in plant commodities.
Environment	A — Although additional pesticide applications would be required to control these pests on susceptible crops, this is not considered to have significant consequences for the environment.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Low**

SOFT SCALES

Three species of soft scales [Hemiptera: Coccidae] are included in this risk assessment.

Coccus viridis Green – green coffee scale

Drepanococcus chiton – wax scale

Pulvinaria psidii Maskell (syn. *Chloropulvinaria psidii* Maskell) – green shield scale

Probability of importation

The likelihood that soft scales will arrive in Australia with the importation of fresh longan or lychee fruit from China or Thailand: **High**.

- Soft scale species are frequently reported in longan and lychee orchards in China and Thailand (Waite & Hwang, 2002). *Coccus viridis* and *Pulvinaria psidii* are both associated with longan and lychee in China and Thailand (Waite & Hwang, 2002; ScaleNet, 2001), while *Drepanococcus chiton* is associated with longan fruit in Thailand (DOA, 2003a).
- Soft scales are sessile and small (1.4-3 mm), but may be present in significant populations on the fruit surface (Waite & Hwang, 2002).
- Soft scales are likely to be hidden within bunches of fruit, and are likely to be difficult to remove during fruit cleaning, sorting and packing, especially at low population levels.
- Soft scales are likely to survive storage and transportation.

Probability of distribution

The likelihood that soft scales will be distributed to the endangered area as a result of the processing, sale or disposal of fresh longan or lychee fruit from China or Thailand: **Moderate**.

- Adults and crawlers are likely to survive storage and transport and be associated with infested waste. Soft scales may enter the environment in two ways: adults may be discarded with fruit, or juveniles may be blown by wind, or carried by other vectors, from the point of sale or after purchase by consumers. Long-range dispersal would require movement of adults and nymphs with vegetative material. Shorter-range dispersal would occur readily through the random movement of crawlers with wind currents or biological or mechanical vectors.

- The commodity is likely to be distributed throughout Australia for retail sale. The intended use of the commodity is human consumption but waste material would be generated (eg. longan or lychee skin and longan panicles).
- Because soft scales are polyphagous and all life stages survive in the environment for some time, they could be transferred to a susceptible host.

Probability of entry

The likelihood that soft scales will arrive in Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, and be distributed to the endangered area: **Moderate**.

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that soft scales will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **High**.

- Soft scales are highly polyphagous and host plants are common in Australia e.g. citrus, mango and pineapple, particularly in the warmer subtropical and tropical regions of Australia.
- Existing control programs (eg. broad spectrum pesticide applications) may be effective to control soft scales on some hosts, but may not be effective on hosts where specific integrated pest management programs are used.
- Soft scales have a high reproductive rate e.g. *P. psidii* reproduces parthogenetically and has 3-4 generations per year. Crawlers move on to flower panicles, and later on to young fruit (Waite & Hwang, 2002).

Probability of spread

The likelihood that soft scales will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **High**.

- Tropical or subtropical areas of Australia would be suitable for the spread of soft scales because they are recorded from such environments.
- Adults and nymphs may be moved within and between plantations with the movement of equipment and personnel, and crawlers may be dispersed by wind (Greathead, 1997).
- The relevance of natural enemies in Australia is not known.

Probability of entry, establishment and spread

The overall likelihood that soft scales will enter Australia as a result of trade in fresh longan or lychee from China or Thailand, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Moderate**.

The probability of entry, establishment and spread is determined by combining the likelihoods of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of soft scales: **Low**.

Criterion	Estimate
Direct consequences	
Plant life, health or welfare	C — Scale insects can cause direct harm to a wide range of plant hosts, affecting fruit quality and whole plant health. Fruit quality can be reduced by the presence of secondary sooty mould.
Any other aspects of the environment	A — There are no known consequences of these pests on other aspects of the environment.
Indirect consequences	
Eradication, control etc.	B — Programs to minimise the impact of these pests on host plants are likely to be costly and include pesticide applications and crop monitoring. Existing control programs (eg. broad spectrum pesticide applications) may be effective to control soft scales on some hosts, but may not be effective on hosts where specific integrated pest management programs are used. Soft scales are estimated to have consequences that are unlikely to be discernible at the national level and of minor significance at the district level.
Domestic trade	B — The presence of these pests in commercial production areas is likely to have a significant effect at the local level due to any resulting interstate trade restrictions on a wide range of commodities. These restrictions may lead to a loss of markets, which in turn would be likely to require industry adjustment.
International trade	C – The presence of these pests in commercial production areas of a range of export commodities (eg. citrus, mango) may have a significant effect at the district level due to any limitations to access to overseas markets where these pests are absent.
Environment	A — Although additional pesticide applications would be required to control these pests on susceptible crops, this is not considered to have significant consequences for the environment.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Low**

STINK BUGS

Two species of stink bugs [Hemiptera: Pentatomidae] are included in this risk assessment.

Nezara antennata Scott - green stink bug

Tessaratoma papillosa (Drury) – litchi stink bug

Probability of importation

The likelihood that stink bugs will arrive in Australia with the importation of fresh longan or lychee fruit from China or Thailand: **Very Low**.

- Female stink bugs lay eggs on leaves. Both nymphs and adults cause damage by feeding on young shoots, flower clusters, developing fruits and occasionally on mature fruits (Waite & Hwang, 2002; Tan *et al*., 1997). This results in brown spotting followed by flower and fruit abscission (Zhang, 1997).
- The nymphs and adults will fly away when disturbed or the nymphs may exhibit a defensive response, emitting a foul smelling fluid and then falling to the ground (Waite & Hwang, 2002). This means that they are unlikely to be included in consignments of fruit packed for export.

Probability of distribution

The likelihood that stink bugs will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee from China or Thailand: **Moderate**.

- Stink bugs are likely to survive storage and transportation because the nymphs are highly resistant to starvation and can live without feeding for up to 12 days. Adults can live for over one year (Waite & Hwang, 2002).
- Adults and nymphs are likely to survive storage and transport and be associated with infested waste. Stink bugs are likely to enter the orchard environment in one or two ways: nymphs may be discarded with longan or lychee skin, mature into adults and fly to a suitable host plant, or adults can fly directly to suitable hosts.

Probability of entry

The likelihood that stink bugs will arrive in Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, and be distributed to the endangered area: **Very Low**.

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that stink bugs will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **Moderate**.

- Stink bugs can infest a moderate range of plants that include lychee, longan, loquat, plum peach, pear, pomegranate, castor oil plant, rose, canna, citrus and *Eucalyptus* species (Waite & Hwang, 2002). Stink bugs are likely to survive and find suitable hosts, especially in the warmer subtropical and tropical regions of Australia.
- Stink bugs have a low reproductive rate of one generation per year, but the females lay up to 14 egg masses, each containing about 14 eggs, on the back of leaves. Old adults can live up to a year (Waite & Hwang, 2002).

Probability of spread

The likelihood that stink bugs will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **Moderate**.

- Tropical or subtropical environments of Australia would be suitable for the spread of these stink bugs because they are recorded from such environments.
- Eggs are laid on the back of leaves (Waite & Hwang, 2002) and may be moved long distances on planting material.
- Adults and nymphs are mobile and can spread short distances (Waite & Hwang, 2002).
- The relevance of natural enemies is not known.

Probability of entry, establishment and spread

The overall likelihood that stink bugs will enter Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Very Low**.

The probability of entry, establishment and spread is determined by combining the likelihoods of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of stink bugs: **Low**.

Criterion	Estimate
Direct consequences	
Plant life, health or welfare	C — Stink bugs can cause direct harm to a moderate range of plant hosts *T. papillosa* has been reported as a possible vector of longan witches' broom disease (Chen *et al*., 2001).
Any other aspects of the environment	A — There are no known consequences of these pests on other aspects of the environment.
Indirect consequences	
Eradication, control etc.	B — Programs to minimise the impact of these pests on host plants are likely to be costly and include pesticide applications and crop monitoring.
Domestic trade	B — The presence of these pests in commercial production areas can have a significant effect at the local level due to any resulting interstate trade restrictions on a wide range of commodities. These restrictions can lead to a loss of markets
International trade	B — The presence of these pests in commercial production areas of a range of commodities (e.g. stonefruit and pomefruit) can have a significant effect at the local level due to any limitations to access to overseas markets where these pests are absent.
Environment	A — Although additional pesticide applications would be required to control these pests on susceptible crops, this is unlikely to affect the environment.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Negligible**.

FRUIT BORERS

Deudorix epijarbas Moore (Syn. *Deudorix epijarbas amatius* Fruhstorfer) [Lepidoptera: Lycaenidae] – Lycaenid fruit borer.

Probability of importation

The likelihood that *Deudorix epijarbas* will arrive in Australia with the importation of fresh longan or lychee fruit from China or Thailand: **Moderate**.

- *Deudorix epijarbas* lays a single egg on the fruit of host plants and the larva bores inside, completely destroying the flesh and seed. A neat hole is chewed on the skin and the larva plugs this. The larvae also produce a substance that is attractive to ants, which are often seen in attendance (Waite & Hwang, 2002).
- Infested fruit can be detected by the neat hole and plug as well as the presence of ants in vicinity of the bored hole.
- This pest causes rotting of fruit (Waite & Hwang, 2002) so infested fruit are unlikely to be packed for export.
- The presence of the larva on fruit can be easily discerned as the stout-bodied, slug-like larva is purplish brown with orange and green markings (Herbison-Evans & Crossley, 2002).
- Although the signs of insect infestation on fruits can be detected, it is likely that recently infested fruit would be exported as the larva can remain inside the fruit.
- The larvae of the borer in the shipment must survive for at least 12-14 days before emerging from fruit to pupate upon arrival.

Probability of distribution

The likelihood that *Deudorix epijarbas* will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee from China or Thailand: **Moderate**.

- The commodity is likely to be distributed throughout Australia for retail sale. The intended use of the commodity is human consumption but waste material would be generated (eg. longan or lychee skin and longan panicles).
- If adults and larvae were to survive storage and transport, they may enter the environment in two ways: larvae may be discarded with longan or lychee skin, or adults may fly directly to a suitable host plant.

Probability of entry

The likelihood that *Deudorix epijarbas* will arrive in Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, and be distributed to the endangered area: **Low**.

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that *Deudorix epijarbas* will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **Low**.

- Larva can attack several fruit, but each infested fruit will only contain a single larva (Waite & Hwang, 2002).
- Surviving female borers must then be successful in locating suitable mating partners and fruiting hosts to lay eggs.
- This pest has a relatively narrow host range including lychee, longan, macadamia, pomegranate, kulandoi (*Caryota albertii*), shell vine (*Connarus conchocarpus),* Saptrangi *(Salacia chinensis*)*, Salacia dispepala* and *Sarcopteryx martyana* and narrow environmental tolerances i.e. tropical and sub-tropical environments (Herbison-Evans & Crossley, 2002).

Probability of spread

The likelihood that *Deudorix epijarbas* will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **Moderate**.

- Tropical or subtropical environments of Australia would be suitable for the spread of *D. epijarbas* because it is recorded from these environments.
- The adult moths are able to fly so are likely to spread to other host plants.
- The relevance of natural enemies is not known.

Probability of entry, establishment and spread

The overall likelihood that *Deudorix epijarbas* will enter Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Very Low**.

The probability of entry, establishment and spread is determined by combining the likelihoods of entry, establishment and spread using the matrix of ‘rules’ for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of *Deudorix epijarbas*: **Very Low**.

Criterion	Estimate
Direct consequences	
Plant life, health or welfare	B — *Deudorix epijarbas* can cause direct harm to a range of plant species.
Any other aspects of the environment	A — There are no known consequences of this pest on other aspects of the environment.
Indirect consequences	
Eradication, control etc.	B — A control program would have to be implemented in infested orchards to reduce fruit damage and yield losses, thereby increasing production costs.
Domestic trade	B — The presence of this pest in commercial production areas can have a significant effect at the local level due to any resulting interstate trade restrictions on a wide range of commodities. These restrictions can lead to a loss of markets.
International trade	B — The presence of this pest in commercial longan and lychee production areas can have a significant effect at the local level due to any limitations to access to overseas markets where this pest is absent.
Environment	A — Pesticides required to control this fruit borer may have a significant consequence at a local level.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the ‘Method for assessing consequences’ section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall ‘probability of entry, establishment and spread’ with the ‘consequences’ using the risk estimation matrix (Table 1): **Negligible**.

LITCHI FRUIT BORER

Conopomorpha sinensis Bradley [Lepidoptera: Gracillariidae] – litchi fruit borer.

Probability of importation

The likelihood that *Conopomorpha sinensis* will arrive in Australia with the importation of fresh longan or lychee fruit from China or Thailand: **High**.

- *C. sinensis* lays yellow, scale-like eggs on the fruit anytime after fruit set as well as on new leaves and shoots of lychee and longan (Waite & Hwang, 2002).
- After hatching, the larvae bore into the fruit, tunnelling through the flesh and seed of the fruit (FAO 2001; Waite & Hwang, 2002).
- It is unlikely that *C. sinensis* inside fruit will be detected during sorting and packing procedures.

Probability of distribution

The likelihood that *Conopomorpha sinensis* will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee from China or Thailand: **Moderate**.

- The commodity is likely to be distributed throughout Australia for retail sale. The intended use of the commodity is human consumption but waste material would be generated (eg. longan or lychee skin and longan panicles).
- If adults and larvae were to survive storage and transport, they may enter the environment in two ways: larvae may be discarded with longan or lychee skin, or adults may fly directly to a suitable host plant.
- Adults emerge from the pupae after 5-7 days and live for 5-8 days (Waite & Hwang, 2002).

Probability of entry

The likelihood that *Conopomorpha sinensis* will arrive in Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, and be distributed to the endangered area: **Moderate**.

This overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that *Conopomorpha sinensis* will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **Low**.

- The host range for litchi fruit borer is limited and is only known to include longan and lychee (CABI, 2002).
- This species has a high reproductive rate and is known to have up to eleven generations per year in China (Zhang *et al*., 1997).
- Female borers must be successful in locating suitable mating partners and fruiting hosts to lay eggs.

Probability of spread

The likelihood that *Conopomorpha sinensis* will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **Moderate**.

- Tropical or subtropical environments of Australia would be suitable for the spread of *C. sinensis* because it is recorded from these environments.
- The adult moths are able to fly so are likely to spread.
- The relevance of natural enemies is not known.

Probability of entry, establishment and spread

The overall likelihood that *Conopomorpha sinensis* will enter Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Low**.

This probability of entry, establishment and spread is determined by combining the likelihoods of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of litchi fruit borer: **Moderate**.

Criterion	Estimate
Direct consequences	
Plant life, health or welfare	B — Litchi fruit borer can cause direct harm to a narrow range of plant hosts such as lychee, longan and cocoa.
Any other aspects of the environment	A — There are no known direct consequences of this pest on other aspects of the environment.

Indirect consequences	
Eradication, control etc.	B — A control program would have to be implemented in infested orchard to reduce fruit damage and yield losses and this may increase production costs.
Domestic trade	B — The presence of this pest in commercial production areas may have a significant effect at the local level due to any resulting interstate trade restrictions on a wide range of commodities. These restrictions can lead to a loss of markets.
International trade	D – *C. sinensis* is considered an important pest of lychee and longan (Waite & Hwang, 2002). Therefore the presence of this pest in longan and lychee production areas may have a significant effect at the regional level in subtropical areas of Australia, due to any limitations to access to overseas markets for where these pests are absent.
Environment	A — Pesticides required to control litchi fruit borer may have a significant consequence at a local level.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Low**.

LEAF ROLLERS

Two species of leaf rollers [Lepidoptera: Tortricidae] are included in this assessment.

Adoxophyes cyrtosema Meyrick - citrus leaf roller

Adoxophyes orana (Fischer von Röeslerstamm) - smaller tea tortrix.

Probability of importation

The likelihood that leaf rollers will arrive in Australia with the importation of fresh longan or lychee fruit from China: **Very Low**.

- *Adoxophyes* spp. rarely occur in longan and lychee orchards in China (AQSIQ, 2003b).
- Larvae often spin leaves against the fruit and hide underneath on the fruit surface. Fruit damage mostly occurs at sites where a leaf is attached to the fruit with a silken thread. Larvae damage the fruit by chewing large, visible holes, which usually causes fruit rot or desiccation.
- Damage to young fruits caused by *Adoxophyes* spp. usually results in premature drop. On mature fruits, the damage causes scarring and pitting, giving the fruit a corky like appearance and abnormal shape. Frass is externally visible (CABI, 2002).

- The larvae are green in colour, with a yellow head, and the larvae and eggs are easily discernible on fruit (CABI, 2002). Furthermore, the presence of leaves and silken webbing on the fruit indicates the presence of *Adoxophyes* spp. When disturbed, the larvae typically drop from the tree by the silken threads (CABI, 2002).
- It is likely that infested fruit will be detected during packing and culled from export consignments.

Probability of distribution

The likelihood that leaf rollers will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee from China: **Low**.

- The pests are unlikely to survive commercial storage and transportation because *Adoxophyes* spp. do not tolerate cold temperatures. Egg development stops at temperatures below 9ºC and temperatures of above 10ºC are required for egg laying (CABI, 2002).
- If adults and larvae were to survive storage and transport, they may enter the environment in two ways: larvae may be discarded with longan or lychee skin, or adults may fly up to 400m from their initial location (CABI, 2002).
- The skin of infested fruit is likely to be discarded, therefore these pests may survive and find suitable hosts especially in the warmer subtropical and tropical regions of Australia.
- Long-range migration is not possible without vectors (CABI, 2002).

Probability of entry

The likelihood that leaf rollers will arrive in Australia as a result of trade in fresh longan or lychee fruit from China, and be distributed to the endangered area: **Very Low**.

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of ‘rules’ for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that leaf rollers will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **Moderate**.

- *Adoxophyes* spp. have a high reproductive rate and lay masses of 25-150 eggs. A single female may deposit more than 300 eggs (Waite & Hwang, 2002). The eggs are laid on the leaves, fruit and bark (CABI, 2002).
- Warmer temperatures are required for mating and egg development, so the Australian environment is suitable for establishment of *Adoxophyes* spp.

- *Adoxophyes* spp. have a wide host range, many of which are common in temperate regions of Australia, including apples, pears and a number of *Prunus* spp. (Waite & Hwang, 2002).

Probability of spread

The likelihood that leaf rollers will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **Moderate**.

- Tropical or subtropical environments of Australia would be suitable for the spread of *Adoxophyes* spp. because higher temperatures are required for reproduction (CABI, 2002).
- Adults may fly short distances, and larvae may be moved within and between plantations with the movement of equipment and personnel.
- The relevance of natural enemies in Australia is not known.

Probability of entry, establishment and spread

The overall likelihood that leaf rollers will enter Australia as a result of trade in fresh longan or lychee fruit from China, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Very Low**.

The probability of entry, establishment and spread is determined by combining the likelihoods of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of leaf rollers: **Low**.

Criterion	Estimate
Direct consequences	
Plant life, health or welfare	C — *Adoxophyes* spp. can cause direct harm to a wide range of economically important plant hosts, including apples, pears and stone fruit.
Any other aspects of the environment	A — There are no known direct consequences of these pests on other aspects of the environment.
Indirect consequences	
Eradication, control etc.	B — Programs to minimise the impact of these pests on host plants are likely to be costly and include pesticide applications and crop monitoring.
Domestic trade	B — The presence of these pests in commercial production areas can have a significant effect at the local level due to any resulting interstate trade restrictions on a wide range of commodities. These restrictions can lead to a loss of markets.

International trade	C — The presence of these pests in commercial production areas of a range of commodities (e.g. longan and lychee, stonefruit, pomefruit) can have a significant effect at the local level due to any limitations to access to overseas markets where these pests are absent.
Environment	A — Although additional pesticide applications would be required to control these pests on susceptible crops, this is unlikely to affect the environment.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Negligible**.

CYLINDROCLADIELLA DISEASE

Cylindrocladiella peruviana (Batista, Bezerra & Herrera) Boesewinkel ['Mitosporic fungi': Hyphomycetes] - root rot; leaf spot; fruit rot.

Probability of importation

The likelihood that *Cylindrocladiella peruviana* will arrive in Australia with the importation of fresh longan or lychee fruit from China: **Low**

- Generally *Cylindrocladiella peruviana* is recorded in the soil as a root rot, and occasionally as a leaf spot. Longan and lychee fruit are likely to be infected from contact with the ground or by wind or rain splash to low branches.
- *Cylindrocladiella peruviana* has been recorded on longan and lychee fruit in China (CIQ, 2000).
- Damage on fruit is recorded as low in China (AQSIQ, 2003a) and infected fruit is easily visible due to the presence of white mycelium and decay (Zhang, 1997).
- Visibly infected fruit are unlikely to be picked or would be discarded during routine inspection and sorting. However, it is possible that infected fruit with minor symptoms might be exported.

Probability of distribution

The likelihood that *Cylindrocladiella peruviana* will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee fruit from China: **Moderate.**

- The pathogen is likely to survive storage and transportation even at cool temperatures with growth at 5ºC and is unlikely to progress to visible decay before distribution (Crous & Wingfield, 1993).

Probability of entry

The likelihood that *Cylindrocladiella peruviana* will arrive in Australia as a result of trade in fresh longan or lychee from China and be distributed to the endangered area: **Low.**

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that *Cylindrocladiella peruviana* will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **High.**

- The host range includes mango and tea and a variety of native and exotic shrub and tree species in addition to longan and lychee (SBML, 2000).
- Conducive conditions exist in Australia in temperate and tropical regions for other *Cylindrocladiella* spp. recorded on *Rosa* spp. and *Mangifera indica. C. camelliae*, which was previously considered a synonym, is present in Australia on *Synoun* spp., *Rubus rugosus*, *Durio zibethinus, Banksia* spp. and *Camellia* spp. (APPD, 2003).
- *Cylindrocladiella peruviana* is well adapted with a temperature range from 5ºC to 30ºC and an optimum of 25ºC (Crous & Wingfield, 1993).
- The skin of infected longan and lychee fruit and panicles is likely to be discarded, so the pathogen is likely to be able to survive in the soil near a suitable host.

Probability of spread

The likelihood that *Cylindrocladiella peruviana* will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **Moderate**.

- *Cylindrocladiella peruviana* has extensive sporulation on aerial mycelium and may be spread locally by wind or rain splash.
- The pathogen has been isolated from ants (Batista *et al.,* 1965) so can be spread mechanically by insects.

Probability of entry, establishment and spread

The overall likelihood that *Cylindrocladiella peruviana* will enter Australia as a result of trade in fresh longan or lychee fruit from China, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Low**.

- The probability of entry, establishment or spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of *Cylindrocladiella peruviana:* **Very low**

Criterion	Estimate
Direct consequences	
Plant life or health	B — *Cylindrocladiella peruviana* can cause significant direct harm to longan and lychee, mango and tea production at the local level.
Any other aspects of the environment	A — There are no known direct consequences of this disease on the environment.
Indirect consequences	
Eradication, control etc.	A — Programs to minimise the impact of this disease on host plants are not likely to be more costly than existing pre- and post-harvest treatments.
Domestic trade	A — The presence of this disease in commercial production areas may have a minor effect at the local level due to any resulting interstate trade restrictions on longans and lychees.
International trade	B — The presence of this disease in commercial production areas of longan and lychee may have a significant effect at the local level due to any limitations to access to overseas markets where these pests are absent.
Environment	A — Although additional pre- and post-harvest fungicide applications might be required to control this disease on longan and lychee, this is unlikely to affect the environment.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Negligible**.

LITCHI BROWN BLIGHT

Peronophythora litchii Chen ex Ko. Chang, Su, Chen & Leu. [Pythiales: Pythiaceae] - litchi downy blight; litchi brown blight; downy blossom blight of lychee; fruit rot; root rot.

Probability of importation

The likelihood that *Peronophythora litchii* will arrive in Australia with the importation of fresh lychee fruit from China or Thailand: **Moderate**.

- Lychee orchards in both Thailand and China are frequently infected with *Peronophythora litchi* at the blossom and fruiting stage (DOA, 2003b; Ou, 2001).
- Early symptoms of infected fruit are necrosis – irregular brown lesions with an unclear border and hyphal growth on the surface (Ann & Ko, 1984). Infected fruit turn brown and become enveloped in a white downy growth of hyphae, sporangiophores and sporangia (Vien *et al*., 2001).
- Due to the visible symptoms of the disease at the flower budding and fruitlet stage, control measures can be applied before fruit maturity.
- In China, optimal temperatures of 22-25ºC for mycelial growth, sporulation and germination of sporangia of *P. litchii* coincide with the maturing stage of lychee fruit (Li, 1997).
- Most infected developing fruit will have fallen from the tree prematurely.
- Visibly infected fruit are unlikely to be picked or would be discarded during routine inspection and sorting; however, it is possible that infected fruit with minor symptoms could be exported.

Probability of distribution

The likelihood that *Peronophythora litchii* will be distributed to the endangered area as a result of the processing, sale or disposal of lychee fruit from China or Thailand: **High**.

- The pathogen is likely to survive storage and transportation, even at cool dry temperatures, and is unlikely to progress to visible decay before distribution.

Probability of entry

The likelihood that *Peronophythora litchii* will arrive in Australia as a result of trade in fresh lychee from China or Thailand, and be distributed to the endangered area: **Moderate.**

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of ‘rules’ for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that *Peronophythora litchii* will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **Low.**

- The host range is limited to lychee and in Australia lychees are only grown commercially in northern NSW and Queensland.
- Conducive conditions for the establishment of *Peronophythora litchii* occur in some production areas in Australia during the growing season.
- The skin of infected fruit is likely to be discarded, therefore the pathogen is likely to move into the soil, survive on roots and find a suitable lychee host nearby.

Probability of spread

The likelihood that *Peronophythora litchii* will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **Low**.

- Tropical or subtropical environments of Australia would be suitable for the spread of *Peronophythora litchii* if lychee hosts were available.
- The pathogen is present in the soil, which would limit the possible mode of spread; however, it can remain on infected fruit skins, germinate and spread as sporangia.
- Sporangia are not liberated by moving air, but are readily dispersed in splash droplets, suggesting a rain-splash mechanism (CMI, 1989).

Probability of entry, establishment and spread

The overall likelihood that *Peronophythora litchii* will enter Australia as a result of trade in fresh lychee fruit from China or Thailand, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Very Low**.

The probability of entry, establishment or spread is determined by combining the probabilities of entry, establishment and spread using the matrix of ‘rules’ for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of *Peronophythora litchii:* **Low.**

Criterion	Estimate
Direct consequences	
Plant life or health	C — *Peronophythora litchi* can cause significant direct harm to lychee production at the district level.
Any other aspects of the environment	A — There are no known direct consequences of this disease on the environment.
Indirect consequences	
Eradication, control etc.	B — Programs to minimise the impact of this disease on host plants are likely to be required and would incur costs for fungicide sprays and additional crop monitoring.
Domestic trade	B — The presence of this disease in commercial production areas may have a significant effect at the local level due to any resulting interstate trade restrictions on lychees.
International trade	B — The presence of this disease in commercial production areas of lychee may have a significant effect at the local level due to any limitations to access to overseas markets where this disease is absent.
Environment	A — Although additional fungicide applications would be required to control this disease on lychee, this is unlikely to affect the environment.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Negligible**.

FRUIT BLOTCH

Phomopsis longanae Chi & Jiang – fruit blotch; branch canker [Diaporthales: Valsaceae]

Probability of importation

The likelihood that *Phomopsis longanae* will arrive in Australia with the importation of fresh longan or lychee fruit from China: **Moderate**

- *Phomopsis* spp. are often recorded on longan and lychee (Coates *et al*., 2003) and are mostly post-harvest disorders. *Phomopsis longanae* has been recorded as a disease on longan in China (Lin & Chi, 1992).
- Damage on fruit is recorded to be low in China (AQSIQ, 2003a).
- Controlling insect pests in the orchards can help reduce skin injuries and therefore potential infection sites for many pathogens (Coates *et al*., 2003).
- Infected fruit are likely to show visible lesions on the surface, with the developing rot penetrating into the flesh and commonly occurring at the stem end (Coates *et al*., 2003). Visibly affected fruit is likely to be discarded during sorting and inspection processes but symptomless fruit or latent infections could be overlooked and exported.

Probability of distribution

The likelihood that *Phomopsis longanae* will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee fruit from China: **Moderate**.

- Post harvest refrigeration is essential for post-harvest disease suppression and disease can develop if fruit is held at ambient temperature (Coates *et al*., 2003). However, as the pathogen is not killed by refrigeration, it could sporulate when infected fruit is brought out from cool storage into ambient temperature.

Probability of entry

The likelihood that *Phomopsis longanae* will arrive in Australia as a result of trade in fresh longan or lychee from China and be distributed to the endangered area: **Low.**

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of ‘rules’ for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that *Phomopsis longanae* will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **Very Low.**

- The host range is limited to longan and lychee, which are only grown commercially in northern NSW and Queensland.
- The skin of infected fruit is likely to be discarded, therefore the pathogen is likely to survive, especially in the warmer subtropical and tropical regions of Australia.
- Longan and lychee imports are likely to be counter-seasonal to Australian longan and lychee production so mature fruits on domestic trees are unlikely to be available to be infected.

Probability of spread

The likelihood that *Phomopsis longanae* will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **Low**.

- Tropical or subtropical environments of Australia would be suitable for the spread of *Phomopsis* spp. if longan or lychee hosts were available.
- The process of infection of *Phomopsis* spp. that causes stem end rot on longan and lychee has not been clearly established. Symptoms probably arise from quiescent infections in the skin and at the stem end of fruit (Coates *et al*. 2003). *Phomopsis* spp. have also been isolated as an endophyte from longan, lychee and rambutan stem tissue, suggesting another mode of infection (Johnson *et al*., 1998).
- A related pathogen, *Phomopsis caricae-papayae*, which causes a post-harvest rot on mango has been reported to spread by spores on stalks spreading to fruit in wet weather; however, the spread from fruit to fruit after harvest is not significant in mango (DPI, 1993).

Probability of entry, establishment and spread

The overall likelihood that *Phomopsis longanae* will enter Australia as a result of trade in fresh longan or lychee fruit from China, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Very low**.

The probability of entry, establishment or spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of *Phomopsis longanae:* **Very low**.

Criterion	Estimate
Direct consequences	
Plant life or health	B — *Phomopsis longanae* can cause significant direct harm to longan and lychee production at the local level.
Any other aspects of the environment	A — There are no known direct consequences of this disease on the environment.
Indirect consequences	
Eradication, control etc.	A — Programs to minimise the impact of this disease on host plants are not likely to be more costly than existing fungicidal dips and post-harvest treatments but may affect chemical free produce.
Domestic trade	A — The presence of this disease in commercial production areas may have a minor effect at the local level due to any resulting interstate trade

	restrictions on lychees.
International trade	B — The presence of this disease in commercial production areas of lychee may have a significant effect at the local level due to any limitations to access to overseas markets where this pathogen is absent.
Environment	A — Although additional pre- and post-harvest fungicide applications might be required to control this disease on longan and lychee, this is unlikely to affect the environment.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Negligible**.

PHYTOPHTHORA FRUIT ROT

Phytophthora palmivora MF4 (E. J. Butler) E. J. Butler [Pythiales: Pythiaceae] (Phytophthora leaf blight and fruit rot)

Probability of importation

The likelihood that *Phytophthora palmivora* will arrive in Australia with the importation of fresh longan or lychee fruit from Thailand: **Moderate.**

- *Phytophthora palmivora* is present in the Northern Territory and Queensland; however, *P. palmivora* is not recorded from Western Australia and is therefore a quarantine pest for Western Australia (DAWA, 2003).
- *Phytophthora palmivora* is recorded as a root rot, in the soil but can also affect shoots, leaves, fruits and pods (DOA, 2003a,b). Longan and lychee fruit are likely to be infected from contact with the ground or by wind or rain splash to low branches.
- Damage on fruit can be serious where fruit is induced to set out of season in cool weather after rainfall in Thailand (Visitpanich *et al*., 2000).
- Symptoms on fruit appear as irregular brown lesions and visibly infected fruit is unlikely to be picked or would be discarded during packing and sorting. However, it is possible that infected fruit with no or minor symptoms might be overlooked and be exported.

Probability of distribution

The likelihood that *Phytophthora palmivora* will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee fruit from Thailand: **Moderate.**

Although a tropical pathogen, *P. palmivora* is likely to survive storage and transportation even at dry cool temperatures, as chlamydospores in the fruit are the most important survival structure.

Probability of entry

The likelihood that *Phytophthora palmivora* will arrive in Australia as a result of trade in fresh longan or lychee from Thailand, and be distributed to the endangered area: **Low.**

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that *Phytophthora palmivora* will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **High**.

- The pathogen has a wide host range (over 200 species) including many subtropical and tropical fruits grown in Australia such as longan, lychee, papaya, coconut, durian, mango, palm, avocado, pineapple, fig and *Annona* spp. (Ploetz *et al*., 2003).
- The pathogen is already established in tropical fruit growing areas in Northern Territory and Queensland.
- The skins of infected fruit and the panicles are likely to be discarded, therefore the pathogen is likely to survive and move into the soil or carried by insects to susceptible hosts.
- Low levels of inoculum can build up rapidly due to a short regeneration time with the release of zoospores in the presence of free moisture (DOA, 2003a,b).

Probability of spread

The likelihood that *Phytophthora palmivora* will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **High**.

- The dormant chlamydospores, oospores and mycelium can survive dry periods (CABI, 2002). Movement of soil, infected plant material or machinery could result in spread to other orchards.

- Wind dispersal of inoculum and windblown rain permits spread and development of epidemics amongst plantations and orchards under optimal conditions once the disease is established (CABI, 2002).

Probability of entry, establishment and spread

The overall likelihood that *Phytophthora palmivora* will enter Australia as a result of trade in fresh longan or lychee fruit from Thailand, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Low**.

The probability of entry, establishment or spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of *Phytophthora palmivora:* **Low.**

Criterion	**Estimate**
Direct consequences	
Plant life or health	C — *Phytophthora palmivora* can cause significant direct harm to production of a number of subtropical and tropical fruits at the district level.
Any other aspects of the environment	A — There are no known direct consequences of this disease on the environment.
Indirect consequences	
Eradication, control etc.	A — Programs to minimise the impact of this disease on host plants are not likely to be more costly than existing management and fungicide application.
Domestic trade	A — The presence of this disease in commercial production areas will have a minor effect at the local level due to any resulting interstate trade restrictions on tropical or subtropical fruit.
International trade	A — The presence of this disease in commercial production areas of longan or lychee will have a minor effect at the local level due to any limitations to access to overseas markets where these pests are absent.
Environment	A — Although additional post-harvest fungicide applications might be required to control this disease on longan and lychee, this is unlikely to affect the environment.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall ‘probability of entry, establishment and spread’ with the ‘consequences’ using the risk estimation matrix (Table 1): **Very Low**.

LONGAN WITCHES’ BROOM DISEASE

Longan witches’ broom (disease of unconfirmed aetiology – filamentous virus/phytoplasma/mycoplasma/mites)

Probability of importation

The likelihood that longan witches’ broom will arrive in Australia with the importation of fresh longan or lychee fruit from China or Thailand: **Very Low**.

- In China, there is only limited experimental evidence to suggest that longan witches’ broom disease can be transmitted by seed (Li, 1955; Chen *et al*., 1992; Chen *et al*., 2001).
- In Thailand, witches’ broom disease has not been found to be seed-borne or transmissible by seed. Thailand only exports longan varieties that are resistant to longan witches’ broom disease (DOA, pers. comm. 2003).
- Longan witches’ broom symptoms appear on the branches and leaves of affected longan trees but fruit do not show any symptoms.
- Symptoms of longan witches’ broom disease on lychee are reported (Chen *et al.,* 1996); however there is limited evidence that the disease infects lychee fruit or occurs in lychee in China (AQSIQ, 2003a). It is not recorded in association with lychee fruit in Thailand or elsewhere.
- *Tessaratoma papill*osa (litchi stink bug) is a vector of longan witches’ broom disease and has been identified as a quarantine pest for Australia.

Probability of distribution

The likelihood that longan witches’ broom will be distributed to the endangered area as a result of the processing, sale or disposal of longan or lychee fruit from China or Thailand: **Moderate**.

- Adults and nymphs of the vector *Tessaratoma papillosa* are likely to survive storage and transportation because the nymphs are highly resistant to starvation and can live without feeding for up to 12 days, and adults live for up to 311 days (Waite & Hwang, 2002).

- Stink bugs may enter the orchard environment in one or two ways: nymphs may be discarded with longan or lychee skin, mature into adults and fly to a suitable host plant, or adults being mobile may fly directly to suitable hosts.

Probability of entry

The likelihood that longan witches' broom will arrive in Australia as a result of trade in fresh longan or lychee from China or Thailand, and be distributed to the endangered area: **Very low.**

The overall probability of entry is determined by combining the likelihoods of importation and distribution using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Probability of establishment

The likelihood that longan witches' broom will establish based on a comparative assessment of factors in the source and destination areas considered pertinent to the ability of the pest to survive and propagate: **Low.**

- The host range is thought to be limited to longan and in Australia longan is only grown commercially in northern NSW and Queensland but susceptible varieties do exist.
- Other arthropods not on the pathway can vectors the disease in China and Thailand and there may be species in Australia that could be vectors.

Probability of spread

The likelihood that longan witches' broom will spread based on a comparative assessment of those factors in the area of origin and in Australia considered pertinent to the expansion of the geographical distribution of the pest: **Moderate**.

- There could be potential vectors amongst Australian species of sucking insects/mites found on longan and or lychee such as litchi stink bug (*Lyramorpha rosea),* and the mites *Polyphatarsonemus latus* and *Aceria litchii*.
- The disease can be spread in nursery stock through grafting from diseased material onto susceptible varieties grown in Australia such as Biew Kiew.

Probability of entry, establishment and spread

The overall likelihood that longan witches' broom will enter Australia as a result of trade in fresh longan or lychee fruit from China or Thailand, be distributed in a viable state to suitable hosts, establish in that area and subsequently spread within Australia: **Very low**.

The probability of entry, establishment or spread is determined by combining the probabilities of entry, establishment and spread using the matrix of 'rules' for combining descriptive likelihoods (Table 3).

Consequences

Consequences (direct and indirect) of longan witches' broom: **Low.**

Criterion	Estimate
Direct consequences	
Plant life or health	C — Longan witches' broom disease can cause significant harm to longan production at the district level. The disease causes losses of 10-20% annually in China and up to 50% in severe cases (Chen *et al*, 1999).
Any other aspects of the environment	A — There are no known direct consequences of this disease on the environment.
Indirect consequences	
Eradication, control etc.	C — Programs to minimise the impact of this disease on host plants are likely to be costly and include quarantine and or destruction of infected trees, breeding resistant cultivars, selective nursery practices, and additional control of pest vectors.
Domestic trade	C — The presence of this disease in commercial production areas may have a significant effect at the district level due to any resulting interstate trade restrictions on longan grafting/planting material.
International trade	C — The presence of this disease in commercial production areas of lychee may have a significant effect at the district level due to any limitations to access to overseas markets for Australian longan nursery stock where this organism on longans is absent.
Environment	A — Although some control might be required to control this disease on longan, this is unlikely to affect the environment.

Note: Refer to Table 5 (The assessment of local, district, regional and national consequences) and text under the 'Method for assessing consequences' section for details on the approach taken to consequence assessment.

Unrestricted risk estimate

The unrestricted risk estimate as determined by combining the overall 'probability of entry, establishment and spread' with the 'consequences' using the risk estimation matrix (Table 1): **Negligible**.

CONCLUSIONS: RISK ASSESSMENTS

The results of the risk assessments are summarised in Table 7. The results show that unrestricted risk estimates for fruit flies, mealybugs, soft scales and litchi fruit borer exceed the ALOP. Risk management measures are required for these pests. The proposed risk management measures are described in the following section.

Table 7. Results of the risk assessments

Pest Name	Probability of			Overall probability of entry, establishment and spread	Consequences	Unrestricted Risk
	Entry	Establishment	Spread			
Arthropods						
Scarab beetles	Negligible	N/A	N/A	N/A	N/A	N/A
Fruit flies	High	Moderate	High	Moderate	High	High
Mealybugs	Moderate	High	High	Moderate	Low	Low
Soft scales	Moderate	High	High	Moderate	Low	Low
Stink bugs	Very Low	Moderate	Moderate	Very Low	Low	Negligible
Fruit borers	Low	Low	Moderate	Very Low	Very Low	Negligible
Litchi fruit borer	Moderate	Low	Moderate	Low	Moderate	Low
Leaf rollers	Very Low	Moderate	Moderate	Very Low	Low	Negligible
Pathogens						
Cylindrocladiella disease	Low	High	Moderate	Low	Very Low	Negligible
Litchi brown blight	Moderate	Low	Low	Very Low	Low	Negligible
Fruit blotch	Low	Very Low	Low	Very Low	Very Low	Negligible
Phytophthora leaf blight and fruit rot	Low	High	High	Low	Low	Very Low
Longan witches' broom disease	Very Low	Low	Moderate	Very Low	Low	Negligible

RISK MANAGEMENT

Pest risk management evaluates and selects options for measures to reduce the risk of entry, establishment or spread of quarantine pests assessed to pose an unacceptable level of risk to Australia via the importation of commercially produced longan or lychee fruit from China or Thailand (i.e. fruit sourced from commercial production sites subjected to standard cultivation, harvesting and packing activities).

Biosecurity Australia considers that the risk management measures proposed below are commensurate with the identified risks and invites technical comments on their economic and technical feasibility. In particular, technical comments are welcome on the appropriateness of the measures and any alternative measures that stakeholders consider would achieve the objective(s) identified for each of the measures.

The measures described below will form the basis of proposed import conditions for fresh longan and/or lychee fruit from China and/or Thailand, and are detailed in the section entitled 'Draft Quarantine Conditions'. The proposal for the use of the risk management measures described below does not preclude consideration of other risk management measures should they be proposed by stakeholders.

PROPOSED RISK MANAGEMENT MEASURES

There are 4 categories of measures proposed to manage the risks identified in the pest risk assessment:

1. cold disinfestation treatment or vapour heat treatment for the management of fruit flies;
2. cold disinfestation treatment or orchard control and inspection for the management of fruit borers;
3. inspection for the management of mealybugs and soft scales; and
4. supporting operational maintenance systems and verification of phytosanitary status.

[1] Options for management of fruit flies

Fruit flies, *Bactrocera cucurbitae and B. dorsalis*, have been assessed to have an unrestricted risk estimate of high, and measures are therefore required to mitigate the risk. As clear visual signs of infestation (particularly in recently infested fruit) may not be present, visual inspection alone is not considered to be an appropriate risk management option. If infested fruit was not detected at inspection, fruit flies may enter, establish and spread. Biosecurity Australia has identified the following phytosanitary risk management options: [1a] cold disinfestation treatment (CT) or [1b] vapour heat treatment (VHT).

The objective of this measure is to ensure that no viable life stages of fruit flies are present in export consignments of longan or lychee fruit from China or Thailand. This measure is considered to reduce the risk associated with fruit flies to an acceptable level.

Other postharvest disinfestation treatments for fruit flies (e.g. hot water treatment and irradiation) were identified as in-principle options for these pests but were considered to be less economically and technically feasible than the proposed optional measures which are already implemented in commercial fruit production in China and Thailand.

Hot water treatment is accepted as a phytosanitary measure against the risk of fruit flies in imports of longan and lychee fruit from the State of Hawaii to Mainland USA under USDA treatment schedule *T 102-d-1 Hot water immersion* – 120ºF [49ºC] for 20 minutes.

The International Plant Protection Convention (IPPC) acknowledges the application of ionising radiation as a phytosanitary treatment for regulated pests or articles (*ISPM No. 18).* Irradiation is accepted and used as a phytosanitary measure against the risk of fruit flies in imports of longan and lychee from the State of Hawaii to Mainland USA under the USDA treatment schedule *T105-a-1 Irradiation*. Irradiation is also a treatment option for longan fruit (including panicles) and lychee fruit from China to the USA under *T105-b-1 Irradiation*. In both treatments the minimum absorbed dose of gamma radiation is 250 Gray (Gy).

Biosecurity Australia accepts the recommendation of a treatment dose of 150 (Gy) for non-emergence of treated eggs and larvae of fruit flies (Hallman & Loaharanu, 2002; Corcoran & Waddell, 2003). In addition to addressing the risk of fruit flies, ionising radiation at the required dose could address the risk posed by other quarantine pests – fruit borers, mealybugs and soft scales (Corcoran & Waddell, 2003).

[1a] Cold treatment (CT)

China has provided cold disinfestation efficacy trial data for *B. dorsalis* on longan and lychee. Eggs and larvae of *B. dorsalis* were eliminated when fruit temperatures were maintained in lychee fruit at 2ºC for 13 days in a controlled atmosphere (1-5% oxygen: 5-6% carbon dioxide) (Liang *et al*. 1997) and in longan fruit at 1ºC for 13 days (Liang *et al*. 1999).

These treatment regimes are consistent with those used by the USDA for disinfestation of *B. dorsalis* in longan and lychee fruit imported into mainland United States.

For longan, the USDA use treatment schedule *T107-j Cold treatment* against fruit fly pests as follows:

- 0.99ºC or below for 13 days
- 1.38ºC or below for 18 days

For lychee, the USDA use treatment schedule *T107-f Cold treatment* against fruit flies and a mite pest as follows:

- 0ºC or below for 10 days
- 0.56ºC or below for 11 days
- 1.11ºC or below for 12 days
- 1.67ºC or below for 14 days

Biosecurity Australia proposes the option of cold treatment as specified by the USDA above in treatment schedules T107j for longan and T107f for lychee to manage the risk of fruit flies.

[1b] Vapour heat treatment (VHT)

Vapour heat treatment is accepted and used as a phytosanitary measure against the risk of fruit flies in imports of lychee fruit from the State of Hawaii to Mainland USA under USDA treatment schedule *T106-f Vapour Heat* – 47.2ºC or above for 20 minutes.

Biosecurity Australia accepts VHT to mitigate the risk of fruit flies for mango fruit from the Philippines under a schedule of 46ºC for 10 minutes.

Biosecurity Australia proposes the option of a pre-export vapour heat treatment of 46ºC (core fruit temperature) for 10 minutes to manage the risk of fruit flies.

[2] Options for the management of fruit borers

The litchi fruit borer, *Conopomorpha sinensis*, has been assessed to have an unrestricted risk of low, and measures are therefore required to mitigate that risk. Standard visual inspection alone is not considered to be an appropriate risk management option in view of the level of risk identified, because these pests are internal borers and entry points and frass may not always be easily visible. If infested fruit was not detected at inspection, these fruit borers may enter, establish and spread.

Biosecurity Australia has identified the following phytosanitary risk management options: [2a] cold treatment or [2b] orchard control and inspection. These measures are considered to reduce the risk associated with *Conopomorpha sinensis* to an acceptable level.

Other risk management options for fruit borers (e.g. pest free areas, vapour heat treatment and irradiation) were identified as in-principle options for these pests but were considered to be less economically and technically feasible than the proposed option of measures which are already implemented in commercial production in China and Thailand. Neither China nor Thailand has proposed longan and lychee export areas as pest free areas for litchi fruit borer. No efficacy data is available to show that vapour heat treatment is an effective measure to address the risk of this fruit borer.

[2a] Cold treatment (CT)

For the import of longan and lychee fruit from China, the USDA require cold disinfestation based on USDA treatment schedule *T107-h Cold treatment* for longan and lychee against fruit flies and *Conopomorpha sinensis* (litchi fruit borer) – 1ºC or below for 15 days or at 1.39 ºC or below for 18 days.

Biosecurity Australia proposes an option of pre-export/in-transit cold treatment at 1ºC or below for 15 days or at 1.39 ºC or below for 18 days. This cold treatment option would manage the risk of both fruit flies and the litchi fruit borer in longan and lychee.

[2b] Orchard control and visual inspection

Biosecurity Australia proposes an alternative option of implementing an NPPO approved orchard control program and inspection for freedom from litchi fruit borer. The orchard control program for litchi fruit borer may include an Integrated Pest Management (IPM) program using appropriate, effective and compatible measures at critical stages of development of the pest and crop. Measures should be based on pest monitoring through weekly orchard inspections and forecasts of infestations.

Information on the NPPO approved orchard control program for litchi fruit borer must be made available to AQIS if requested.

Harvested fruit/panicles would be individually inspected specifically for evidence of litchi fruit borers prior to cold disinfestation/vapour heat treatment for fruit flies.

The combination of orchard control and inspection for freedom from this pest would reduce the risk of litchi fruit borer associated with the importation of longan and lychee fruit from China and Thailand to an acceptable level.

[3] Inspection for the management of mealybugs and soft scales

The mealybugs (*Ferrisia virgata*, *Planococcus lilacinus*, *Planococcus litchi and Pseudococcus jackbeardsleyi*) and the soft scales (*Coccus viridis*, *Drepanococcus chiton*, *Pulvinaria psidii*) have been assessed to have an unrestricted risk estimate of low, and measures are therefore required to mitigate that risk.

Biosecurity Australia proposes that inspection for freedom from mealybugs or soft scales is considered to be an appropriate risk management measure in view of the level of risk identified. If infested fruit was not inspected and found free from these mealybugs and soft scales, they may enter, establish and spread.

[4] Operational maintenance systems and verification of phytosanitary status

It is necessary to have a system of operational procedures in place to ensure that the phytosanitary status of fresh longan or lychee fruit from China or Thailand is maintained and verified during the process of production and export to Australia. This is to ensure that the objectives of the risk mitigation measures previously identified have been met and are being maintained.

The proposed system of operational maintenance for the production and export of fresh longan and lychee from China and Thailand to Australia consists of:

- registration of export orchards and, where relevant, registration of export orchards implementing an approved control program for litchi fruit borer;
- registration of packinghouses and auditing of procedures;
- pre-export inspection by the National Plant Protection Organisation (NPPO);
- packing and labelling;
- phytosanitary certification by the NPPO;
- storage and movement; and
- on-arrival quarantine clearance by AQIS.

[4a] Registration of export orchards

All longan and lychee fruit for export to Australia must be sourced from export orchards and growers registered with China or Thailand's NPPO. Copies of the registration records must be made available to AQIS if requested. The NPPO is required to register export orchards prior to commencement of exports.

All export orchards are expected to produce commercial longan and lychee under standard cultivation, harvesting and packing activities.

The objective of this procedure is to ensure that orchards from which longan and lychee are sourced can be identified. This is to allow trace back to individual orchards and growers in the event of non-compliance and for audit (of control measures). For example, if live pests are frequently intercepted, the ability to identify a specific orchard/grower allows the investigation and corrective action to be targeted rather than applying to all possible orchards/growers.

[4b] Registration of packinghouses and auditing of procedures

All packinghouses intending to export longan and lychee fruit to Australia need to be registered with the NPPO.

Cold treatment/vapour heat treatment for disinfestation of fruit flies and litchi fruit borer is to be done within the registered packinghouses in China and Thailand. Copies of the registration records for cold treatment/vapour heat treatment facilities in China and Thailand must be provided to AQIS.

The inspection for freedom from mealybugs and soft scales and/ or inspection for freedom from the litchi fruit borer is to be done within the registered packinghouses.

Packinghouses would be required to identify the individual orchard with a numbering system and identify fruit from individual orchards by marking boxes or pallets (i.e. one orchard per pallet) with the unique orchard number. The list of registered packinghouses must be kept by the NPPO and provided to AQIS prior to exports commencing with updates provided if packinghouses are added or removed from the list.

Registration of orchards and packinghouses is to include an audit program by the NPPO. An audit is to be conducted prior to registration and then done at least annually.

The objective of this measure is to ensure that packinghouses at which treatment procedures are carried out can be identified. This is to allow trace back to individual packinghouses and orchards in the event of non-compliance.

[4c] Pre-export inspection by NPPO

The NPPO will inspect all consignments in accordance with official procedures for all visually detectable quarantine pests and trash using sampling rates developed by the NPPO in consultation with Biosecurity Australia/AQIS.

The objective of this procedure is to ensure that longan and lychee fruit exported to Australia do not contain quarantine pests or trash, are clean of any extraneous organic material on the surface of the fruit or panicle, and complies with packing and labelling requirements.

Records of the interceptions made during these inspections (live or dead quarantine pests, and trash) are to be maintained by the NPPO and made available to Biosecurity Australia as requested. This information will assist in future reviews of this import pathway and consideration of the appropriateness of the phytosanitary measures that have been applied.

[4d] Packing and labelling

All packages of longan and lychee fruit for export would be free from contaminated plant materials including trash and weed seeds and would meet Australia’s general import conditions for fresh fruits and vegetables (C6000 General Requirements for All Fruit and Vegetables, available at http://www.aqis.gov.au/icon/). Trash refers to soil, splinters, twigs, leaves and other plant materials but excludes longan panicles/fruiting stems 10-15 cm in length and 3-4 mm in diameter.

Inspected and treated fruits would be required to be packed in new boxes. Packing material would be synthetic or processed if of plant origin. No unprocessed packing material of plant origin, such as straw, will be allowed. All wood material used in packaging of longan and lychee must comply with the AQIS conditions (e.g. those in "Cargo containers: Quarantine aspects and procedures" (AQIS, 2003).

All boxes would be labelled with the orchard registration number and packinghouse registration number for the purposes of trace back in the event that this is necessary. The pallets should be securely strapped only after phytosanitary inspection has been carried out following mandatory postharvest treatments. Palletised product is to be identified by attaching a uniquely numbered pallet card to each pallet or part pallet to enable trace back to registered orchards.

The objectives of this procedure are to ensure that:

- The longan and lychee exported to Australia are not contaminated by weeds or trash
- Unprocessed packing material (which may vector pests identified as not on the pathway and pests not known to be associated with longan and lychee) is not imported with the longan or lychee.
- The packaged longans and lychees are labelled in such as way to identify the orchard and packinghouse (see measures 4a,b).

[4e] Phytosanitary certification by the NPPO

The NPPO is required to issue a Phytosanitary Certificate for each consignment upon completion of pre-export phytosanitary inspection and treatment. The objective of this procedure is to provide formal documentation to AQIS verifying that the relevant measures have been done offshore. Each Phytosanitary Certificate is to contain the following information:

Additional declarations

"*The longan/lychee in this consignment have been produced in China/Thailand in accordance with the conditions governing entry of fresh longan/lychee fruit to Australia and inspected and found to be free of quarantine pests*".

Distinguishing marks

The orchard registration number, packinghouse registration number, number of boxes per consignment, and container and seal numbers (as appropriate); (to ensure trace back to the orchard in the event that this is necessary).

Treatments

"The product in this consignment has been <cold treated> <vapour heat treated> for disinfestation of fruit flies and <cold treated> <subjected to orchard control> for litchi fruit borer."

A consignment is the quantity of longan or lychee fruits covered by one Phytosanitary Certificate that arrives at one port in one shipment. All consignments would need to be shipped directly from one port or city in China or Thailand to a designated port or city in Australia.

[4f] Storage and movement

Packed product and packaging is to be protected from pest contamination during and after packing, during storage and during movement between locations (e.g. packinghouse to cool storage/depot, to inspection point, to export point).

Product for export to Australia that has been inspected and certified by the NPPO must be maintained in secure conditions that will prevent mixing with fruit for export to other destinations.

Security of the consignment is to be maintained until release from quarantine in Australia.

The objective of this procedure is to ensure that the phytosanitary status of the product is maintained during storage and movement.

[4g] On-arrival quarantine clearance by AQIS

On arrival in Australia, each consignment would be inspected by AQIS. AQIS would undertake a documentation compliance examination for consignment verification purposes at the port of entry in Australia prior to release from quarantine. Fruit from each consignment would be randomly sampled for inspection. Such sampling methodology would provide 95% confidence that there is not more than 0.5% infestation in a consignment.

The objective of this procedure is to verify that the required measures have been undertaken.

Where consignments are found to be non-compliant with requirements on-arrival, the importer will be given the option to treat (if suitable treatments for the pests detected can be applied), re-export or destroy the consignment. If product continually fails inspection, AQIS reserves the right to suspend the export program and conduct an audit of the Chinese or Thai longan or lychee risk management systems. The program will continue only once Biosecurity Australia/AQIS is satisfied that appropriate corrective action has been taken.

Uncategorised pests

If an organism is detected on longan or lychee from China or Thailand that has not been categorised, it will require assessment to determine its quarantine status and if phytosanitary action is required. The detection of any pests of quarantine concern not already identified in the analysis may result in the suspension of the trade while a review is conducted to ensure that the existing measures continue to provide the appropriate level of phytosanitary protection for Australia.

DRAFT QUARANTINE CONDITIONS

The components of the draft quarantine conditions are summarised in dot point format below and Biosecurity Australia invites comments on their technical and economic feasibility. The proposed risk management measure that links with each component is given in brackets ( ).

- Import Condition 1. Registration of export orchards (links with risk management measure 4a)
- Import Condition 2. Packing house registration and auditing of procedures (4b)
- Import Condition 3. Pre-export cold treatment (1a, 2a)
- Import Condition 4. Pre-export vapour heat treatment (1b)
- Import Condition 5. Orchard control and inspection for freedom from fruit borers (2b)
- Import Condition 6. Inspection for freedom from mealybugs and soft scales (3)
- Import Condition 7. Packing and labelling (4c)
- Import Condition 8. Pre-export inspection by NPPO (4d)
- Import Condition 9. Phytosanitary certification by NPPO (4e)
- Import Condition 10. Storage and movement (4f)
- Import Condition 11. On-arrival quarantine clearance by AQIS (4g)
- Import Condition 12. Review of policy.

IMPORT CONDITION 1. REGISTRATION OF EXPORT ORCHARDS

All longan and lychee fruit for export to Australia must be sourced from export orchards registered with China or Thailand's NPPO (AQSIQ/CIQ; ARD). Copies of the registration records must be made available to AQIS if requested. The NPPO is required to register all export orchards and growers prior to commencement of exports.

All export orchards are expected to produce commercial longan and lychee under standard cultivation, harvesting and packing activities.

IMPORT CONDITION 2. PACKINGHOUSE REGISTRATION AND AUDITING OF PROCEDURES

All packinghouses intending to export longan and lychee fruit to Australia need to be registered with the NPPO.

Cold treatment/vapour heat treatment for pre-export disinfestation of fruit flies and litchi fruit borer is to be conducted within the registered packinghouses in China and Thailand. Copies of the registration records for cold treatment/vapour heat treatment facilities in China and Thailand must be provided to AQIS.

The inspection for freedom from mealybugs and soft scales and/inspection for freedom from the litchi fruit borer is to be done within the registered packinghouses.

Packinghouses would be required to identify the individual orchard with a numbering system and identify fruit from individual orchards by marking boxes or pallets (i.e. one orchard per pallet) with the unique orchard number. The list of registered packinghouses must be kept by the NPPO and provided to AQIS prior to exports commencing with updates provided should packinghouses be added or removed from the list.

Registration of orchards and packinghouses is to include an audit program by the NPPO. An audit is to be conducted prior to registration and then done at least annually.

IMPORT CONDITION 3. PRE-EXPORT/INTRANSIT COLD TREATMENT

If the cold treatment option is taken for fruit fly disinfestation/fruit fly and litchi fruit borer disinfestation, the following procedures must be followed:

Fruit fly disinfestation only

Longan fruit must be treated as follows:

- 0.99ºC or below for 13 days, or
- 1.38ºC or below for 18 days.

Lychee fruit must be treated as follows:

- 0ºC or below for 10 days,
- 0.56ºC or below for 11 days, or
- 1.11ºC or below for 12 days.

Fruit fly and litchi fruit borer disinfestation

Longan/lychee fruit must be kept at 1ºC or below for 15 days or at 1.39 ºC or below for 18 days.

The pulp of the fruit must be at or below the indicated temperature at time of beginning treatment. Cold treatment may be conducted in China or Thailand in packinghouses that are registered with and audited by the NPPO, or in-transit in containers designated by the NPPO for such purposes. Temperature and values would need to be recorded to standards agreed between the NPPO and AQIS and monitored by the NPPO.

IMPORT CONDITION 4. PRE-EXPORT VAPOUR HEAT TREATMENT

If the vapour heat treatment option is taken for fruit fly disinfestation, the following procedures must be followed:

Vapour heat treatment may be conducted in China or Thailand. This must be completed in packinghouse VHT facilities that are registered with and audited by the NPPO. Fruit needs to be treated at 46ºC (fruit core temperature) for 10 minutes.

Temperature and humidity values would need to be recorded to standards agreed between the NPPO and AQIS and monitored by the NPPO.

IMPORT CONDITION 5. ORCHARD CONTROL AND INSPECTION FOR FREEDOM FROM LITCHI FRUIT BORER

If the orchard control and inspection for freedom from litchi fruit borer option is taken, the following procedures must be followed:

Registered growers must implement an orchard control program (i.e. good agricultural practice/integrated pest management (IPM) programs for export fruits) that has been approved by the NPPO, incorporating field sanitation and appropriate biocontrol and/or pesticide applications for the management of litchi fruit borer. Care would be taken to ensure that any chemicals used are registered and approved for use on the produce exported to Australia and that any residues do not exceed Australian Maximum Residue Limits (MRLs). Registered growers would have a registration number and would need to keep records of control measures for auditing purposes. The program would include:

- Monitoring of the litchi fruit borer throughout the year and inspection of fruit weekly from fruit set;
- Chemical control, using appropriate, effective and compatible insecticides for litchi fruit borer. Recommended withholding periods must be enforced for export fruit; and
- Field sanitation with all unparasitised fallen fruit to be removed from the orchards regularly (i.e. every 7 days) and destroyed or deep buried to prevent unparasitised larvae from accumulating.

All fruit is to be inspected and found free of litchi fruit borer and frass. This must be completed in packinghouses that are registered with and audited by the NPPO.

Information on the NPPO approved orchard control program for litchi fruit borer must be made available to AQIS if requested.

IMPORT CONDITION 6. INSPECTION FOR FREEDOM FROM MEALYBUGS AND SOFT SCALES

All fruit is to be inspected and found free from mealybugs and soft scales on the surface of the fruit and panicles. Inspection must be completed in packinghouses that are registered with and audited by the NPPO.

IMPORT CONDITION 7. PRE-EXPORT INSPECTION

The NPPO will inspect all consignments in accordance with official procedures for all visually detectable quarantine pests and trash using sampling procedures developed by the NPPO in consultation with Biosecurity Australia/AQIS.

The inspection procedures would ensure that detached longan fruit, longan panicles (10-15 cm in length and 3-4 mm in diameter) and detached lychee fruit are free from pests of quarantine concern to Australia, are free of any contaminant plant material (leaves, twigs, seed, etc.) and soil, and are free from mealybugs and soft scales and litchi fruit borers.

Consignments that do not comply with the above requirements will be rejected for export to Australia.

Records of the interceptions made during these inspections (live or dead quarantine pests, and trash) are to be maintained by the NPPO and made available to Biosecurity Australia/AQIS as requested. This information will assist in future reviews of this import pathway and consideration of the appropriateness of the phytosanitary measures that have been applied.

IMPORT CONDITION 8. PACKING AND LABELLING

All packages of longan and lychee fruit for export would be free from contaminated plant materials including trash and weed seeds and would meet Australia's general import conditions for fresh fruits and vegetables. (C6000 General Requirements for All Fruit and Vegetables, available at http://www.aqis.gov.au/icon/). Trash refers to soil, splinters, twigs, leaves and other plant materials. Longan panicles with fruit attached are permitted but must meet the size requirements.

Inspected and treated fruits would be required to be packed in new boxes. Packing material would be synthetic or processed if of plant origin. No unprocessed packing material of plant origin, such as straw, will be allowed. All wood material used in packaging of longan and lychee fruit must comply with the AQIS conditions (e.g. those in "Cargo containers: Quarantine aspects and procedures" (AQIS, 2003).

All boxes would be labelled with the orchard registration number and packinghouse registration number for the purposes of trace back in the event that this is necessary. The pallets should be securely strapped only after phytosanitary inspection has been carried out following mandatory postharvest treatments. Palletised product is to be identified by attaching a uniquely numbered pallet card to each pallet or part pallet to enable trace back to registered orchards.

IMPORT CONDITION 9. PHYTOSANITARY CERTIFICATION

The NPPO is required to issue a Phytosanitary Certificate for each consignment upon completion of pre-export inspection and treatment. Each Phytosanitary Certificate is to contain the following information:

Additional declarations

"The longan/lychees in this consignment have been produced in China/Thailand in accordance with the conditions governing entry of fresh longan/lychee fruit to Australia and inspected and found to be free of quarantine pests".

Distinguishing marks

The orchard registration number, packinghouse registration number, number of cartons per consignment, and container and seal numbers (as appropriate); (to ensure trace back to orchard in the event that this is necessary).

A consignment is the quantity of longan and lychee fruit covered by one Phytosanitary Certificate that arrives at one port in one shipment. All consignments would need to be shipped directly from one port or city in China and Thailand to a designated port or city in Australia.

Treatment

"The product in this consignment has been <cold treated> <vapour heat treated> for disinfestation of fruit flies and <cold treated> <subjected to orchard control> for litchi fruit borer."

IMPORT CONDITION 10. STORAGE AND MOVEMENT

Packed product and packaging is to be protected from pest contamination during and after packing, during storage and during movement between locations (e.g., packing house to cool storage/depot, to inspection point, to export point).

Product for export to Australia that has been inspected and certified by the NPPO must be maintained in secure conditions that will prevent mixing with fruit for export to other destinations. This could be achieved through segregation of fruit for export to Australia in separate storage facilities, netting or shrink-wrapping pallets in plastic, or by placing sealed cartons in low temperature cold storage before loading into a shipping container. Alternatively, packed fruit would be directly transferred at the packinghouse into a shipping container, which would be sealed and not opened until the container reached Australia.

Security of the consignment is to be maintained until release from quarantine in Australia.

IMPORT CONDITION 11. ON-ARRIVAL QUARANTINE CLEARANCE BY AQIS

On arrival, each consignment would be inspected by AQIS and documentation examined for consignment verification purposes at the port of entry in Australia prior to release from quarantine. Sampling methodology would provide 95% confidence that there is not more than 0.5% infestation in a consignment.

An example of a sampling size for inspection of longan/lychee is given below.

Consignment size (Units)	**Sample size (Units)**
For ‘consignments’ of fruit of less than 1000 units	either 450 units or 100% of consignment (whichever is smaller)
For ‘consignments’ of fruit of greater than or equal to 1000 units	600 units

Unit = one detached longan fruit/one panicle of longan fruit/one detached lychee fruit

Where consignments are found to be non-compliant with requirements on-arrival, the importer will be given the option to treat (if suitable treatments for the pests detected can be applied), re-export or destroy the consignment. If product continually fails inspection, Biosecurity Australia/AQIS reserves the right to suspend the export program and conduct an audit of the Chinese or Thai longan and lychee risk management systems. The program will continue only after Biosecurity Australia/AQIS is satisfied that appropriate corrective action has been taken.

Uncategorised pests

If an organism that is detected on longan and lychee from China and Thailand has not been categorised, it will require assessment to determine its quarantine status and if phytosanitary action is required. The detection of any pests of quarantine concern not already identified in the analysis may result in the suspension of the trade while a review is conducted to ensure that the existing measures continue to provide the appropriate level of phytosanitary protection for Australia.

IMPORT CONDITION 12. REVIEW OF POLICY

Biosecurity Australia reserves the right to review this policy.

CONCLUSIONS

The findings of this draft IRA report are based on a comprehensive analysis of relevant scientific literature.

Biosecurity Australia considers that the risk management measures proposed in this draft IRA report will provide an appropriate level of protection against the pests identified in the risk assessment. Various risk management measures may be suitable to manage the risks associated with fresh longan and lychee fruit from China and Thailand and Biosecurity Australia will consider any other measures suggested by stakeholders that provide an equivalent level of phytosanitary protection.

FURTHER STEPS IN THE IMPORT RISK ANALYSIS PROCESS[4]

The IRA will now proceed through the following steps:

- Consultation with stakeholders on the Draft IRA Report[4]
  - Stakeholders have 60 days to submit comments
- Preparation of the Final IRA Report
- Consideration of the Final IRA Report by the Executive Manager, Biosecurity Australia
- Consultation with State and Territory Government agencies
- Release of Final IRA Report and recommendation for a policy determination
  - Stakeholders have 30 days from the publication of the recommendation for a policy determination to lodge an appeal in writing
  - With determination of appeals, if required
- Final policy determination by the Director of Animal and Plant Quarantine and public notification
  - Notification being made to the proponent/applicant, registered stakeholders and the WTO

Stakeholders will be advised of any significant variations to this process.

[4] The process described here differs from that in *The AQIS Import Risk Analysis Process Handbook*.
This is the new process as outlined in Biosecurity Australia's *Import Risk Analysis Handbook* 2003, which will become effective on its publication in August.

STAKEHOLDER COMMENTS TO THE TECHNICAL ISSUES PAPER AND RESPONSES FROM BIOSECURITY AUSTRALIA

A synopsis of all of the stakeholder comments received about the Technical Issues Paper for this IRA and the response by Biosecurity Australia is detailed in this section. All stakeholder comments and Biosecurity Australia's response to the comments have been placed on the Public File for this IRA.

Large number of pest and diseases on longans and lychees from China

Stakeholder comment

The range of pests and diseases in China is significantly more than those in Australia and it will take a detailed analysis of each of these categories and their specific method of control to assess the phytosanitary risks to the Australian industry. While protocol may be enacted they could create a real threat to our lychee and longan industry [list supplied of all pests and diseases not in Australia].

Biosecurity Australia's response

The pests and diseases listed in your letter as present in China and not in Australia include all those in the Technical Issues Paper appendices as associated with longan and lychee trees. The majority of these pests and diseases are only associated with the roots, branches, leaves, flowers or immature fruit and not on the mature, commercially produced fruit for export. Only those 49 pests listed as on the pathway in Appendix 6 of the Technical Issues Paper, were potential quarantine pests that needed further consideration in the risk analysis process. Following a detailed risk assessment of the quarantine pests and diseases, risk management measures are proposed in the draft IRA Report. Proposed import protocols are based on the accepted measures.

Affect of importation of pests and diseases on Australia's 'clean green' image

Stakeholder comment

The importation of pests and diseases would have an impact on our 'clean green' image in comparison to China, particularly should adequate chemical controls be available to producers in Australia to manage these incoming pests and diseases. However, there is no guarantee the same controls or processes are available in Australia.

Biosecurity Australia's response

The IRA will identify the pests of unacceptable risk and propose risk management measures to mitigate the risk of pests and diseases entering Australia on longan and lychee and affecting Australian industries. The indirect consequence of eradication or control of a pest or disease is considered as part of the risk assessment.

Conflict with the Australian industry time of harvest for longan

Stakeholder comment

The Chinese season with lychees would generally not conflict with the Australian industry time of harvest, but in the case of longans where potassium chlorate is used, they could be brought into production at a time similar to Australian production.

Biosecurity Australia's response

The import risk analysis considers the risk of quarantine pests associated with the imported commodity. Where seasonality of production and agronomic practices are relevant to the life cycles of pests and diseases or influence their management they are considered within the risk assessment process. Counter seasonal compatibility of imports is not a quarantine issue.

Consideration of *Bactrocera dorsalis*

Stakeholder comments

Bactrocera dorsalis (Oriental fruit fly) has a wide host range and could pose a threat to horticultural crops other than longan and lychee such as citrus and thus support is given to Biosecurity Australia's decision that this pest will be considered further in the draft Import Risk Analysis.

Biosecurity Australia's response

Biosecurity Australia agrees that exotic fruit flies such as *Bactrocera dorsalis* (Oriental fruit fly) would be of major concern to a wide range of horticultural industries in Australia. *B. dorsalis* has been identified as a quarantine pest likely to be on the fruit pathway and has undergone a full risk assessment in the draft IRA.

Consideration of disease of unknown aetiology

Stakeholder comments

Support is given for the decision by Biosecurity Australia to consider the mycoplasm-like/filamentous virus organisms causing the disease "witches' broom" and insect vectors in the pathway for longans and lychees.

Biosecurity Australia's response

Biosecurity Australia included the witches' broom disease for further consideration on the basis of the unconfirmed aetiology and lack of agreement in the literature on the possible means of transmission of the disease, in particular through seeds and sucking insect and mite vectors. A full risk assessment and pest datasheet are included in this draft IRA.

Content of the pest list

Stakeholder comment

There were a number of queries on the content of the pest list used for the IRA, such as suggestions of additional species, suggestions that certain pests be removed and provision of additional technical information on certain species.

Biosecurity Australia's response

Biosecurity Australia appreciates the provision of the additional information on pests and omissions and or corrections. This information was combined with the additional revisions undertaken by Biosecurity Australia on the preliminary pest lists. A number of revisions have been made on the presence/absence of pest species in Australia (including regional differences), China and Thailand, and those pest species found on the pathway. Additional species or information have not been incorporated into the pest lists for the draft IRA report where Biosecurity Australia did not consider it technically justified.

Consistency in consideration of regional differences in IRA documents

Stakeholder comment

Biosecurity Australia should apply a consistent approach to regional differences in pest status and risk, by including this information, throughout the IRA process in all IRAs. Suggest the inclusion of additional arthropod, nematode and pathogen pests not considered in the Technical Issue Paper pest lists after response to preliminary pest lists sent to interested stakeholders in 2001.

Biosecurity Australia's response

Biosecurity Australia, in collaboration with State Departments of Agriculture, is working towards a consistent approach to regional differences in pest risk and status. This process is now better defined and regional differences are incorporated into the IRA process at an early stage of pest categorisation. However, due to differential timing in the preparation and release of various technical issues papers during the past year while regional differences were under discussion, the regional differences were not always included at the technical issues paper stage. All comments on regionalisation are considered and where substantiated, have been incorporated into the draft IRA report.

Consistency in consideration of weed pests

Stakeholder comment

There should be consistency in consideration of all potential pests in IRAs. Some technical issues papers such as mangosteen fruit from Thailand have considered potential weed pests but they were not considered in the Technical Issues Paper for longans and lychees from China.

Biosecurity Australia's response

The inclusion of plant pests (weeds) as potential quarantine pests in an IRA is determined by the relevance of plant pests to the commodity and to the import pathway. Weeds are considered where there is a case for them being potential pests either from prior experience in domestic or international trade or by the physical nature of the commodity or import pathway that could potentially cause or predispose the commodity to contamination by weeds. For example, there is interception data to support the presence of weeds in the crowns of fresh pineapples and in clusters of grapes and it was initially conceivable that weed seeds might become trapped under the calyx of certain fruits such as mangosteen if they were on the ground. Weeds were not considered to be potential pest of orchard crops of longan and lychee and thus were not considered in the Technical Issues Paper. Biosecurity Australia will uphold consistency on this issue in the IRAs where appropriate, and will ensure that justification for the inclusion or exclusion of weeds is adequately provided in all future IRA documents.

Comments on pathway and risk of the 49 pests

Stakeholder comment

The risk assessment method section is very brief and the probability of introduction into a PRA area is not as required by international standards. The document also lists many minor species with little possibility of fruit transmission [further information on the 49 pests provided for consideration in the assessment].

Biosecurity Australia's response

The technical issues paper provided the initial categorisation of pests associated with longan or lychee in China that are not present in the PRA area and believed to be on the import pathway. These 49 pests were listed for further consideration. It was not intended to provide any risk assessment at that stage. In the draft IRA, the pests are further categorised and those remaining as quarantine pests were assessed for the risk according to potential for entry, establishment and spread in the PRA area and the potential for consequences in the PRA area according to international standard ISPM Pub. No. 11 Pest Risk Analysis for Quarantine Pests.

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