Australian Government

Biosecurity Australia

FINAL

Review of policy: Alternative risk management measures to import *Phalaenopsis* nursery stock from Taiwan


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Figure 1 Map of Australia

Tropic of Capricorn

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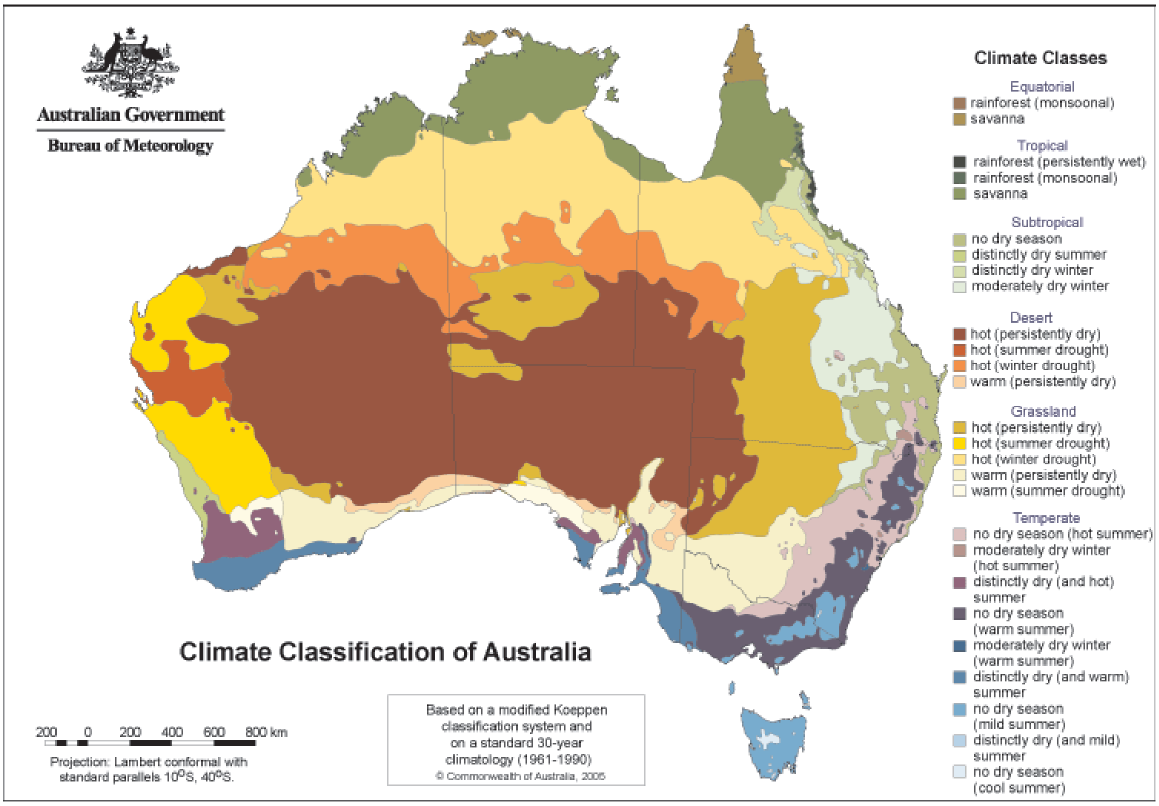

Acronyms and abbreviations

Term or abbreviation	**Definition**
ALOP	Appropriate level of protection
APPD	Australian Plant Pest Database (Plant Health Australia)
AQIS	Australian Quarantine and Inspection Service
BAPHIQ	Bureau of Animal and Plant Health Inspection and Quarantine, Taiwan
CABI	CAB International, Wallingford, UK
CMI	Commonwealth Mycological Institute
DAFF	Australian Government Department of Agriculture, Fisheries and Forestry
FAO	Food and Agriculture Organization of the United Nations
IPC	International Phytosanitary Certificate
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IRA	Import Risk Analysis
ISPM	International Standard for Phytosanitary Measures
NPPO	National Plant Protection Organization
NSW	New South Wales
NT	Northern Territory
PRA	Pest Risk Analysis
Qld	Queensland
Tas.	Tasmania
Vic.	Victoria
WA	Western Australia
WTO	World Trade Organisation

Abbreviations of units

Term or abbreviation	**Definition**
°C	degree Celsius
°F	degree Fahrenheit
kg	kilogram
km	kilometre
m	metre
µm	micrometre (one millionth of a metre)
ml	millilitre
mm	millimetre
ppm	parts per million
s	second

Summary

Biosecurity Australia received a request from the Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ), in June 2006, seeking acceptance of equivalent measures of Australia's current conditions for commercially produced *Phalaenopsis* nursery stock. Currently, *Phalaenopsis* nursery stock is permitted entry into Australia and requires mandatory insecticidal dipping on arrival and a minimum of three months of post-entry quarantine (PEQ). However, if live arthropods are detected during inspection on arrival, the consignment is fumigated with methyl bromide.

This report reviewed existing policy for the importation of *Phalaenopsis* orchid nursery stock from Taiwan and evaluated a proposed systems approach to replace existing risk management measures, consistent with the *Agreement on the Application of Sanitary and Phytosanitary Measures* (SPS Agreement) Article 4 *Equivalence*. The report recommends that the systems approach proposed by Taiwan, with additional testing for an identified viral quarantine pest and the application of pesticides, is equivalent to existing risk management measures and meets Australia's appropriate level of protection (ALOP).

This review of existing policy has identified leaf spots (*Cylindrosporium phalaenopsidis* and *Sphaerulina phalaenopsidis*), flower thrips (*Frankliniella intonsa*), a snail (*Bradybaena tourannensis*) and Phalaenopsis chlorotic spot (Phalaenopsis chlorotic spot *potyvirus*) as pests of quarantine concern.

Consistent with SPS Agreement, Article 4 *Equivalence,* BAPHIQ proposed a systems approach as an alternative measure which may be equally effective in meeting Australia's quarantine requirements. Taiwan has requested that *Phalaenopsis* orchid nursery stock produced under the systems approach be exempt from mandatory on-arrival insecticidal dip and three months growth in PEQ facilities in Australia.

BAPHIQ's proposed systems approach has three main mitigation measures: use of pest-free propagative material, growth in pest exclusionary production houses and inspection. The systems approach is designed to establish and maintain a secure production environment and ensure the use of pest-free mother stock. These mitigation measures minimise the risk of pests entering the importation pathway, thus reducing the risk of them establishing in Australia.

- The systems approach commences with tissue culture of plants, sourced from pathogen tested mother plants, which are then transferred to quarantine standard production houses. Hence, there is very limited opportunity for infection or infestation by pests of quarantine concern to Australia. If fungal pathogens are associated with tissue cultures, their presence will be revealed in the culture medium.
- Resultant tissue culture plants are visually inspected for freedom from disease symptoms and only disease free plants are grown further. Tissue cultured plants are grown in soil free media such as perlite, vermiculite, inorganic fibres or pasteurised sphagnum moss in BAPHIQ approved production houses for a minimum of four months.
- Fungicidal and insecticidal treatments is applied no longer than 14 days prior to export. Phytosanitary inspection by BAPHIQ officers is undertaken immediately prior to export of the nursery stock to Australia.

Under the proposed systems approach, *Phalaenopsis* orchid nursery stock is produced in controlled environmental conditions, with strict nursery hygiene practices, that are controlled at various stages by BAPHIQ. As a consequence of these measures, high health *Phalaenopsis*

orchid plants are produced. The production system will be subject to audits by the Australian Quarantine and Inspection Service (AQIS).

Furthermore, AQIS will undertake a documentation compliance examination for consignment verification purposes, at the port of entry in Australia, prior to inspection and discharge of the imported *Phalaenopsis* nursery stock shipment. All *Phalaenopsis* nursery stock including their growing media will be subject to inspection on-arrival by AQIS officers. The detection of live insects, disease symptoms or regulated articles will result in the failure of the consignment, and remedial action, including methyl bromide fumigation if live insects are detected.

This report includes a detailed categorisation of the pests associated with *Phalaenopsis* nursery stock in Taiwan, highlighting those pests that are likely to result in economic or environmental consequences should they establish in Australia. Detailed assessments are presented for each organism of quarantine concern and the risk evaluated against Australia's ALOP. For those organisms where the risk posed is too great, specific risk management measures have been recommended.

Biosecurity Australia has made several changes following consideration of stakeholder comments on the *Draft Review of policy: alternative risk management measures to import* Phalaenopsis *nursery stock from Taiwan*. These changes include:

- the removal of the species not known to occur in Taiwan from the pest categorisation as these species are not associated with the importation pathway at the origin;
- the inclusion of perlite, vermiculite and inorganic fibres (as additional growth media) as plants imported in these media are currently allowed entry;
- an increase in the fungicidal and insecticidal treatment time has been extended from 10 days to 14 days prior to export to Australia. This change should give *Phalaenopsis* orchids sufficient time to dry prior to export (which increases their life span) whilst still retaining a residual effect of the treatment at the time of export; and
- the removal of the testing requirement of all tissue culture plantlets produced from mother plants which are tested and found free of viruses. The proposed conditions require that all plants destined for Australia are subject to secure production lines which will maintain their plant health status from tissue culture through to the time of export.

1 Introduction

1.1 Australia's biosecurity policy framework

Australia's biosecurity policies aim to protect Australia against the risks that may arise from exotic pests[1] entering, establishing and spreading in Australia, thereby threatening Australia's unique flora and fauna, as well as those agricultural industries that are relatively free from serious pests.

The pest risk analysis (PRA) process is an important part of Australia's biosecurity policies. It enables the Australian Government to formally consider the risks that could be associated with proposals to import products into Australia. If the risks are found to exceed Australia's appropriate level of protection (ALOP), risk management measures are proposed to reduce the risks to an acceptable level. But, if it is not possible to reduce the risks to an acceptable level, then no trade will be allowed.

Successive Australian Governments have maintained a conservative, but not a zero-risk, approach to the management of biosecurity risks. This approach is expressed in terms of Australia's ALOP, which reflects community expectations through government policy and is currently described as providing a high level of protection aimed at reducing risk to a very low level, but not to zero.

Australia's PRAs are undertaken by Biosecurity Australia using teams of technical and scientific experts in relevant fields, and involves consultation with stakeholders at various stages during the process. Biosecurity Australia provides recommendations for animal and plant quarantine policy to Australia's Director of Animal and Plant Quarantine (the Secretary of the Australian Department of Agriculture, Fisheries and Forestry). The Director or delegate is responsible for determining whether or not an importation can be permitted under the *Quarantine Act 1908*, and if so, under what conditions. The Australian Quarantine and Inspection Service (AQIS) is responsible for implementing appropriate risk management measures.

More information about Australia's biosecurity framework is provided in the *Import Risk Analysis Handbook 2007* (update 2009) located on the Biosecurity Australia website www.daff.gov.au/ba.

1.2 This review of existing policy

Australia has well established policy for the importation of plants from the Orchidaceae family, including *Phalaenopsis* species, from all countries of the world. Imported nursery stock requires mandatory on-arrival fumigation and growth in post-entry quarantine (PEQ) facilities. For certain methyl bromide sensitive species (such as *Phalaenopsis*) an insecticidal dip is used in place of methyl bromide fumigation on arrival. However, if live arthropods are detected on-arrival, the consignment is fumigated with methyl bromide.

Nursery stock represents one of the highest plant quarantine risks, as it can harbour various forms of pathogens and arthropod pests. Many pests have been introduced to new locations on nursery stock; for example, *Phytophthora ramorum*, *Phytophthora kernoviae,* psyllids, aphids, scales, gall wasps and leaf miners.

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[1] A pest is any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products (FAO 2009).

The introduction of plant pathogens, especially pathogens with latent infection, is of particular concern in nursery stock. A range of exotic pathogens can be introduced and established via nursery stock which is imported in a viable state suitable for propagation; for example, '*Candidatus* Liberibacter asiaticus'.

The existing policy for the importation of plants from the Orchidaceae family, including *Phalaenopsis* species, is based on minimising the risk of accidental introduction of any pathogen and arthropod pest associated with the nursery stock.

1.2.1 Background

In June 2006, the Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ) requested that Australia review its import conditions for *Phalaenopsis* orchid nursery stock from Taiwan. Consistent with the *Agreement on the Application of Sanitary and Phytosanitary Measures* (SPS Agreement) Article 4 *Equivalence*, BAPHIQ proposed alternative measures that they consider are equally effective in meeting Australia's requirements.

BAPHIQ's proposed measures include:

- sourcing tissue cultures from disease-free mother plants
- growth of tissue cultures in approved soil free media in BAPHIQ approved quarantine houses in Taiwan under a managed work plan for over four months
- monitoring and quarantine inspection by BAPHIQ during the growing period in the approved production houses
- secure transportation and storage to minimise the risk of pest reinfestation.

Based on these measures, BAPHIQ requested that *Phalaenopsis* orchids be exempt from three months post-entry quarantine in Australia and mandatory insecticide dipping on-arrival in Australia.

Following the official request, and as part of the Australia–Taiwan Agricultural Working Group Meeting held in Taipei, officers from Biosecurity Australia visited an orchid production facility in Taiwan in June 2006. BAPHIQ requested Biosecurity Australia recognise United States Department of Agriculture (USDA) accreditation of the facility.

In October 2008, at the 5th Agricultural Working Group meeting in Taipei, Taiwan indicated that the *Phalaenopsis* orchids are its top market improvement issue.

In July 2009, officers from Biosecurity Australia held technical discussions with BAPHIQ and visited a number of orchid production facilities in Taiwan.

1.2.2 Scope

The scope of this review is limited to:

- identification of biosecurity risks associated with *Phalaenopsis* nursery stock from Taiwan
- evaluation of alternative measures which may be equally effective in meeting Australia's ALOP.

This review does not consider interstate quarantine regulations or pests of regional quarantine concern. States and territories in Australia have restrictions or specific conditions for the entry of nursery stock from other states and territories.

1.2.3 Existing policy

Currently, genera of the Orchidaceae family are permitted entry into Australia, from all countries of the world, subject to specific import conditions. These conditions can be viewed on the AQIS import conditions database ICON at http://www.aqis.gov.au/icon.

All imported consignments of *Phalaenopsis* species (Orchidaceae) nursery stock are subject to risk management measures set out in ICON. The general requirements (Condition C7300: General Import requirements, nursery stock for all species) include:

- an AQIS import permit
- freedom from regulated articles including soil, disease symptoms and other extraneous contamination of quarantine concern
- on-arrival inspection
- mandatory methyl bromide fumigation of plants or alternative insecticidal dip for approved species
- growth under closed quarantine, at a Government post-entry quarantine facility or an AQIS approved private facility, for a minimum of three months.

In addition to these general measures, specific risk management measures that apply to all orchid nursery stock being imported from all countries have been developed (Table 1.1).

Table 1.1 Specific quarantine/biosecurity measures for orchids

Reference number	Condition title
Condition C17937	General guide for the Orchidaceae family
Condition C7302	Nursery stock – Medium risk – Other than Tissue Cultures
Condition C8637	Orchidaceae Nursery Stock – Other than Tissue Culture – Susceptible to Methyl Bromide
Condition C5012	Australian Government of the Environment, Water, Heritage and the Arts legislation under CITES.

2 Method for pest risk analysis

In accordance with the International Plant Protection Convention (IPPC), the technical component of a plant import risk analysis (IRA) is termed a pest risk analysis (PRA). Biosecurity Australia has conducted this PRA in accordance with the International Standards for Phytosanitary Measures (ISPMs), including ISPM 2: *Framework for Pest Risk Analysis* (FAO 2007) and ISPM 11: *Pest Risk Analysis for Quarantine Pests, including analysis of environmental risks and living modified organisms* (FAO 2004).

A PRA is ‘the process of evaluating biological or other scientific and economic evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it’ (FAO 2009). A pest is ‘any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products’ (FAO 2009).

Quarantine risk consists of two major components: the probability of a pest entering, establishing and spreading in Australia from imports; and the consequences should this happen. These two components are combined to give an overall estimate of the risk.

Unrestricted risk is estimated taking into account the existing commercial production practices of the exporting country and that minimal on arrival verification procedures will apply. Restricted risk is estimated with phytosanitary measure(s) applied. A phytosanitary measure is ‘any legislation, regulation or official procedure having the purpose to prevent the introduction and spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests’ (FAO 2009).

A glossary of the terms used is provided at the back of this PRA report.

PRAs are conducted in three consecutive stages.

2.1 Stage 1: Initiation

Initiation identifies the pest(s) and pathway(s) that are of quarantine concern and should be considered for risk analysis in relation to the identified PRA area.

The initiation point for this PRA was the receipt of a technical submission from the National Plant Protection Organisation (NPPO) for improved access to the Australian market for the commodity. This submission included information on the pests associated with the production of the commodity, including the plant part affected, and measures that Taiwan considered equivalent to current import policy.

The pests associated with the crop and the exported commodity were tabulated from information provided by the NPPO of the exporting country and literature and database searches. This information is set out in Appendix A.

For this PRA, the ‘PRA area’ is defined as Australia for pests that are absent, or of limited distribution and under official control.

For pests that had been considered by Biosecurity Australia in other risk assessments and for which import policies already exist, a judgement was made on the likelihood of entry of pests on the commodity and whether existing policy is adequate to manage the risks associated with its import. Where appropriate, the previous policy has been adopted.

2.2 Stage 2: Pest risk assessment

A pest risk assessment (for quarantine pests) is: 'the evaluation of the probability of the introduction and spread of a pest and of the likelihood of associated potential economic consequences' (FAO 2009).

2.2.1 Pest risk assessment of nursery stock

Nursery stock is significantly different from other commodities such as fruit and cut flowers/foliage, in that nursery stock may support all life stages of arthropod pests and pathogens associated with it. With few exceptions, these arthropod pests and pathogens are able to develop, reproduce and complete their life cycle without leaving the host.

Unlike fruit and vegetable commodities, which are perishable, nursery stock is generally used for propagation. Propagative material is of high value and a large investment is made in its health and survival. Therefore, nursery stock presents a higher risk than perishable commodities.

In this PRA, pest risk assessment was divided into the following interrelated processes:

2.2.2 Pest categorisation

Pest categorisation identifies which of the pests identified in Stage 1 require a pest risk assessment. The categorisation process examines, for each pest, whether the criteria in the definition for a quarantine pest are satisfied. A 'quarantine pest' is 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, as defined in ISPM 5: *Glossary of phytosanitary terms* (FAO 2009).

The pests identified in Stage 1 were categorised using the following primary elements to identify the quarantine pests for the commodity being assessed:

- identity of the pest
- presence or absence in the PRA area
- regulatory status
- potential for establishment and spread in the PRA area
- potential for economic consequences (including environmental consequences) in the PRA area.

The results of pest categorisation are set out in Appendix A. The quarantine pests identified during pest categorisation were carried forward for pest risk assessment and are listed in Table 4.1.

2.2.3 Assessment of the probability of entry, establishment and spread

Details of how to assess the 'probability of entry', 'probability of establishment' and 'probability of spread' of a pest are given in ISPM 11 (FAO 2004). A summary of this process is given below, followed by a description of the qualitative methodology used in this PRA.

Probability of entry

The probability of entry describes the probability that a quarantine pest will enter Australia as a result of trade in a given commodity, be distributed in a viable state in the PRA area and subsequently be transferred to a host. It is based on pathway scenarios depicting necessary steps in the sourcing of the commodity for export, its processing, transport and storage, its use in Australia and the generation and disposal of waste. In particular, the ability of the pest to survive is considered for each of these various stages.

The probability of entry estimates for the quarantine pests for a commodity are based on the use of the existing commercial production, packaging and shipping practices of the exporting country. Details of the existing commercial production practices for the commodity are set out in Section 3. These practices are taken into consideration by Biosecurity Australia when estimating the probability of entry.

For the purpose of considering the probability of entry, Biosecurity Australia divides this step of this stage of the PRA into two components:

- **Probability of importation**: the probability that a pest will arrive in Australia when a given commodity is imported
- **Probability of distribution**: the probability that the pest will be distributed, as a result of the processing, sale or disposal of the commodity, in the PRA area and subsequently transfer to a susceptible part of a host.

Factors considered in the probability of importation include:

- distribution and incidence of the pest in the source area
- occurrence of the pest in a life-stage that would be associated with the commodity
- volume and frequency of movement of the commodity along each pathway
- seasonal timing of imports
- pest management, cultural and commercial procedures applied at the place of origin
- speed of transport and conditions of storage compared with the duration of the lifecycle of the pest
- vulnerability of the life-stages of the pest during transport or storage
- incidence of the pest likely to be associated with a consignment
- commercial procedures (e.g. refrigeration) applied to consignments during transport and storage in the country of origin, and during transport to Australia.

Factors considered in the probability of distribution include:

- commercial procedures (e.g. refrigeration) applied to consignments during distribution in Australia
- dispersal mechanisms of the pest, including vectors, to allow movement from the pathway to a host
- whether the imported commodity is to be sent to a few or many destination points in the PRA area
- proximity of entry, transit and destination points to hosts
- time of year at which import takes place
- intended use of the commodity (e.g. for planting, processing or consumption)

- risks from by-products and waste.

As nursery stock would be distributed throughout Australia and planted directly into suitable habitats there is often no need for these pests to be transported to a suitable host.

Probability of establishment

Establishment is defined as the 'perpetuation for the foreseeable future, of a pest within an area after entry' (FAO 2004). In order to estimate the probability of establishment of a pest, reliable biological information (lifecycle, host range, epidemiology, survival, etc.) is 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.

Factors considered in the probability of establishment in the PRA area include:

- availability of hosts, alternative hosts and vectors
- suitability of the environment
- reproductive strategy and potential for adaptation
- minimum population needed for establishment
- cultural practices and control measures.

Probability of spread

Spread is defined as 'the expansion of the geographical distribution of a pest within an area' (FAO 2004). The probability of spread considers the factors relevant to the movement of the pest, after establishment on a host plant or plants, to other susceptible host plants of the same or different species in other areas. In order to estimate the probability of spread of the pest, reliable biological information is obtained from areas where the pest currently occurs. The situation in the PRA area is then carefully compared with that in the areas where the pest currently occurs and expert judgement used to assess the probability of spread.

Factors considered in the probability of spread include:

- suitability of the natural and/or managed environment for natural spread of the pest
- presence of natural barriers
- potential for movement with commodities, conveyances or by vectors
- intended use of the commodity
- potential vectors of the pest in the PRA area
- potential natural enemies of the pest in the PRA area.

Assigning qualitative likelihoods for the probability of entry, establishment and spread

In its qualitative PRAs, Biosecurity Australia uses the term 'likelihood' for the descriptors it uses for its estimates of probability of entry, establishment and spread. Qualitative likelihoods are assigned to each step of entry, establishment and spread. Six descriptors are used: high; moderate; low; very low; extremely low; and negligible (Table 2.1). Definitions for these descriptors and their indicative probability ranges are given in Table 2.1. The indicative probability ranges are only provided to illustrate the boundaries of the descriptors. These indicative probability ranges are not used beyond this purpose in qualitative PRAs. The standardised likelihood descriptors and the associated indicative probability ranges provide guidance to the risk analyst and promote consistency between different risk analyses.

Table 2.1 Nomenclature for qualitative likelihoods

Likelihood	Descriptive definition	Indicative probability (P) range
High	The event would be very likely to occur	0.7 < P ≤ 1
Moderate	The event would occur with an even probability	0.3 < P ≤ 0.7
Low	The event would be unlikely to occur	0.05 < P ≤ 0.3
Very low	The event would be very unlikely to occur	0.001 < P ≤ 0.05
Extremely low	The event would be extremely unlikely to occur	0.000001 < P ≤ 0.001
Negligible	The event would almost certainly not occur	0 ≤ P ≤ 0.000001

The likelihood of entry is determined by combining the likelihood that the pest will be imported into the PRA area and the likelihood that the pest will be distributed within the PRA area, using a matrix of rules (Table 2.2). This matrix is then used to combine the likelihood of entry and the likelihood of establishment, and the likelihood of entry and establishment is then combined with the likelihood of spread to determine the overall likelihood of entry, establishment and spread.

For example, if the probability of importation is assigned a likelihood of 'low' and the probability of distribution is assigned a likelihood of 'moderate', then they are combined to give a likelihood of 'low' for the probability of entry. The likelihood for the probability of entry is then combined with the likelihood assigned to the probability of establishment (e.g. 'high') to give a likelihood for the probability of entry and establishment of 'low'. The likelihood for the probability of entry and establishment is then combined with the likelihood assigned to the probability of spread (e.g. 'very low') to give the overall likelihood for the probability of entry, establishment and spread of 'very low'.

Table 2.2 Matrix of rules for combining qualitative likelihoods

	High	Moderate	Low	Very low	Extremely low	Negligible
High	High	Moderate	Low	Very low	Extremely low	Negligible
Moderate		Low	Low	Very low	Extremely low	Negligible
Low			Very low	Very low	Extremely low	Negligible
Very low				Extremely low	Extremely low	Negligible
Extremely low					Negligible	Negligible
Negligible						Negligible

Time and volume of trade

One factor affecting the likelihood of entry is the volume and duration of trade. If all other conditions remain the same, the overall likelihood of entry will increase as time passes and the overall volume of trade increases.

Biosecurity Australia normally considers the likelihood of entry on the basis of the estimated volume of one year's trade. This is a convenient value for the analysis that is relatively easy to estimate and allows for expert consideration of seasonal variations in pest presence, incidence and behaviour to be taken into account. The consideration of the likelihood of entry, establishment and spread and subsequent consequences takes into account events that might happen over a number of years even though only one year's volume of trade is being considered. This difference reflects biological and ecological facts, for example where a pest or disease may establish in the year of import but spread may take many years.

The use of a one year volume of trade has been taken into account when setting up the matrix that is used to estimate the risk and therefore any policy based on this analysis does not simply apply to one year of trade. Policy decisions that are based on Biosecurity Australia's method that uses the estimated volume of one year's trade are consistent with Australia's policy on appropriate level of protection and meet the Australian Government's requirement for ongoing quarantine protection. Of course, if there are substantial changes in the volume and nature of the trade in specific commodities then Biosecurity Australia has an obligation to review the risk analysis and, if necessary, provide updated policy advice.

In assessing the volume of trade in this PRA, Biosecurity Australia assumed that a substantial volume of trade will occur.

2.2.4 Assessment of potential consequences

The objective of the consequence assessment is to provide a structured and transparent analysis of the likely consequences if the pests or disease agents were to enter, establish and spread in Australia. The assessment considers direct and indirect pest effects and their economic and environmental consequences. The requirements for assessing potential consequences are given in Article 5.3 of the SPS Agreement (WTO 1995), ISPM 5 (FAO 2009) and ISPM 11 (FAO 2004).

Direct pest effects are considered in the context of the effects on:

- plant life or health
- other aspects of the environment.

Indirect pest effects are considered in the context of the effects on:

- eradication, control, etc
- domestic trade
- international trade
- the environment.

For each of these six criteria, the consequences were estimated over four geographic levels, defined as:

- **Local**: an aggregate of households or enterprises (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 or territory, such as 'Far North Queensland').
- **Regional**: a geographically or geopolitically associated collection of districts in a geographic area (generally a state or territory, although there may be exceptions with larger states such as Western Australia).
- **National**: Australia wide (Australian mainland states and territories and Tasmania).

For each criterion, the magnitude of the potential consequence at each of these levels was described using four categories, defined as:

- **Indiscernible**: pest impact unlikely to be noticeable.
- **Minor significance**: expected to lead to a minor increase in mortality/morbidity of hosts or a minor decrease in production but not expected to threaten the economic viability of production. Expected to decrease the value of non-commercial criteria but not threaten the criterion's intrinsic value. Effects would generally be reversible.
- **Significant**: expected to threaten the economic viability of production through a moderate increase in mortality/morbidity of hosts, or a moderate decrease in production. Expected to significantly diminish or threaten the intrinsic value of non-commercial criteria. Effects may not be reversible.
- **Major significance**: expected to threaten the economic viability through a large increase in mortality/morbidity of hosts, or a large decrease in production. Expected to severely or irreversibly damage the intrinsic 'value' of non-commercial criteria.

Values were translated into a qualitative impact score (A–G)[2] using Table 2.3.

Table 2.3 Decision rules for determining the consequence impact score based on the magnitude of consequences at four geographic scales

Impact score	Local	District	Region	Nation
G	Major significance	Major significance	Major significance	Major significance
F	Major significance	Major significance	Major significance	Significant
E	Major significance	Major significance	Significant	Minor significance
D	Major significance	Significant	Minor significance	Indiscernible
C	Significant	Minor significance	Indiscernible	Indiscernible
B	Minor significance	Indiscernible	Indiscernible	Indiscernible
A	Indiscernible	Indiscernible	Indiscernible	Indiscernible

Geographic scale

The overall consequence for each pest is achieved by combining the qualitative impact scores (A–G) for each direct and indirect consequence using a series of decision rules (Table 2.4). These rules are mutually exclusive, and are assessed in numerical order until one applies.

Table 2.4 Decision rules for determining the overall consequence rating for each pest

Rule	The impact scores for consequences of direct and indirect criteria	Overall consequence rating
1	Any criterion has an impact of 'G'; or more than one criterion has an impact of 'F'; or a single criterion has an impact of 'F' and each remaining criterion an 'E'.	Extreme
2	A single criterion has an impact of 'F'; or all criteria have an impact of 'E'.	High
3	One or more criteria have an impact of 'E'; or all criteria have an impact of 'D'.	Moderate

[2] In earlier qualitative IRAs, the scale for the impact scores went from A to F and did not explicitly allow for the rating 'indiscernible' at all four levels. This combination might be applicable for some criteria. In this report, the impact scale of A-F has changed to become B–G and a new lowest category A ('indiscernible' at all four levels) was added. The rules for combining impacts in Table 2.4 were adjusted accordingly.

Rule	The impact scores for consequences of direct and indirect criteria	Overall consequence rating
4	One or more criteria have an impact of 'D'; or all criteria have an impact of 'C'.	Low
5	One or more criteria have an impact of 'C'; or all criteria have an impact of 'B'.	Very Low
6	One or more but not all criteria have an impact of 'B', and all remaining criteria have an impact of 'A'.	Negligible

2.2.5 Estimation of the unrestricted risk

Once the above assessments are completed, the unrestricted risk can be determined for each pest or groups of pests. This is determined by using a risk estimation matrix (Table 2.5) to combine the estimates of the probability of entry, establishment and spread and the overall consequences of pest establishment and spread. Therefore, risk is the product of likelihood and consequence.

When interpreting the risk estimation matrix, note the descriptors for each axis are similar (e.g. low, moderate, high) but the vertical axis refers to likelihood and the horizontal axis refers to consequences. Accordingly, a 'low' likelihood combined with 'high' consequences, is not the same as a 'high' likelihood combined with 'low' consequences—the matrix is not symmetrical. For example, the former combination would give an unrestricted risk rating of 'moderate', whereas, the latter would be rated as a 'low' unrestricted risk.

Table 2.5 Risk estimation matrix

Likelihood of pest entry, establishment and spread	Negligible	Very low	Low	Moderate	High	Extreme
High	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	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk

Consequences of pest entry, establishment and spread

2.2.6 Australia's appropriate level of protection (ALOP)

The SPS Agreement defines the concept of an 'appropriate level of sanitary or phytosanitary protection ' 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. The band of cells in Table 2.5 marked 'very low risk' represents Australia's ALOP.

2.3 Stage 3: Pest risk management

Pest risk management describes the process of identifying and implementing phytosanitary measures to manage risks to achieve Australia's ALOP, while ensuring that any negative effects on trade are minimised.

The conclusions from pest risk assessment are used to decide whether risk management is required and if so, the appropriate measures to be used. Where the unrestricted risk estimate exceeds Australia's ALOP, risk management measures are required to reduce this risk to a very low level. The guiding principle for risk management is to manage risk to achieve Australia's ALOP. The effectiveness of any proposed phytosanitary measure (or combination of measures) is evaluated, using the same approach as used to evaluate the unrestricted risk, to ensure it reduces the restricted risk for the relevant pest or pests to meet Australia's ALOP.

ISPM 11 (FAO 2004) 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 entry of the pest.

Examples given of measures commonly applied to traded commodities include:

- options for consignments – e.g., inspection or testing for freedom from pests, 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 – if no satisfactory measure can be found.

Risk management measures are identified for each quarantine pest where the risk exceeds Australia's ALOP. These are presented in the 'Pest Risk Management' section of this report.

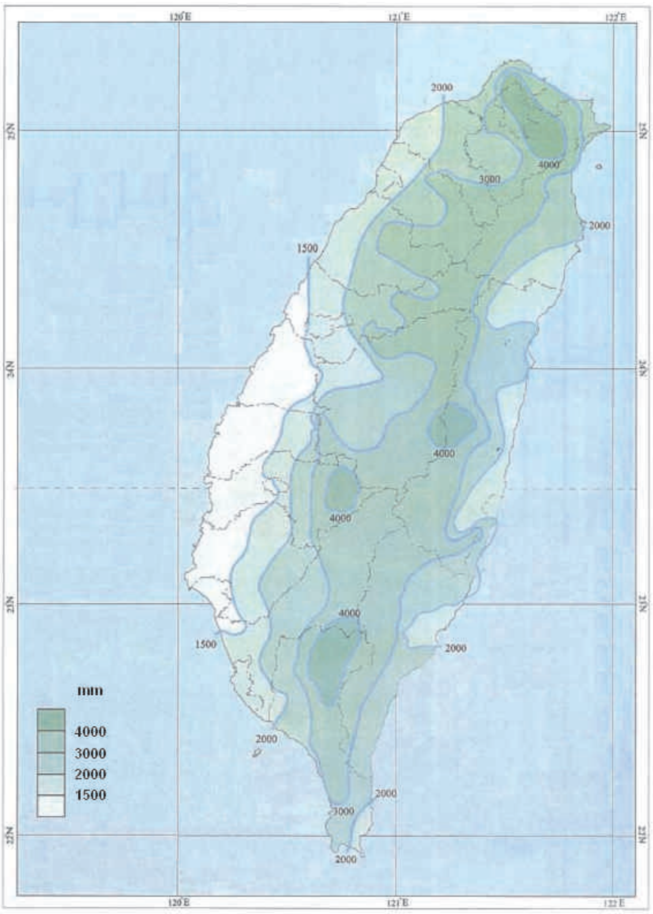
3 Taiwan's commercial production practices for *Phalaenopsis* orchid nursery stock

This chapter provides information on the pre-harvest, harvest and post-harvest practices of Taiwan for *Phalaenopsis* orchid nursery stock considered to be commercial production practices. The export capacity of Taiwan is also outlined.

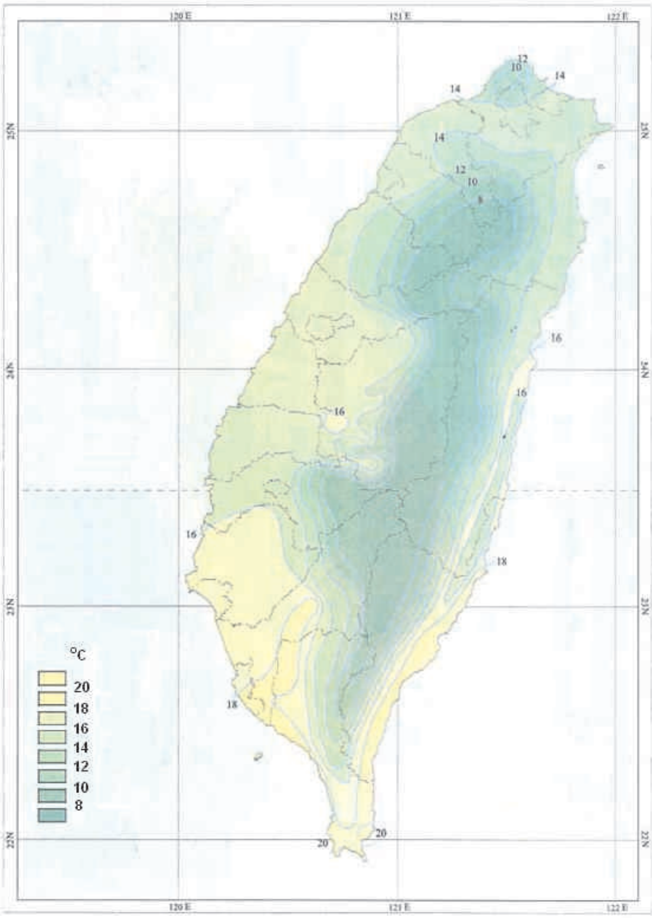
3.1 Climate in production areas

The island of Taiwan has a climate characterised by tropical monsoon conditions. Annual rainfall is generally above 2 000 mm in the lowlands and increases with altitude (Figure 3.1a). Rainfall occurs throughout the year, but may increase from July to September due to the typhoon season (BBC 2009). Winter in the north of the island is marked by more cloud and rain than the south of the island (BBC 2009). At lower elevations humidity increases during the summer months (BBC 2009). Orchid production is concentrated, but not limited to, the south-east of the island; a number of large producers grow in the mountainous interior and other parts of the island.

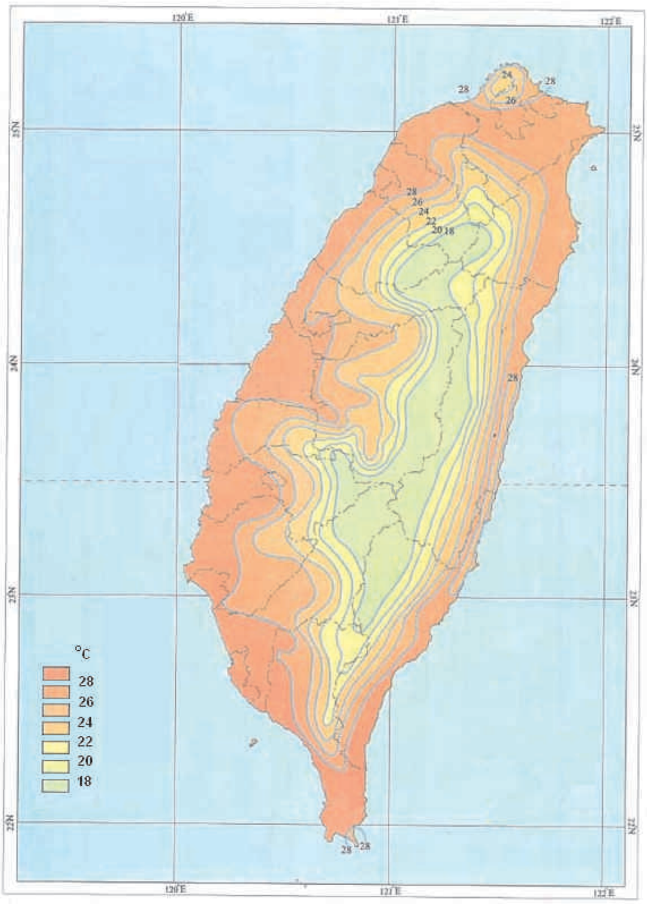
Figure 3.1: Climate in Taiwan: a) annual rainfall, b) January average temperatures, and c) July average temperatures (NICT 2009)



(a)


120°E
121°E
122°E
25°N
24°N
23°N
22°N
°C
20
18
16
14
12
10
8

b)


120°E
121°E
122°E
25°N
24°N
23°N
22°N
°C
28
26
24
22
20
18

c)

3.2 Pre-harvest

3.2.1 Production practices

Phalaenopsis orchids for exports are hybrid species bred for their ornamental value and specific flower colour and patterns.

Phalaenopsis orchids for export are produced through tissue culture of mother plants. Mother plants are routinely virus tested, using indirect Enzyme-linked immuno-sorbent assay (ELISA) testing, for Cymbidium mosaic virus and Odontoglossom ring spot virus prior to tissue culture.

When ready for planting out, the tissue cultured plants are transported in flasks to the growing houses where they are de-flasked and planted into individual containers using a variety of growing media. Growth media may, or may not be treated depending on the producer, and export market.

All production facilities can demonstrate full trace back of exported plants to the original mother stock, allowing identification of the pathway should any non-compliance issues be detected on arrival in Australia.

3.2.2 Cultivation practices

Growing houses are constructed of double skin polyethylene sheeting, with no visible apertures for insect entry. Quarantine size mesh is used to screen ventilation openings and other areas that might be at risk of insect entry (such as spaces between individual rooms within the growing area complex). Double entry doors are used; the area between the doors is large enough to accommodate a large number of people (20–30) or trolley loads of plants and/or equipment. Foot baths are employed at the entry to the growing houses.

All potting of plants and re-potting into larger size containers is done within the quarantine facility. Watering and feeding of plants is performed either manually or through automated systems, and water undergoes reverse osmosis treatment prior to use.

Insecticidal and fungicidal treatments may be used by individual growers, but practices vary. Some growers spray regularly as a preventative treatment, while others spray only as required. In some markets plants for export are treated with a broad spectrum insecticide and fungicide prior to export.

BAPHIQ inspectors inspect the plants during their growth, ensure the above treatments are applied and supervise the packing of the plants for export. Exported plants are covered by BAPHIQ phytosanitary certification. BAPHIQ advised that they would not certify any plants that showed disease-like symptoms.

3.3 Export capability

3.3.1 Production and export statistics

Taiwan’s export trade in *Phalaenopsis* orchids is well established (COA 2007). Taiwan’s leading export market for *Phalaenopsis* orchids is Japan followed by the US, and the Netherlands (Table 3.1). The export of *Phalaenopsis* orchids from Taiwan in 2006 was worth a total of AU$35.6 million, an increase of 52% from the 2005 export season (Reinders 2007).

This export value was expected to continue to increase in subsequent years. It is estimated that Taiwan's world market share for *Phalaenopsis* orchids is 20% of global consumption (Reinders 2007).

Table 3.1: Value of leading export markets for *Phalaenopsis* orchids from Taiwan (Reinders 2007).

Destination	Market Value
Japan	AU$15.9 million
United States	AU$13.5 million
The Netherlands	AU$2.5 million

3.3.2 Export season

Phalaenopsis orchids are produced year round in growing houses. Peak production times are in spring (April–June) and autumn (September–November).

4 Pest risk assessments for quarantine pests

Quarantine pests associated with *Phalaenopsis* orchids from Taiwan are identified in Appendix A. This chapter assesses the probability of the introduction and spread of these pests and the likelihood of associated potential economic consequences.

4.1 Quarantine pests for pest risk assessment

The quarantine pests for *Phalaenopsis* nursery stock have been determined by establishing the pathway association, comparison of the pests recorded in Australia and Taiwan (present or absent, or present but with a limited distribution and under official control), the potential for establishment or spread and associated consequences.

The quarantine pests of *Phalaenopsis* orchids, determined through this process of pest categorisation are listed in Table 4.1..

Table 4.1 Quarantine pests of *Phalaenopsis* orchids from Taiwan

Pest	Common name
ARTHROPODS	
Orgyia postica (Walker) [Lepidoptera: Lymantriidae] [EP]	Tussock moth
Frankliniella intonsa (Trybom) [Thysanoptera: Thripidae] [EP]	Eastern flower thrips
MOLLUSCA	
Bradybaena tourannensis (Souleyet) [Eupulmonata: Bradybaenidae]	Snail
PATHOGENS	
Fungi	
Cylindrosporium phalaenopsidis Sawada [Unassigned]	Leaf spot
Sphaerulina phalaenopsidis Sawada [Mycosphaerellaceae]	Leaf spot
Viruses	
Phalaenopsis chlorotic spot virus [Rhabdoviridae: *Potyvirus*]	Phalaenopsis chlorotic spot virus

[EP] pests for which policy already exists

Risk assessments are presented in this review for each of the quarantine pests identified through the process of pest categorisation. Each risk assessment involves the ‘assessment of the probability of entry, establishment and spread’ and ‘assessment of consequences’ as described in Section 2 – Method for Pest Risk Analysis.

4.2 Tussock moth

Tussock moth (*Orgyia postica*) is polyphagous and is an important defoliating pest of commercial crops including durian, eucalypts, longan, lychee, mango, mangosteen, poplar, rambutan, roses and table grapes (Nasu *et al.* 2004; CABI 2007). Females are flightless and cling to the exterior of their cocoons, releasing pheromones to attract mates (Wakamura *et al.* 2005). Eggs hatch after about 5–6 days, and the resulting male larvae take 15–26 days to become fully grown; the larger female larvae take 15–28 days (Sanchez and Laigo 1968). The female and male pupal stages last 4–5 and 6–7 days, respectively (Sanchez and Laigo 1968). Optimum temperature for egg hatch is 25 °C, and for larval development is 25–30 °C (Cheng *et al.* 2001).

Orgyia postica was previously assessed in the *Policy for the Importation of Fresh Mangoes* (Mangifera indica *L.*) *from Taiwan* (Biosecurity Australia 2006) under its synonym, *Orgyia australis postica* (Walker). The assessment presented here builds on the previous assessment.

The probability of importation and of distribution for *O. postica* was rated as 'moderate' in the pest risk assessment conducted in the Taiwanese mango IRA (Biosecurity Australia 2006).

Once *O. postica* has entered Australia and transferred to a suitable host, the commodity on which it is imported is not likely to affect the probability of establishment, spread or consequences. Accordingly, there is no need to re-assess these components. However, differences in production practices and the import pathway make it necessary to re-assess the likelihood of *O. postica* entering Australia with trade in *Phalaenopsis* nursery stock from Taiwan.

4.2.1 Re-assessment of probability of entry

Probability of importation

The likelihood that *O. postica* will arrive in Australia with the importation of *Phalaenopsis* nursery stock from Taiwan is **LOW**.

- *Orgyia postica* is present in Taiwan (BAPHIQ 2006) and has been recorded on the leaves and stems of *Phalaenopsis* species (Wang and Lin 1997).
- Eggs of *Orgyia* spp. are quite small and individually may be difficult to detect during routine visual inspection. The eggs of congeneric species *Orgyia pseudotsugata* range in diameter from 0.88–1.28 mm (CABI 2007). Female *O. postica* deposit a mass of 300–501 eggs (Cheng *et al.* 2001) on the cocoon of the recently emerged adult (Sanchez and Liago 1968), which would increase the chances of detection.
- Mature larvae and pupa of *Orgyia* spp. are quite large and their presence would be relatively easy to detect. Mature larvae grow up to 30–40 mm in length (CABI 2007).
- Pupation occurs on leaves and stems (Sanchez and Liago 1968) and emerging adult males have a wingspan of 21–30 mm (CABI 2007).
- Optimum temperature for egg hatch is 25 °C, and is 25–30 °C for larval development (Cheng *et al.* 2001).
- *Phalaenopsis* nursery stock is expected to be shipped at moderate temperatures and humidity which is unlikely to adversely affect any *O. postica* populations that are present during shipment.

Probability of distribution

The likelihood that *O. postica* will be distributed within Australia in a viable state, as a result of the processing, sale or disposal of *Phalaenopsis* nursery stock from Taiwan is **HIGH**.

- *Orgyia postica* is able to develop, reproduce and complete its life cycle without leaving the host. As *Phalaenopsis* nursery stock would be distributed throughout Australia and planted directly into suitable habitats there is no need for this pest to be transported to a suitable host.

4.2.2 Probability of entry (importation x distribution)

The probability of entry is determined by combining the probability of importation with the probability of distribution using the matrix of rules shown in Table 2.2.

The probability that *O. postica* will arrive in Australia, be distributed within the PRA area and transferred to a suitable host as a result of trade in *Phalaenopsis* nursery stock from Taiwan is **LOW**.

4.2.3 Probability of establishment and of spread

As indicated above, the probability of establishment and of spread for *O. postica* will be the same as those assessed for mangoes from Taiwan (Biosecurity Australia 2006). The ratings from the previous assessments are presented below:

Probability of establishment:	**MODERATE**
Probability of spread:	**MODERATE**

4.2.4 Overall probability of entry, establishment and spread

The probability of entry, establishment and spread is determined by combining the probabilities of entry, of establishment and of spread using the matrix of 'rules' for combining descriptive probabilities shown in Table 2.2.

The likelihood that *O. postica* will be imported as a result of trade in *Phalaenopsis* nursery stock from Taiwan, be distributed in a viable state to a susceptible host, establish and spread within Australia is **LOW**.

4.2.5 Consequences

The consequences of the establishment of *O. postica* have been estimated previously for mangoes from Taiwan (Biosecurity Australia 2006). This estimate of impact scores is provided below:

Plant life or health	**D** – minor significance at the regional level
Other aspects of the environment	**B** – minor significance at the local level
Eradication, control, etc.	**C** – minor significance at the district level
Domestic trade	**C** – significant at the local level
International trade	**D** – significant at the district level
Environment	**B** – minor significance at the local level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are '**D**', the overall consequences are estimated to be **LOW**.

4.2.6 Unrestricted risk estimate

The unrestricted risk estimate for *Orgyia postica* is **VERY LOW**.

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the outcome of overall consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

The unrestricted risk estimate for *O. postica* of 'very low risk' is below Australia's ALOP. Therefore, specific risk management measures are not required for this species.

4.3 Eastern flower thrips

Eastern flower thrips (*Frankliniella intonsa*) has a wide host range and has been recorded on 146 plant species (Miyazaki and Kudo 1988). It normally occurs together with other Thripidae in flowers and is highly dependent on pollen for reproduction (Murai and Ishii 1982). Flower thrips are known to overwinter in a state of reproductive diapause (Murai 1988) and produce 22 generations per year in favourable conditions (CABI 2007). Thrips are not considered to be strong fliers and are believed to be incapable of directional flight in anything but the slightest breeze (Pearsall and Myers 2001). Eastern flower thrips have been introduced to other countries through cut flowers and nursery stock, and have been intercepted on *Phalaenopsis* nursery stock from Taiwan to the USA (USDA 2003).

Frankliniella intonsa was previously assessed in the *Provisional final import risk analysis report for fresh unshu mandarin fruit from Japan* (Biosecurity Australia 2009). The assessment presented here builds on the previous assessment.

The probability of importation and of distribution for *F. intonsa* was rated as 'moderate' in the pest risk assessment conducted in the unshu mandarin IRA (Biosecurity Australia 2009).

Once *F. intonsa* has entered Australia and transferred to a suitable host, the commodity on which it is imported is not likely to affect the probability of establishment, spread, or consequences. Accordingly, there is no need to re-assess these components. However, differences in the pathway, production practices, climatic conditions and prevalence of the pests in the exporting country make it necessary to re-assess the likelihood of *F. intonsa* entering Australia with trade in *Phalaenopsis* nursery stock from Taiwan.

4.3.1 Re-assessment of probability of entry

Probability of importation

The likelihood that *F. intonsa* will arrive in Australia with the importation *Phalaenopsis* nursery stock from Taiwan is **HIGH**.

- *Frankliniella intonsa* is associated with the flowers, leaves and stems of *Phalaenopsis* in Taiwan (BAPHIQ 2001).
- Thrips are small and inconspicuous, and may be difficult to detect during routine visual inspection, particularly in low numbers. Adult *Frankliniella* spp. range in length from 1.0–1.5 mm (Hill 1987)
- Eggs of *Frankliniella* spp. are small (about 200 µm long) and are inserted into the host plant tissues, usually in the buds, flowers or unfurled leaves (CABI 2007; Hill 1987).
- Damage may appear as abnormal flower colouring and distortion of leaves and flowers (CABI 2007; Hill 1987), which at low levels would be difficult to detect.
- The lifespan of an adult female *F. intonsa* is up to 49 days (CABI 2007), which would exceed the duration of transport.
- Optimum temperature for oviposition is 28 °C (Tang 1976).

- *Phalaenopsis* nursery stock is expected to be shipped at moderate temperatures and humidity which is unlikely to adversely affect any *F. intonsa* populations that are present during shipment.
- *Frankliniella intonsa* has been intercepted on *Phalaenopsis* nursery stock from Taiwan to the USA (USDA 2003).

Probability of distribution

The likelihood that *F. intonsa* will be distributed within Australia in a viable state, as a result of the processing, sale or disposal of *Phalaenopsis* nursery stock from Taiwan is **HIGH**.

- *Frankliniella intonsa* is able to reproduce and complete its nymphal life stages without leaving the host. Pupation in *Frankliniella* spp. can take place in soil (Hill 1987), in the surface layer of dead leaves beneath a plant or on the plant itself (CABI 2007).
- As *Phalaenopsis* nursery stock would be distributed throughout Australia and planted directly into suitable habitats there is no need for this pest to be transported to a suitable host.

4.3.2 Probability of entry (importation x distribution)

The probability of entry is determined by combining the probability of importation with the probability of distribution using the matrix of rules shown in Table 2.2.

The probability that *F. intonsa* will arrive in Australia, be distributed within the PRA area and transferred to a suitable host as a result of *Phalaenopsis* nursery stock from Taiwan is **HIGH**.

4.3.3 Probability of establishment and of spread

As indicated above, the probability of establishment and of spread for *F. intonsa* will be the same as those assessed for unshu mandarins from Japan (Biosecurity Australia 2009). The ratings from the previous assessments are presented below:

Probability of establishment: **HIGH**

Probability of spread: **HIGH**

4.3.4 Overall probability of entry, establishment and spread

The probability of entry, establishment and spread is determined by combining the probabilities of entry, of establishment and of spread using the matrix of 'rules' for combining descriptive probabilities shown in Table 2.2.

The likelihood that *F. intonsa* will be imported as a result of trade in *Phalaenopsis* nursery stock from Taiwan, be distributed in a viable state to a susceptible host, establish and spread within Australia is **HIGH**.

4.3.5 Consequences

The consequences of the establishment of thrips have been estimated previously for unshu mandarins from Japan (Biosecurity Australia 2009). This estimate of impact scores is provided below:

Plant life or health **D** – significant at the district level

Other aspects of the environment	**B** – minor significance at the local level
Eradication, control, etc.	**D** – significant at the district level
Domestic trade	**D** – significant at the district level
International trade	**D** – significant at the district level
Environment	**B** – minor significance at the local level

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are '**D**', the overall consequences are estimated to be **LOW**.

4.3.6 Unrestricted risk estimate

The unrestricted risk estimate for *Frankliniella intonsa* is **LOW**.

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the outcome of overall consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

The unrestricted risk estimate for *F. intonsa* of 'low' exceeds Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.4 Snail

The snail (*Bradybaena tourannensis*) has a tropical distribution and is recorded on more than 10 families of plants including herbaceous and tree species (Lai 1984). Although the adults may be large and easily detected, the eggs are small. Snails may chew irregular holes with smooth edges in succulent foliage and some can clip succulent plant parts (Ohlendorf 1999). Snails feed on foliage, flowers and fruit from various plant species, especially in greenhouses (Godan 1983).

4.4.1 Probability of entry

Probability of importation

The likelihood that *B. tourannensis* will arrive in Australia with the importation of *Phalaenopsis* nursery stock from Taiwan is **MODERATE**.

- *Bradybaena tourannensis* is present in Taiwan (Anon. 2009) and is associated with the flowers, leaves and stems of host plants, including *Phalaenopsis* (USDA 2003).
- Adult *B. tourannensis* are large (20 mm shell) and would be easily detected during routine visual inspection (Wu *et al.* 2007).
- Previous research also suggests that adult snails are likely to be dislodged from plants prior to importation (Godan 1983; Ohlendorf 1999).
- Molluscs are also detectable by slime trails, chewed leaves and excrement (Hollingwoth and Sewake 2002).
- In contrast to the adult stage, eggs of *Bradybaena* spp. are small and inconspicuous, and would be difficult to detect during routine visual inspection, particularly in low numbers. The eggs of congeneric species *Bradybaena similaris* are spherical, clear and gelatinous

measuring approximately 2 mm in diameter and are laid together in tight clusters in the soil (GSMFC 2003).

- *Bradybaena tourannensis* has been intercepted on bare-rooted *Phalaenopsis* plants imported into the United States (USDA 2003).
- *Phalaenopsis* nursery stock is expected to be shipped at moderate temperatures and humidity which is unlikely to adversely affect any *B. tourannensis* that are present during shipment.

Probability of distribution

The likelihood that *B. tourannensis* will be distributed within Australia in a viable state, as a result of the processing, sale or disposal of *Phalaenopsis* nursery stock from Taiwan is **HIGH**.

- *Bradybaena tourannensis* is able to survive and reproduce without leaving the host. Eggs of *Bradybaena* spp.; however, are likely to be laid in soil (GSMFC 2003; USDA 2003).
- As *Phalaenopsis* nursery stock would be distributed throughout Australia and planted directly into suitable habitats there is no need for *B. tourannensis* to be transported to a suitable host.

4.4.2 Probability of entry (importation x distribution)

The probability of entry is determined by combining the probability of importation with the probability of distribution using the matrix of rules shown in Table 2.2.

The probability that snails will arrive in Australia, be distributed within the PRA area and transferred to a suitable host as a result of *Phalaenopsis* nursery stock from Taiwan is **MODERATE**.

4.4.3 Probability of establishment

The likelihood that the snail will establish within Australia, based on a comparison of factors in the source and destination areas considered pertinent to its survival and reproduction is **HIGH**.

- The host range reported for *B. tourannensis* consists of species from more than 10 plant families, including herbaceous plants and trees (Lai 1984).
- *Acacia, Adenanthera, Albizzia, Cocos, Morus* and *Phalaenopsis* spp. are hosts for the snail (USDA 2003). Potential hosts are widely distributed in suburban and natural environments within Australia (AVH 2009).
- *Bradybaena tourannensis* occurs in Taiwan (Anon. 2009). There are similar climatic regions in parts of Australia that would be suitable for the establishment of *B. tourannensis* (Peel *et al.* 2007).
- *Bradybaena tourannensis* is expected to behave like other gastropods and be hermaphroditic, relying on sexual reproduction (Wiwegweaw *et al.* 2009)—i.e. requiring two individuals.
- Sexual material is exchanged between both snails via a spermatophore (Wiwegweaw *et al.* 2009), which can then be stored in the spermatheca. After exchange of spermatozoa, both snails will lay fertilized eggs after a period of gestation, which then proceed to hatch after a development period.

- Common cultural practices and control methods may hamper the establishment of *B. tourannensis* in Australia. Homemade traps, baited snail pellets and sprays are used commonly, although not uniformly, in Australia as a means of controlling mollusc pests.

4.4.4 Probability of spread

The likelihood that the snail will spread within Australia, based on a comparison of those factors in the source and destination areas considered pertinent to the expansion of the geographic distribution of the pest is **HIGH**.

- In its natural range in Taiwan, *B. tourannensis* occurs in temperate climatic regions with a hot summer, without a dry season (Peel *et al.* 2007).
- There are similar climatic regions in parts of eastern Australia that would facilitate the spread of this pest (Peel *et al.* 2007).
- Host plants that may support the spread of *B. tourannensis* are distributed in suburban and natural environments within Australia (AVH 2009).
- The presence of natural barriers such as long distances between suitable hosts, arid areas, mountain ranges and climatic differentials may limit the ability of *B. tourannensis* to spread to new areas unaided.
- Wu (1982) reported that since its discovery in southern Taiwan, *B. tourannensis* had not spread to other areas of Asia. However, Wu *et al.* (2007) describes the species as being widespread in south-eastern Asia and newly recorded on Dongsha Island in the South China Sea.
- Adults and juveniles move slowly from one site to another (Lai 1984). Nevertheless, snails are spread through commerce (USDA 2003).
- *Bradybaena tourannensis* may be spread to new areas through human mediated transport of infested nursery stock or contaminated soil. Infested nursery stock and associated soil would be planted directly into a suitable habitat, thus spreading the pest to new areas.

4.4.5 Overall probability of entry, establishment and spread

The probability of entry, establishment and spread is determined by combining the probabilities of entry, of establishment and of spread using the matrix of 'rules' for combining descriptive probabilities shown in Table 2.2.

The likelihood that *B. tourannensis* will be imported as a result of trade in *Phalaenopsis* nursery stock from Taiwan, be distributed in a viable state to a susceptible host, establish and spread within Australia is **MODERATE**.

4.4.6 Consequences

The consequences of the entry, establishment and spread of *B. tourannensis* have been estimated according to the methods described in Table 2.3. The assessment of potential consequences is provided below:

Criterion	Estimate and rationale
Direct	
Plant life or health	**Impact score: C** – minor significance at the district level Snails feed on the foliage, flowers and fruits of various host plants, especially in greenhouses, and some molluscs also clip succulent plant parts (Godan 1983; Ohlendorf 1999). Feeding reduces the visual quality of the plant and reduces plant vigour due to loss of photosynthetic leaf areas (Godan 1983; Ohlendorf 1999).
Other aspects of the environment	**Impact score: A** – indiscernible at the local level There are no known consequences of *B. tourannensis* on other aspects of the environment.
Indirect	
Eradication, control etc.	**Impact score: B** – minor significance at the local level Programs to minimize the impact of *B. tourannensis* on host plants may include the use of homemade traps, baiting and sprays; weed control and stubble management to reduce the availability of food resources and refuges; and biological control (Micic *et al.* 2007).
Domestic trade	**Impact score: C** – minor significance at the district level The presence of *B. tourannensis* in parts of the PRA area may result in interstate trade restrictions on affected commodities. Restrictions may lead to a loss of markets and industry adjustment.
International trade	**Impact score: D** – significant at the district level The presence of *B. tourannensis* in Australia is likely to have a significant effect, due to limitations on access to overseas markets where this pest is absent.
Environmental and non-commercial	**Impact score: A** – indiscernible at the local level There are no known indirect environmental and non-commercial consequences of *B. tourannensis*.

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are 'D', the overall consequences are estimated to be **LOW**.

4.4.7 Unrestricted risk estimate

The unrestricted risk estimate for *B. tourannensis* is **LOW**.

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the outcome of overall consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

The unrestricted risk estimate for *B. tourannensis* of 'low' is above Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.5 Leaf spot

Leaf spots, caused by *Cylindrosporium phalaenopsidis* and *Sphaerulina phalaenopsidis*, are important diseases of orchids (USDA 2003). They reduce the visual quality and value of ornamental crops, in addition to decreasing the available photosynthetic area and plant vigour (Agrios 1997; Pirone 1978). Both pathogens are known from mainland China and Taiwan (Lu *et al.* 1994; Farr *et al.* 2009). Leaf spot symptoms could easily be detected during routine inspections; however, latent infections are unlikely to be detected (Agrios 1997; Pirone 1978). Movement in conveyances provides opportunity for the long distance dispersal of these pathogens. *Cylindrosporium phalaenopsidis* has been intercepted on *Phalaenopsis* exported to the USA (USDA 2003), supporting the argument that it would disperse unintentionally in orchid nursery stock.

Genus species

Cylindrosporium phalaenopsidis Sawada

Sphaerulina phalaenopsidis Sawada

These species have been grouped together as they are predicted to pose a similar risk and require similar mitigation measures. In this pest risk assessment, the term 'leaf spot' is used to refer to these species, unless otherwise specified.

4.5.1 Probability of entry

Probability of importation

The likelihood that leaf spot will arrive in Australia with the importation of *Phalaenopsis* nursery stock from Taiwan is **HIGH**.

- *Cylindrosporium phalaenopsidis* and *S. phalaenopsidis* are associated with the leaves of *Phalaenopsis* spp. in Taiwan (BAPHIQ 2006).
- The pathogens cause leaf spots (Lu *et al*. 1994; USDA 2003), which would be observable during routine visual inspection. However, latent infections are unlikely to be detected (Agrios 1997; Pirone 1978).
- *Phalaenopsis* nursery stock is expected to be shipped at moderate temperatures and humidity which is unlikely to adversely affect the survival of any *C. phalaenopsidis* or *S. phalaenopsidis* present during shipment.
- *Cylindrosporium phalaenopsidis* has been intercepted on *Phalaenopsis* spp. exported to the USA (USDA 2003).

Probability of distribution

The likelihood that leaf spot will be distributed within Australia in a viable state, as a result of the processing, sale or disposal of *Phalaenopsis* nursery stock from Taiwan is **HIGH**.

- *Cylindrosporium phalaenopsidis* and *S. phalaenopsidis* are able to develop, reproduce and complete their life cycles without leaving the host. As *Phalaenopsis* nursery stock would be distributed throughout Australia and planted directly into suitable habitats there is no need for these pathogens to be transported to a suitable host.

4.5.2 Probability of entry (importation x distribution)

The probability of entry is determined by combining the probability of importation with the probability of distribution using the matrix of rules shown in Table 2.2.

The probability that leaf spot will arrive in Australia, be distributed within the PRA area and transferred to a suitable host as a result of *Phalaenopsis* nursery stock from Taiwan is **HIGH**.

4.5.3 Probability of establishment

The likelihood that leaf spot will establish within Australia, based on a comparison of factors in the source and destination areas considered pertinent to its survival and reproduction is **MODERATE**.

- The known host range for *C. phalaenopsidis* is limited to the Orchidaceae. The pathogen has been recorded from *Cymbidium sinensis* and *Phalaenopsis* spp. (Lu *et al.* 1994; USDA 2003). Lu *et al.* (1994) has also demonstrated the susceptibility of a further eight species of Orchidaceae on inoculation in China.
- *Sphaerulina phalaenopsidis* has only been recorded from *Phalaenopsis* spp. [Orchidaceae] (USDA 2003).
- Members of the Orchidaceae are distributed in suburban and natural environments within Australia, and include four native species of *Cymbidium* and two native species of *Phalaenopsis* (PlantNET 2009).
- There is no information regarding resistance or susceptibility of the Australian Orchidaceae to *C. phalaenopsidis* or *S. phalaenopsidis*.
- *Cylindrosporium phalaenopsidis* and *S. phalaenopsidis* occur in mainland China (Guangdong) and Taiwan (BAPHIQ 2006; Lu *et al.* 1994). The climatic regions across this range include temperate: hot summer, without a dry season; and hot summer, dry winter (Peel *et al.* 2007).
- There are similar climatic regions in parts of Australia that would be suitable for the establishment of leaf spot (Peel *et al.* 2007).
- In China, incidence of *C. phalaenopsidis* was highest when the weather was “cloudy and drizzly” (Lu *et al.* 1994).
- The low rainfall and high temperature conditions that prevail in central Australia means it is unlikely that spores could germinate, infect and establish here.
- In China, *C. phalaenopsidis* is successfully controlled by cutting and removing diseased leaves, and spraying with Bordeaux mixture (Lu *et al.* 1994). Similar gardening practices in Australia may hamper the establishment of the pathogen.

4.5.4 Probability of spread

The likelihood that leaf spot will spread within Australia, based on a comparison of those factors in the source and destination areas considered pertinent to the expansion of the geographic distribution of the pest is **HIGH**.

- *Cylindrosporium phalaenopsidis* and *S. phalaenopsidis* are likely to be spread to new areas through human mediated transport of infected nursery stock (USDA 2003). Infected nursery stock would be planted directly into a suitable habitat, thus spreading the disease to new areas.
- In their natural range in mainland China (Guangdong) and Taiwan, *C. phalaenopsidis* and *S. phalaenopsidis* occur in temperate climatic regions with a hot summer, without a dry season or a hot summer with a dry winter (Peel *et al.* 2007). There are similar climatic regions in parts of eastern Australia that would facilitate the spread of leaf spot (Peel *et al.* 2007).
- Host plants that may support the spread of leaf spot are distributed in suburban and natural environments within Australia (PlantNET 2009).

- There is no information regarding resistance or susceptibility of the Australian Orchidaceae to *C. phalaenopsidis* or *S. phalaenopsidis*.
- The presence of natural barriers such as long distances between suitable hosts, arid areas, mountain ranges and climatic differentials may limit the ability of leaf spot to spread to new areas unaided.
- The climatic conditions predicted to limit the spread of *C. phalaenopsidis* in Australia are the low rainfall and high temperatures that prevail in central Australia. *Cylindrosporium phalaenopsidis* spores are naturally dispersed by rain-splash (USDA 2003). It is therefore unlikely that *C. phalaenopsidis* spores could germinate, infect and establish new infections on the species of Orchidaceae present in arid Australia.
- In China, the incidence of *C. phalaenopsidis* was highest when the weather was "cloudy and drizzly" (Lu *et al.* 1994).
- *Cylindrosporium phalaenopsidis* spores may also be carried by insects, animals and humans moving among infected plants (USDA 2003).
- *Sphaerulina phalaenopsidis* is spread naturally by airborne ascospores that are not likely to be widely dispersed over long distances (Agrios 1997; Crous *et al*. 2003; Pirone 1978).
- There are no known natural enemies of *C. phalaenopsidis* or *S. phalaenopsidis* that would restrict their spread in Australia.

4.5.5 Overall probability of entry, establishment and spread

The probability of entry, establishment and spread is determined by combining the probabilities of entry, of establishment and of spread using the matrix of 'rules' for combining descriptive probabilities shown in Table 2.2.

The likelihood that leaf spot will be imported as a result of trade in *Phalaenopsis* nursery stock from Taiwan, be distributed in a viable state to a susceptible host, establish and spread within Australia is **MODERATE**.

4.5.6 Consequences

The consequences of the entry, establishment and spread of leaf spot have been estimated according to the methods described in Table 2.3. The assessment of potential consequences is provided below:

Criterion	Estimate and rationale
Direct	
Plant life or health	**Impact score: C** – minor significance at the district level Leaf spot is an important disease of *Phalaenopsis* orchids (USDA 2003), which may affect native and cultivated orchids. It reduces the visual quality of the orchid species, and decreases the value of this ornamental crop as it reduces plant vigour due to loss of photosynthetic leaf areas thereby reducing the market value (Agrios 1997; Pirone 1978). There is no information regarding resistance or susceptibility to *C. phalaenopsidis* or *S. phalaenopsidis* for the Australian Orchidaceae. Lu *et al.* (1994) demonstrated the susceptibility of eight species of Orchidaceae to *C. phalaenopsidis* on inoculation in China.
Other aspects of the environment	**Impact score: A** – indiscernible at the local level There are no known consequences of leaf spot on other aspects of the environment.
Indirect	

Criterion	Estimate and rationale
Eradication, control etc.	**Impact score: B** – minor significance at the local level In China, *C. phalaenopsidis* is successfully controlled by cutting and removing diseased leaves, and spraying with Bordeaux mixture, carbendazim and sulphur (Lu *et al.* 1994). Similar gardening practices would be required in Australia to minimize the impact of leaf spot on host plants.
Domestic trade	**Impact score: C** – minor significance at the district level The presence of *C. phalaenopsidis* or *S. phalaenopsidis* in parts of the PRA area may result in interstate trade restrictions on affected commodities. Restrictions may lead to a loss of markets and industry adjustment.
International trade	**Impact score: D** – significant at the district level The presence of *C. phalaenopsidis* or *S. phalaenopsidis* in Australia is likely to have a significant effect, due to limitations on access to overseas markets where these pathogens are absent.
Environmental and non-commercial	**Impact score: A** – indiscernible at the local level There are no known indirect environmental and non-commercial consequences of leaf spot.

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are 'D', the overall consequences are estimated to be **LOW**.

4.5.7 Unrestricted risk estimate

The unrestricted risk estimate for leaf spot is **LOW**.

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the outcome of overall consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

The unrestricted risk estimate for leaf spot of 'low' exceeds Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.6 Phalaenopsis chlorotic spot virus

In October 2003, chlorotic spot symptoms were found on *Phalaenopsis* orchids; following testing, these symptoms were attributed to a virus (Chen *et al.* 2006). The species was named Phalaenopsis chlorotic spot virus and is the first *potyvirus* to be recorded on any *Phalaenopsis* species (Zheng *et al.* 2008). The species was first described in brief in 2006 (Chen *et al.* 2006) and is only known to occur in Taiwan. Subsequently in 2008, back-inoculation of the virus was undertaken confirming the virus as the causal agent of chlorotic spots on *Phalaenopsis* orchids (Zheng *et al.* 2008). Traditionally, isolation, identification and back inoculation of viruses from diseased *Phalaenopsis* orchids has been difficult to achieve (Zheng *et al.* 2008).

Probability of entry

Probability of importation

The likelihood that Phalaenopsis chlorotic spot virus will arrive in Australia with the importation of *Phalaenopsis* orchid nursery stock from Taiwan is **HIGH**.

- Phalaenopsis chlorotic spot virus is the first *potyvirus* to be recorded on *Phalaenopsis* spp., and is known only from Taiwan (Chen *et al.* 2006; Zheng *et al.* 2008).
- A preliminary survey of 150 diseased *Phalaenopsis* orchids found an infection rate of 10% (Zheng *et al.* 2008). As this species is newly described, it is not known if latent infections of *Phalaenopsis* orchids can occur.
- *Phalaenopsis* nursery stock is expected to be shipped at moderate temperatures and humidity which is unlikely to adversely affect the survival of Phalaenopsis chlorotic spot virus during shipment.
- *Phalaenopsis* orchids imported from Taiwan into Japan have been intercepted with chlorotic spots caused by several viruses (Ikeshiro *et al.* 2008). While *Phalaenopsis* chlorotic spot virus was not isolated from infected plants, the interception of viruses suggests that infected nursery stock is likely to introduce the virus.

Probability of distribution

The likelihood that Phalaenopsis chlorotic spot virus will be distributed within Australia in a viable state, as a result of the sale of *Phalaenopsis* orchid nursery stock from Taiwan is **HIGH**.

- Phalaenopsis chlorotic spot virus is able to survive and reproduce without leaving the host. As *Phalaenopsis* nursery stock would be distributed throughout Australia and planted directly into suitable habitats there is no need for Phalaenopsis chlorotic spot virus to be transported to a suitable host.

Probability of entry (importation x distribution)

The probability of entry is determined by combining the probability of importation with the probability of distribution using the matrix of rules shown in Table 2.2.

The probability that Phalaenopsis chlorotic spot virus will arrive in Australia, be distributed within the PRA area and transferred to a suitable host as a result of *Phalaenopsis* nursery stock from Taiwan is **HIGH**.

Probability of establishment

The likelihood that Phalaenopsis chlorotic spot virus will establish within Australia, based on a comparison of factors in the source and destination areas considered pertinent to its survival and reproduction is **HIGH**.

- Phalaenopsis chlorotic spot virus is known only from Taiwan (Chen *et al.* 2006; Zheng *et al.* 2008). The climatic region across this range is temperate with a hot summer and no dry season (Peel *et al.* 2007). There are similar climatic regions in parts of eastern Australia that would be suitable for the establishment of Phalaenopsis chlorotic spot virus (Peel *et al.* 2007).
- Propagative material is high value and a large investment is made in its health and survival, which is likely to assist the establishment of those arthropod pests and pathogens associated with it.
- The establishment of *Phalaenopsis* nursery stock in Australia establishes the viruses associated with it, since the virus does not have to leave the host to establish and *Phalaenopsis* nursery stock is likely to be planted in a suitable habitat.

- Once a host plant is infected with Phalaenopsis chlorotic spot virus the virus is expected to multiply within the host parenchyma cells and in cell vacuoles.

Probability of spread

The likelihood that Phalaenopsis chlorotic spot virus will spread within Australia, based on the comparison of those factors in source and destination areas considered pertinent to the expansion of the geographical distribution of the pest is **MODERATE**.

- Phalaenopsis chlorotic spot virus is likely to be spread to new areas through human mediated transport of infected nursery stock. Infected nursery stock would be planted directly into a suitable habitat, thus spreading the disease to new areas.
- In its natural range in Taiwan, Phalaenopsis chlorotic spot virus occurs in a temperate climatic region with a hot summer and no dry season (Peel *et al.* 2007).
- There are similar climatic regions in parts of eastern Australia that would facilitate the spread of this virus (Peel *et al.* 2007).
- Host plants that may support the spread of Phalaenopsis chlorotic spot virus are distributed in suburban and wild environments within Australia.
- The known host range for Phalaenopsis chlorotic spot virus is limited to *Phalaenopsis* spp. (Zheng *et al.* 2008).
- There are two species of native *Phalaenopsis* in Australia: *Phalaenopsis amabilis* (L.) Blume and *Phalaenopsis rosenstromii* F.M. Bailey (APNI 2008), which are present in Queensland (AVH 2009).
- Twenty-five *Phalaenopsis* spp., and numerous hybrids, have been introduced in to Australia through the nursery trade (Randall 2007) and would be distributed throughout Australia in private collections, for public display and in nurseries.
- There is no information regarding resistance or susceptibility to Phalaenopsis chlorotic spot virus of the native or introduced *Phalaenopsis* species in Australia.
- Phalaenopsis chlorotic spot virus was only recently described by Zheng *et al.* (2008). Potentially vectors of the virus are yet to be identified and while mechanical inoculation has been demonstrated for this species, it has been considered difficult to do in laboratory experiments (Zheng *et al.* 2008), suggesting it may not be the primary natural dispersal mechanism.
- *Phalaenopsis* orchids imported from Taiwan into Japan have been intercepted with chlorotic spots caused by several viruses (Ikeshiro *et al.* 2008). While *Phalaenopsis* chlorotic spot virus was not isolated from infected plants, the interception of viruses suggests that infected nursery stock is likely to spread the virus.

4.6.1 Overall probability of entry, establishment and spread

The probability of entry, establishment and spread is determined by combining the probabilities of entry, of establishment and of spread using the matrix of 'rules' for combining descriptive probabilities shown in Table 2.2.

The likelihood that Phalaenopsis chlorotic spot virus will be imported as a result of trade in *Phalaenopsis* nursery stock from Taiwan, be distributed in a viable state to a susceptible host, establish and spread within Australia is **MODERATE**.

4.6.2 Consequences

The consequences of the entry, establishment and spread of Phalaenopsis chlorotic spot virus have been estimated according to the methods described in Table 2.3. The assessment of potential consequences is provided below:

Criterion	**Estimate and rationale**
Direct	
Plant life or health	**Impact score: C** – minor significance at the district level The *Phalaenopsis* orchid industry in Taiwan often suffers heavy losses from viral diseases including Phalaenopsis chlorotic spot virus (Zheng *et al.* 2008). A preliminary survey of 150 diseased *Phalaenopsis* orchids found 10% to be infected with Phalaenopsis chlorotic spot virus (Zheng *et al.* 2008). This virus causes chlorotic spots on the leaves of *Phalaenopsis* orchids (Chen *et al.* 2006), which affects the quality and marketability of the plant.
Other aspects of the environment	**Impact score: A** – indiscernible at the local level There are no known direct consequences of Phalaenopsis chlorotic spot virus on other aspects of the environment.
Indirect	
Eradication, control etc.	**Impact score: C** – minor significance at the district level The presence of Phalaenopsis chlorotic spot virus in Australia would require testing for freedom in the production of nursery stock. This would add significant costs to orchid nursery stock production in Australia.
Domestic trade	**Impact score: C** – minor significance at the district level The presence of Phalaenopsis chlorotic spot virus in commercial production areas may cause limitations to domestic markets where this virus is absent. Testing for viral freedom would add significant costs to domestic trade.
International trade	**Impact score: D** – significant at the district level The presence of Phalaenopsis chlorotic spot virus in commercial production areas may cause limitations to overseas markets where this virus is absent. Testing for viral freedom would add significant costs to international trade.
Environmental and non-commercial	**Impact score: A** – indiscernible at the local level There are no known indirect environmental and non-commercial consequences of Phalaenopsis chlorotic spot virus.

Based on the decision rules described in Table 2.4, that is, where the consequences of a pest with respect to one or more criteria are 'D', the overall consequences are estimated to be **LOW**.

Unrestricted risk estimate

The unrestricted risk estimate for Phalaenopsis chlorotic spot virus is **LOW**.

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the outcome of overall consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5.

The unrestricted risk estimate for Phalaenopsis chlorotic spot virus of 'low' exceeds Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.7 Risk assessment conclusion

Table 4.2 summarises the detailed risk assessments and provides unrestricted risk estimates for the quarantine pests considered to be associated with orchids from Taiwan.

Frankliniella intonsa, *Bradybaena tourannensis, Cylindrosporium phalaenopsidis, Sphaerulina phalaenopsidis* and Phalaenopsis chlorotic spot *potyvirus* were assessed to have an unrestricted risk estimate of 'low'. The unrestricted risk estimates for these pests exceed Australia's ALOP. Specific risk management measures are therefore required for the importation of orchids from Taiwan into Australia, to adequately address the potential quarantine risk.

Key to table 4.2

Genus species EP	pests for which policy already exists. The outcomes of previous assessments and/or re-assessments in this IRA are presented in table 4.2

Likelihoods for entry, establishment and spread

N	negligible
EL	extremely low
VL	very low
L	low
M	moderate
H	high
P[EES]	overall probability of entry, establishment and spread

Assessment of consequences from pest entry, establishment and spread

PLH	plant life or health
OE	other aspects of the environment
EC	eradication control etc.
DT	domestic trade
IT	international trade
ENC	environmental and non-commercial
A-G	consequence impact scores are detailed in section 2.2.3
URE	unrestricted risk estimate. This is expressed on an ascending scale from negligible to extreme.

Table 4.2 Summary of unrestricted risk estimates for quarantine pests associated with *Phalaenopsis* orchids from Taiwan

Pest name	Likelihood of						Consequences							URE
	Entry			Establishment	Spread	P[EES]	direct		indirect				Overall	
	importation	distribution	Overall				PLH	OE	EC	DT	IT	ENC		
ARTHROPODS														
Orgyia postica Walker [Lepidoptera: Lymantriidae] EP	L	H	**L**	**M**	**M**	**L**	D	B	C	C	D	B	**L**	**VL**
Frankliniella intonsa Trybom [Thysanoptera: Thripidae] EP	H	H	**H**	**H**	**H**	**H**	D	B	D	D	D	B	**L**	**L**
MOLLUSCA														
Bradybaena tourannensis (Souleyet) [Eupulmonata: Bradybaenidae]	M	H	**M**	**H**	**H**	**M**	C	A	B	C	D	A	**L**	**L**
PATHOGENS														
Fungi														
Cylindrosporium phalaenopsidis Sawada	H	H	**H**	**M**	**H**	**M**	C	A	B	C	D	A	**L**	**L**
Sphaerulina phalaenopsidis Sawada	H	H	**H**	**M**	**H**	**M**	C	A	B	C	D	A	**L**	**L**
Viruses														
Phalaenopsis chlorotic spot virus	H	H	**H**	**H**	**M**	**M**	C	A	C	C	D	A	**L**	**L**

5 Pest risk management

Pest risk management evaluates and selects risk management options to reduce the risk of entry, establishment or spread of quarantine pests identified with an unrestricted risk exceeding Australia's ALOP. The pest risks identified in the risk assessment (Table 4.2) represent a baseline biosecurity risk associated with the importation of *Phalaenopsis* orchid nursery stock in the absence of any risk management measures.

The pests assessed to have an unrestricted risk estimate above Australia's ALOP, are presented in Table 5.1. Therefore, risk management measures are required to reduce this risk to achieve Australia's ALOP.

To effectively prevent the introduction of plant pests associated with nursery stock a series of important safeguards, conditions, or phytosanitary measures must be in place. Australia has well established policy for the importation of *Phalaenopsis* nursery stock from all countries of the world. Imported nursery stock requires mandatory on-arrival fumigation and growth in PEQ. Tissue cultures are exempt from mandatory fumigation or growth in the PEQ facilities. In addition, a number of methyl bromide sensitive species are exempt from methyl bromide fumigation providing no live arthropods pests are detected on-arrival. An insecticidal dip can be just as effective as methyl bromide fumigation. Consistent with the existing policy, *Phalaenopsis* orchid nursery stock from Taiwan would be subject to the existing measures to meet Australia's ALOP.

Table 5.1 Existing phytosanitary measures for *Phalaenopsis* orchid nursery stock

<table>
<tr><th>Pest</th><th>Common name</th><th>Existing measures</th></tr>
<tr><td colspan="2">ARTHROPODS</td><td rowspan="12">Visual inspection, mandatory on-arrival fumigation or insecticidal dipping and minimum of three months post-entry quarantine.</td></tr>
<tr><td>Frankliniella intonsa (Trybom)
[Thysanoptera: Thripidae]</td><td>Eastern flower thrips</td></tr>
<tr><td colspan="2">MOLLUSCA</td></tr>
<tr><td>Bradybaena tourannensis (Souleyet)
[Eupulmonata: Bradybaenidae]</td><td>Snail</td></tr>
<tr><td colspan="2">PATHOGENS</td></tr>
<tr><td colspan="2">Fungi</td></tr>
<tr><td>Cylindrosporium phalaenopsidis Sawada</td><td>Leaf spot</td></tr>
<tr><td>Sphaerulina phalaenopsidis Sawada</td><td>Leaf spot</td></tr>
<tr><td colspan="2">Viruses</td></tr>
<tr><td>Phalaenopsis chlorotic spot virus</td><td>Phalaenopsis chlorotic spot</td></tr>
</table>

5.1 Existing risk management measures for *Phalaenopsis* nursery stock

Australia's existing policy on *Phalaenopsis* orchid nursery stock is based on tiered safeguards. That is, if one mitigating measure fails, other safeguards exist to ensure that the risk is progressively reduced and managed. Australia's existing policy includes:

- freedom from regulated articles including soil, disease symptoms and other extraneous contamination of quarantine concern
- on-arrival inspection

- mandatory methyl bromide fumigation of plants (or alternative insecticidal dip)
- mandatory growth for a minimum of three months in PEQ facilities for pathogen screening

The risk assessment has identified one arthropod (*Frankliniella intonsa*), one snail (*Bradybaena tourannensis*), two fungal pathogens (*Cylindrosporium phalaenopsidis*, *Sphaerulina phalaenopsidis*) and one virus (Phalaenopsis chlorotic spot virus) of quarantine concern to Australia.

5.1.1 Freedom from regulated articles including soil

The importation of nursery stock that is free from regulated articles including soil is applied to minimise the risk of accidental introduction of soil inhabiting pests. This risk management option is currently employed in Australia to reduce the risk of entry, establishment and spread of pests associated with *Phalaenopsis* orchid nursery stock. Pest species may be present but hidden in soil and would be difficult to detect. *Bradybaena tourannensis* is likely to lay eggs in soil; importing nursery stock without soil will reduce the risk of snail eggs entering Australia. If *Phalaenopsis* orchids are not subjected to risk management measures, soil borne pests could enter, establish and spread in Australia. Therefore, the existing requirement of freedom from soil is supported.

The mandatory requirement of importing nursery stock that is free from soil will be effective against *Bradybaena tourannensis*.

5.1.2 Mandatory on-arrival AQIS inspection

All imported nursery stock requires mandatory on-arrival inspection to verify the level of infestation and involves the visual inspection of an appropriate sample. Eggs of *Frankliniella* spp. are small (about 200 μm long) and are inserted into the host plant tissues, usually in the buds, flowers or unfurled leaves (CABI 2007; Hill 1987). Similarly eggs of *Bradybaena* spp. laid in the soil are small and inconspicuous, and may be difficult to detect during routine visual inspection, particularly in low numbers. Mounting scientific evidence suggests that reliance on visual inspection to detect pests is untenable, especially in the case of nursery stock. For this reason, visual inspection is not considered an appropriate measure to mitigate the risk posed by thrips and *Bradybaena* spp. in the nursery stock. Therefore, Australia's existing policy requires additional measures to mitigate the risk posed by arthropods and snails in nursery stock.

5.1.3 Mandatory on-arrival fumigation or insecticidal dip

Mandatory on-arrival fumigation or insecticidal dip is applied to minimise the risk of accidental introduction of arthropod pests. This risk management option is currently employed in Australia to reduce the risk of entry, establishment and spread of pests associated with *Phalaenopsis* orchid nursery stock.

Nursery stock represents one of the highest plant quarantine risks, as it harbours various forms of arthropod pests. For example, APHIS intercepted (1985–2003) Acari, Coleoptera (Curculionidae, Sminthuridae, Agromyzidae), Hemiptera (Aphididae, Cicadellidae, Coccidae, Diaspididae, Miridae, Formicidae, Crematogaster), Lepidoptera (Lymantriidae, Noctuidae, Plutellidae, Tortricidae), Orthoptera (Tettigoniidae) and Thysanoptera (Phlaeothripidae) on *Phalaenopsis* plants entering into the USA (USDA 2003). As the intercepted pests have not been identified to species level, this may include both non-quarantine species and quarantine species. If *Phalaenopsis* orchids are not subjected to risk management measures, these pests could enter, establish and spread in Australia. Therefore, the existing requirement of mandatory fumigation or an alternative treatment for all shipments in accordance with the relevant AQIS standards is supported.

The mandatory on-arrival fumigation or insecticidal dip will be effective against *Frankliniella intonsa* (Eastern flower thrips). However, as *Phalaenopsis* nursery stock is susceptible to methyl bromide fumigation, insecticidal dipping is offered as an alternative treatment.

5.1.4 Mandatory growth in post-entry quarantine facilities

Growing *Phalaenopsis* nursery stock in PEQ for a period of observation can minimise the likelihood that pathogens will be undetected. A minimum of three months PEQ provides opportunity for sufficient new growth to occur for disease expression and repeated comprehensive inspection for disease symptoms. A three month PEQ period will minimize the risk of introducing *Cylindrosporium phalaenopsidis*, *Sphaerulina phalaenopsidis* and Phalaenopsis chlorotic spot virus into Australia. This risk management option is currently employed in Australia to reduce the risk of entry, establishment and spread of pests associated with *Phalaenopsis* orchid nursery stock. Therefore, the existing requirement of mandatory on-arrival PEQ is supported.

The mandatory growth in government or private PEQ facilities for three months will be effective against *Cylindrosporium phalaenopsidis*, *Sphaerulina phalaenopsidis* and Phalaenopsis chlorotic spot virus.

5.2 Proposed risk management measures for *Phalaenopsis* nursery stock

BAPHIQ's proposed systems approach is based on the use of pest-free propagative material, pest exclusionary production houses, regular monitoring, insecticidal and fungicidal treatments prior to export and phytosanitary inspection and certification. Based on this systems approach BAPHIQ has proposed the removal of mandatory on-arrival fumigation or insecticidal dip and the mandatory three month PEQ in Australia.

5.2.1 Sourcing tissue culture from pest free mother stock

Ensuring pest-free propagative material requires monitoring and testing of mother stock (Agrios 1997; Jarvis 1992).

Tissue cultures will be sourced from pest-free mother stock, as determined by BAPHIQ inspectors. The prior inspection and testing of mother stock ensures a relatively pest-free source of plant material is used for descendant plants.

Mother plants are routinely virus tested (Cymbidium mosaic virus and Odontoglossum ring spot virus), using indirect Enzyme-linked immuno-sorbent assay (ELISA) prior to tissue culture. Resultant tissue culture plants are visually inspected for freedom from disease symptoms and only disease free plants are grown further.

Biosecurity Australia has identified *Phalaenopsis* chlorotic spot virus, which is not covered by the current testing regime employed by BAPHIQ, as a pathogen of quarantine concern. Biosecurity Australia will require BAPHIQ to test mother plants for this virus using ELISA.

Biosecurity Australia has identified *Cylindrosporium phalaenopsidis* and *Sphaerulina phalaenopsidis* as pathogens of quarantine concern. These pathogens cause leaf spots that would be easily detected during inspection of mother stock; however, latent infections are unlikely to be detected (Agrios 1997; Pirone 1978). Orchids for export to Australia will be propagated from aseptic tissue culture, and if these fungal pathogens are present, their presence will be detected in the culture medium.

As mother stock will be inspected by BAPHIQ inspectors for pest freedom it is highly unlikely that these pests will be associated with tissue culture.

5.2.2 Growth of tissue cultured plants in approved media

The orchids for export to Australia will be grown in perlite, vermiculite, inorganic fibres or sphagnum moss; sphagnum moss must be unused, pasteurized and soil free. The sphagnum moss is treated (immersed) in hot water so that the core temperature of the sphagnum moss is held at 80 °C for 20–30 minutes prior to use. This treatment is designed to sterilise the sphagnum moss, thus reducing the risk of harmful micro-organisms and other contaminants of sphagnum moss from the import pathway; the treatment also kills the sphagnum moss. When ready for planting out, the tissue cultured plants are transported in flasks to the growing houses where they are de-flasked and planted into individual containers using perlite, vermiculite, inorganic fibres or pasteurised sphagnum moss as the growing medium. The use of soil-free growing media eliminates an initial source for pests, including *Bradybaena tourannensis*.

5.2.3 Growth in exclusionary production houses

Ensuring pest-exclusionary production houses requires the implementation of best practice hygiene and plant production systems.

The orchids for export to Australia will be grown solely in production houses in which sanitary procedures are adequate to exclude plant pests and pathogens, which meet Australia's standard for PEQ facilities. Sanitary procedures include cleaning and disinfection of floors, benches, and tools; and the application of measures to protect against any injurious plant diseases, injurious insect pests and other plant pests.

Plants destined for Australia must be housed so that their plant health status has not been compromised by exposure to plants which are produced under other conditions or subject to different disease screening regimes. Physical separation, cleaning of equipment and clear labelling of plants that are destined for the Australian market would be necessary to ensure the plant health status is maintained throughout the production chain.

Fungal pathogens are generally introduced into the production houses via infested plant material or soil. The use of disease-free propagation material, as established by the required inspection of mother stocks (5.2.1), is a primary measure to prevent the introduction of fungal pathogens into the production houses.

The orchids for export to Australia will be grown for at least four months in BAPHIQ approved production houses. This will allow time for plant pests and diseases to develop and become visible and detectable. The growth for four months is necessary to allow ample time for the expression of disease symptoms, and other signs of pests.

5.2.4 Regular monitoring

Plants established from tissue culture sourced from disease free mother stock and grown in BAPHIQ approved production houses will be monitored monthly by BAPHIQ inspectors. This monitoring includes inspection of production houses and the plants growing within the production houses. This will allow the inspectors to pick up any infected plants or signs of pest infestation.

5.2.5 Treatment[3]

In addition to the routine control of pests in the production houses, the application of pesticides will be required to ensure identified quarantine pests that escape detection during BAPHIQ inspections, are controlled. The orchids for export to Australia will have an insecticidal and fungicidal treatment 14 days prior to export. Plants and containers will be immersed or drenched in a broad spectrum insecticide and sprayed with a suitable fungicide no longer than 14 days prior to export to Australia. Insecticidal drenching shall be conducted in a manner that will allow for treatment of roots and growth media and be equivalent to immersion in an insecticidal solution. Drenching treatment will also include a insecticidal foliar spray to ensure that the entire plant is treated with an appropriate insecticide.

The overall systems approach operates with tiered safeguards so that, if one mitigating measure fails, other safeguards exist to ensure that the risk is progressively reduced and managed.

5.2.6 Inspection

Inspections are an integral phytosanitary measure to reduce quarantine risks. The orchids for export to Australia will be inspected by BAPHIQ officers immediately prior to export and certified as meeting Australia's import requirements. The plants and growing media will be inspected in BAPHIQ approved quarantine houses for evidence of plant pests and diseases.

5.3 Evaluation of proposed systems approach for *Phalaenopsis* nursery stock

The evaluation of proposed alternative measures is based on the principles and terminology of the ISPM 14: T*he Use of Integrated Measures in a Systems Approach for Pest Risk Management* (FAO 2002) and ISPM 24: G*uidelines for the Determination and Recognition of Equivalence of Phytosanitary Measures* (FAO 2005) by the IPPC.

Australia is obligated to adhere to the World Trade Organization's SPS Agreement. Under this agreement, Australia is obligated to set the least trade restrictive phytosanitary measures necessary to achieve its appropriate level of protection.

Equivalence is described as basic principle No. 1.1 in ISPM 1: *Principles of plant quarantine as related to international trade* (FAO 2006) as '*Equivalence: Importing contracting parties should recognize alternative phytosanitary measures proposed by exporting contracting parties as equivalent when those measures are demonstrated to achieve the appropriate level of protection determined by the importing contracting party*'. In other words, if the exporting country objectively demonstrates that its measures achieve the ALOP of the importing country then members shall accept SPS measures of other members as equivalent.

Equivalence generally applies to cases where phytosanitary measures already exist. Equivalence determinations are based on the specified pest risk and equivalence may apply to individual measures, a combination of measures or integrated measures in a systems approach. A determination of equivalence requires an assessment of phytosanitary measures to determine their effectiveness in mitigating a specified pest risk.

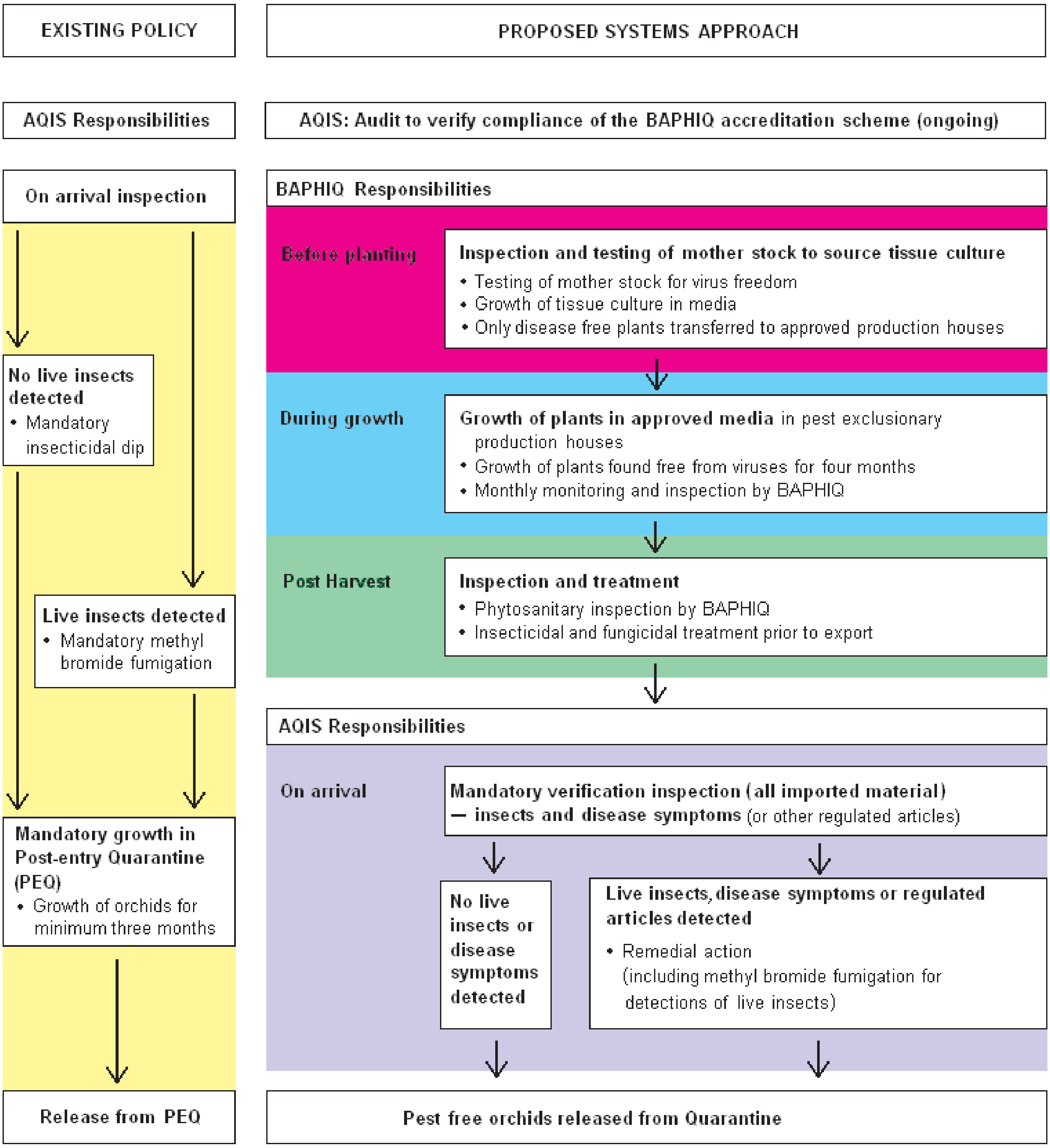
The risk management program proposed by BAPHIQ is a systems approach. Systems approaches are employed as an alternative to the use of a single measure that achieves an appropriate level of phytosanitary protection where a single phytosanitary measure is

[3] Additional requirement requested by Biosecurity Australia to address identified biosecurity risks.

unfeasible or undesirable. The combinations of specific mitigation measures that provide overlapping or sequential safeguards are distinctly different from single mitigation methodologies such as fumigation or inspection. Systems approaches vary in complexity. However, they all require the integration of different pest risk management measures, at least two of which act independently, and their cumulative effect achieve the appropriate level of protection. Systems approaches are often tailored to specific commodity-pest-origin combinations.

To compare the existing measures and those measures proposed by BAPHIQ, a comparison diagram is presented in Figure 5.1.

Figure 5.1 Comparison of existing risk management measures for *Phalaenopsis* nursery stock with proposed systems approach



In accordance with ISPM 24: *Guidelines for the Determination and Recognition of Equivalence of Phytosanitary Measures* (FAO 2005), to compare existing measures and those measures proposed as equivalent, the proposed measures should be assessed for their ability to reduce a specified pest risk. ISPM 24 states that the proposed measures should be assessed for its ability to achieve the importing countries ALOP.

The Australian policy to import nursery stock requires multiple phytosanitary measures designed to reduce the pest risk. Risk was estimated using the various combinations of mitigation measures discussed above and the results are summarised in (Table 5.2). *Phalaenopsis* nursery stock produced under the proposed systems approach would reduce the risk of entry, establishment or spread of quarantine pests to 'extremely low', which would meet Australia's ALOP.

Table 5.2: Risk management measures for *Phalaenopsis* pests

Components of systems approach	Effect of the measure	Probability of entry (cumulative impact of systems approach)
Sourcing tissue culture from pest free mother stock	This component of the proposed systems approach (before planting) consists of four steps: • **Step 1:** visual inspection of mother stock and ELISA testing for viruses of mother stock by BAPHIQ. • **Step 2:** sourcing tissue culture from pest free mother stock. • **Step 3:** growing of tissue cultures on culture media (the presence of bacterial and fungal pathogens will be revealed in the culture media) • **Step 4:** visual inspection for freedom from disease symptoms before being transferred in flasks to the production houses. All these steps will reduce the introduction of pests of quarantine concern to Australia in the production chain.	**Extremely low**
Growth of tissue cultured plants in approved media	This component of the proposed systems approach includes: • pasteurisation of soil-free media, sphagnum moss (treating sphagnum moss in hot water at 80 °C for 20–30 minutes), prior to use; or the use of an approved soil-free inert media such as perlite, vermiculite or inorganic fibres. • tissue cultured plants are de-flasked and planted into individual containers using perlite, vermiculite, inorganic fibres or pasteurised sphagnum moss as the growing medium. The growth of disease free tissue cultured plants in pasteurised, or inert, soil-less media will eliminate initial sources for pests, and therefore reduces the introduction of pests of quarantine concern to Australia in the production chain.	
Growth of tissue cultured plants in exclusionary production houses	This component of the proposed systems approach includes: • entry of disease free tissue cultured plants to the BAPHIQ approved pest exclusionary production houses. • growth of tissue cultured plants in production houses for four months in which sanitary procedures are adequate to exclude arthropod pests and pathogens. The growth of disease free tissue cultured plants for four months in exclusionary production houses provides a physical barrier to plants from arthropod pests and pathogens and will reduce the introduction of pests of quarantine concern to Australia in the supply chain.	

Components of systems approach	Effect of the measure	Probability of entry (cumulative impact of systems approach)
Regular monitoring	This component of the proposed systems approach includes: • monthly inspection of tissue cultured plants for over four months by BAPHIQ. Regular monthly monitoring allows the inspectors to detect infected plants or signs of pests infestation and will reduce the introduction of pests of quarantine concern to Australia in the supply chain.	
Treatment	This component of the proposed systems approach includes: • insecticidal and fungicidal treatment of orchids no longer than 14 days prior to export. The insecticidal and fungicidal treatment will ensure that only pest free orchids are supplied to Australia.	
Inspection	This component of the proposed systems approach includes: • pre-export inspection by BAPHIQ officers immediately prior to export within the approved production houses for evidence of plant pests and diseases. Inspections are an integral phytosanitary measure to reduce pest risk and will ensure that only pest free orchids are supplied to Australia.	

AQIS will conduct audits to ensure compliance with the BAPHIQ work plan for Phalaenopsis orchid exports to Australia.

Phalaenopsis nursery stock will be grown in an AQIS approved greenhouse (closed quarantine facility) for at least four months before export to Australia, and inspected monthly throughout the growth process to ensure the plants are free from organisms of quarantine concern to Australia. If these measures are properly executed in accordance with AQIS terms of reference for approval of accreditation (to be detailed in a bilateral work plan), prior to export to Australia, it would be equivalent to post-entry procedures undertaken in Australia.

5.4 Operational system for the maintenance and verification of phytosanitary status

A system of operational procedures is necessary to maintain and verify the phytosanitary status of *Phalaenopsis* orchid nursery stock from Taiwan. This is to ensure that the proposed risk management measures have been met and are maintained.

It is proposed that Taiwan's NPPO and AQIS prepare a documented work plan that describes the phytosanitary procedures for the pests of quarantine concern for Australia and the various responsibilities of all parties involved in meeting this requirement.

5.4.1 Recognition of the competent authority

BAPHIQ is the designated NPPO for Taiwan under the IPPC.

The objectives of the NPPO are to ensure that:

- recommended service and certification standards, and recommended work plan procedures, are met by all relevant agencies participating in this program
- recommended administrative processes are established that provide assurance that the recommended requirements of the program are being met.

5.4.2 Audit and verification

The objectives of the recommended requirement for audit and verification are to ensure that:

- an effective approved documented system for the greenhouses, the packing houses and during transport is in operation.

The phytosanitary system for *Phalaenopsis* orchid nursery stock export production, certification of export greenhouses, pre-export inspection and certification is subject to an annual audit by AQIS. Audits may be conducted at the discretion of AQIS during the entire production cycle.

AQIS production house audits will measure compliance with production house registration and identification, pest/disease management including maintenance of a spray diary/monitoring, record management, and accreditation requirements including accredited personnel for the recognition of all identified quarantine pests.

AQIS audits of participants involved in pre-export arrangements will include the verification of compliance with specified responsibilities, traceability, labelling, segregation and product security, BAPHIQ/agency certification processes, and the use of accredited personnel for the above tasks.

5.4.3 Registration of export production houses

The objectives of this recommended procedure are to ensure that:

- *Phalaenopsis* nursery stock is sourced from BAPHIQ registered export production houses producing export quality nursery stock, as the pest risk assessments are based on existing commercial production practices
- export production houses from which *Phalaenopsis* orchid nursery stock is sourced can be identified so investigation and corrective action can be targeted rather than applying it to all contributing export production houses in the event that live pests are regularly intercepted during pre-clearance inspection.

It is recommended that BAPHIQ registers the production houses before the commencement of each harvest season.

5.4.4 Registration of packing houses and auditing of procedures

The objectives of this recommended procedure are to ensure that:

- *Phalaenopsis* orchid nursery stock is processed and packaged at BAPHIQ registered packing houses, processing export quality nursery stock, as the pest risk assessments are based on existing commercial packing activities
- reference to the registered packing house and the source production house, by name or a number code, are clearly stated on packaging destined for export of *Phalaenopsis* orchid nursery stock to Australia for trace back and auditing purposes.

It is recommended that BAPHIQ registers the packing houses before the commencement of each harvest season.

5.4.5 Pre-export phytosanitary inspection and certification by BAPHIQ

The objectives of this recommended procedure are to ensure that:

- all consignments are inspected by BAPHIQ in accordance with official procedures for all visually detectable quarantine pests and other regulated articles (including soil, animal and plant debris)
- a phytosanitary certificate (PC) is issued for each consignment upon completion of pre-export inspection and treatment to verify that the relevant measures have been undertaken offshore
- each PC includes a description of the consignment (including grower number and packing house details), and an additional declaration that '*The nursery stock in this consignment has been produced in Taiwan in accordance with the conditions governing entry of* Phalaenopsis *orchid nursery stock to Australia'*.

5.4.6 Packaging and labelling

The objectives of this recommended procedure are to ensure that:

- *Phalaenopsis* orchid nursery stock proposed for export to Australia is not contaminated by quarantine pests or regulated articles (e.g. trash, soil and weed seeds)
- unprocessed packing material (which may vector pests not identified as being on the pathway) is not imported with *Phalaenopsis* orchid nursery stock
- all wood material used in packaging of the commodity complies with AQIS conditions (see AQIS publication 'Cargo Containers: Quarantine aspects and procedures)
- secure packaging is used if consignments are not transported in sealed containers directly to Australia
- the packaged *Phalaenopsis* orchid nursery stock is labelled with the production house registration number for the purposes of trace back to registered production houses

5.4.7 Specific conditions for storage and transport of produce

The objectives of this recommended procedure are to ensure that:

- product for export to Australia is secure by segregation to prevent mixing or cross-contamination with produce destined elsewhere
- the quarantine integrity of the commodity during storage and movement is maintained.

5.4.8 On-arrival phytosanitary inspection by AQIS

AQIS will undertake a documentation compliance examination for consignment verification purposes, at the port of entry in Australia, prior to inspection and discharge of the imported *Phalaenopsis* nursery stock shipment. All *Phalaenopsis* nursery stock including their growing media will be subject to inspection on-arrival by AQIS officers. The detection of live insects, disease symptoms and/or regulated articles will result in the failure of the consignment and remedial action, including methyl bromide fumigation if live insects are detected.

5.4.9 Remedial action(s) for non-compliance – on-arrival verification

The objectives of the recommended requirements for remedial action(s) for non-compliance during on-arrival verification are to ensure that:

- any quarantine risk is addressed by remedial action, as appropriate, for consignments that do not comply with import requirements.

- the detection of live quarantine pests or regulated articles during an inspection will result in the failure of the inspection lot.
- The detection of quarantine pests or regulated articles consistently from a specific pathway will result in a review of the pathway by AQIS and NPPO, and may lead to the suspension of trade.

If quarantine pests or regulated articles are found during an inspection, the importer will be given the option to treat (if a suitable treatment is available), re-export or destroy the consignment.

5.5 Review of policy

Australia reserves the right to review and amend the import policy if circumstances change.

Australia is prepared to review the policy after a substantial volume of trade has occurred.

NPPO, or other relevant agency nominated by NPPO, must inform AQIS immediately of the detection of any new pests of *Phalaenopsis* orchids which are of potential quarantine concern to Australia.

5.6 Uncategorised pests

If an organism is detected on *Phalaenopsis* orchid nursery stock during the pre-clearance inspection, that has not been categorised, it will require assessment by Biosecurity Australia 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 remedial action, as appropriate.

6 Conclusion

The overall systems approach operates like a fail-safe system in that tiered safeguards are built into the process. That is, if one mitigating measure fails, other safeguards exist to ensure that the risk is progressively reduced and managed. The systems approach is designed to apply all the measures to obtain the maximum risk reduction and to apply additional safeguards as required. The steps or measures may be overlapping to ensure an adequate reduction in pest risk and that the reduction is maintained during the entire process.

All phases associated with *Phalaenopsis* nursery stock plants established in growing media—before planting, during the growing period, post harvest, and importation—have been considered.

- The systems approach commences with tissue culture of mother plants, sourced from mother plants that have been tested and found to be free of pathogens, which are then transferred to quarantine standard production houses. Therefore, there is very limited opportunity for infection or infestation by pests of quarantine concern to Australia. If fungal pathogens are associated with tissue cultures, their presence will be revealed in the culture medium.
- Resultant tissue culture plants are visually inspected for freedom from disease symptoms and disease free plants are grown further. Tissue cultured plants are grown in perlite, vermiculite, inorganic fibres or pasteurised soil-free sphagnum moss in BAPHIQ approved production houses for over four months.
- An insecticidal and fungicidal treatment no longer than 14 days prior to export, of the nursery stock to Australia and phytosanitary inspection by BAPHIQ officers immediately prior to export.

The accredited system will be audited by AQIS officers regularly to ensure on-going compliance with the accreditation scheme for *Phalaenopsis* plant exports to Australia.

Production of *Phalaenopsis* nursery stock in accordance with the proposed systems approach, phytosanitary inspection by BAPHIQ officers, an insecticidal and fungicidal treatment no longer than 14 days prior to export to Australia, would be equivalent to mandatory on-arrival insecticidal dip.

Furthermore, AQIS will undertake a documentation compliance examination for consignment verification purposes, at the port of entry in Australia, prior to inspection and discharge of the imported *Phalaenopsis* nursery stock shipment. The detection of live insects and/or regulated articles will result in the failure of the consignment and remedial action, including methyl bromide fumigation if live insects are detected.

Appendixes

Appendix A Initiation and categorisation for pests of Phalaenopsis orchids from Taiwan[4]

Initiation (columns 1–2) identifies the pests of *Phalaenopsis* that have the potential to be associated with *Phalaenopsis* orchid nursery stock in Taiwan.

Pest categorisation (columns 3–6) identifies which of the pests with the potential to be on the import pathway are quarantine pests for Australia and require pest risk assessment. The steps in the initiation and categorisation processes are considered sequentially, with the assessment terminating at the first 'No' for columns 2, 3, 5 or 6 or 'Yes' for column 4. Details of the method used in this PRA are given in Section 2: Method for pest risk analysis.

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
DOMAIN BACTERIA						
Class Betaproteobacteria						
Order Burkholderiales						
Acidovorax avenae subsp. *cattleyae* (Pavarino) Willems [Comamonadaceae]	Yes (BAPHIQ 2006)	**Yes:** This species causes leaf spots (Scortichini *et al.* 2005) and is associated with leaves and stems of *Phalaenopsis* (BAPHIQ 2001).	Yes (APPD 2007)	Not assessed	Not assessed	No
Class Gammaproteobacteria						
Order Enterobacteriales						
Erwinia carotovora subsp. *carotovora* (Jones) Bergey *et al.* [Enterobacteriaceae]	Yes (CABI 2007)	**Yes:** These species cause soft rots, hollow stalk and stem rot in a number of ornamental plants (CABI 2007; Duff 1993). *Erwinia chrysanthemi* is associated with leaves and stems of *Phalaenopsis* (BAPHIQ 2001).	Yes (APPD 2007)	Not assessed	Not assessed	No
Erwinia chrysanthemi Burkholder *et al.* [Enterobacteriaceae]	Yes (BAPHIQ 2006)		Yes (APPD 2007)	Not assessed	Not assessed	No
Erwinia chrysanthemi pv. *zeae* Sabet [Enterobacteriaceae]	Yes (CABI 2007)		Yes (APPD 2007)	Not assessed	Not assessed	No

[4] The *Draft review of policy: Alternative risk management measures to import* Phalaenopsis *nursery stock from Taiwan* included a global list of pests known to occur on *Phalaenopsis* orchids. This final policy has removed species from the pest categorisation which are not known to occur in Taiwan and which subsequently are not associated with the import pathway at the origin.

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
Pectobacterium cypripedii (Hori) Brenner *et al*. [Enterobacteriaceae]	Yes (CABI 2007)	**Yes:** This species causes brown rot on the fleshy leaves of several orchid genera (CABI 2007).	Yes (CABI 2007)	Not assessed	Not assessed	No
Order Pseudomonadales						
Pseudomonas tolassii Paine [Pseudomonadaceae]	Yes (Zhang *et al*. 2009)	**Yes**: This species is known to cause leaf spots on *Phalaenopsis* (Zhang *et al*. 2009)	Yes (Nair and Fahy 1972)	Not assessed	Not assessed	No
DOMAIN EUKARYA						
ANIMALIA (Animal Kingdom)						
ARTHROPODA: Arachnidia (Phylum: Class)						
Acari						
Tenuipalpus pacificus Baker [Tenuipalpidae]	Yes (BAPHIQ 2006)	**Yes:** This species attacks leaves and stems of *Phalaenopsis* species (BAPHIQ 2001).	Yes (AICN 2007)[5]	Not assessed	Not assessed	No
Tetranychus urticae Koch [Tetranychidae]	Yes (CABI 2007)	**Yes:** The red spider mite is polyphagous and feeds on ornamentals as well as other species. It lays its eggs on the leaves, and sucks cell contents causing pale spots or scars (Fasulo and Denmark 2006).	Yes (AICN 2007)	Not assessed	Not assessed	No

[5] This pest is absent from Western Australia and may or may not meet the definition of a regional quarantine pest depending on its potential for establishment, spread and economic consequences. This policy review has not considered regional pests; however, the detection of any live insects (including regional pests), disease symptoms and/or regulated articles during the on arrival inspection will result in the failure of the consignment and remedial action, including methyl bromide fumigation if live insects are detected. In this regard, regional pests are managed in the proposed systems approach without having been directly addressed in the risk assessment.

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
ARTHROPODA: Insecta (Phylum: Class)						
Hemiptera						
Aphis gossypii Glover [Aphididae]	Yes (BAPHIQ 2006)	**Yes:** This species attacks the leaves and stems of *Phalaenopsis* species (BAPHIQ 2001).	Yes (AICN 2007)	Not assessed	Not assessed	No
Coccus hesperidium L. [Coccidae]	Yes (BAPHIQ 2006)	**Yes:** This species attacks the leaves and stems of *Phalaenopsis* species (BAPHIQ 2001).	Yes (AICN 2007)	Not assessed	Not assessed	No
Diaspis boisduvalii (Signoret) [Diaspididae]	Yes (USDA 2009)	**Yes:** Scale insects attack foliage causing discolouration (Rittershausen 1989).	Yes (AICN 2007)[5]	Not assessed	Not assessed	No
Genaparlatoria pseudaspidiotus (Lindinger) [Diaspididae]	Yes (USDA 2009)	**Yes:** Scale insects attack foliage causing discolouration (Rittershausen 1989).	Yes (APPD 2007)[6]	Not assessed	Not assessed	No
Lepidosaphes chinensis Chamberlin [Diaspididae]	Yes (USDA 2009)	**Yes:** Scale insects attack foliage causing discolouration (Rittershausen 1989).	Not known to occur	Association with the host provides ample opportunity for establishment and spread of this pest as *Phalaenopsis* nursery stock will be sold throughout Australia.	There is no evidence to suggest that this species is of any economic importance. It is not considered in compendiums of economically important plant pests.	No
Lindingaspis rossi Maskell [Diaspididae]	Yes (USDA 2009)	**Yes:** This species attacks vegetative and reproductive plant parts (Watson 2005).	Yes (APPD 2007)	Not assessed	Not assessed	No

[6] This species is of regional quarantine concern to Western Australia. A full pest risk analysis including assessment of its potential for establishment, spread and economic consequences was conducted in the *Policy for the Importation of Fresh Mangoes (*Mangifera indica *L.) from Taiwan* (Biosecurity Australia 2006) under its synonym *Parlatoria pseudaspidiotus* Lindinger, 1905. This policy review has not considered regional pests; however, the detection of any live insects (including regional pests) during the on arrival inspection will result in the failure of the consignment and remedial action, including methyl bromide fumigation if live insects are detected. In this regard, regional pests are managed in the proposed systems approach without having been directly addressed in the risk assessment.

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
Parlatoria proteus (Curtis) [Diaspididae]	Yes (BAPHIQ 2006)	**Yes:** This species attacks the leaves and stems of *Phalaenopsis* species (BAPHIQ 2001).	Yes (AICN 2007)	Not assessed	Not assessed	No
Planococcus minor (Maskell) [Pseudococcidae]	Yes (USDA 2009)	**Yes:** Mealy bugs suck sap from the plant producing honeydew which favours fungal growth (Rittershausen 1989).	Yes (AICN 2007)[7]	Not assessed	Not assessed	No
Pseudaulacaspis pentagona (Targioni-Tozzetti) [Diaspididae]	Yes (CABI 2007)	**Yes:** Associated with foliage (Ben-Dov *et al.* 2001)	Yes (APPD 2007)[5]	Not assessed	Not assessed	No
Pseudococcus longispinus (Targ.) [Pseudococcidae]	Yes (BAPHIQ 2006)	**Yes:** This species attacks the leaves and stems of *Phalaenopsis* species (BAPHIQ 2001).	Yes (AICN 2007)	Not assessed	Not assessed	No
Saissetia coffeae (Signoret) [Coccidae]	Yes (BAPHIQ 2006)	**Yes:** This species attacks the leaves and stems of *Phalaenopsis* species (BAPHIQ 2001).	Yes (AICN 2007)	Not assessed	Not assessed	No

[7] This species is of regional quarantine concern to Western Australia. A full pest risk analysis including assessment of its potential for establishment, spread and economic consequences was conducted in the *Final import risk analysis report for the importation of Cavendish bananas from the Philippines* (Biosecurity Australia 2008). This policy review has not considered regional pests; however, the detection of any live insects (including regional pests) during the on arrival inspection will result in the failure of the consignment and remedial action, including methyl bromide fumigation if live insects are detected. In this regard, regional pests are managed in the proposed systems approach without having been directly addressed in the risk assessment.

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
Lepidoptera						
Amsacta lactinea (Cramer) [Arctiidae]	Yes (BAPHIQ 2006)	**Yes:** This species attacks the leaves and stems of *Phalaenopsis* species (BAPHIQ 2001).	Not known to occur	Association with the host provides ample opportunity for establishment and spread of this pest as *Phalaenopsis* nursery stock will be sold throughout Australia.	Waterhouse (1993) lists this species as of concern to peanut production in Southeast Asia; however, other recent publications from the region consider the species to be a minor pest that does not cause serious damage (Sharma and Ramamurthy 2009; Butani 1993). Consequently, this species is not considered further.	No
Orgyia postica (Walker) [Lymantriidae]	Yes (BAPHIQ 2006)	**Yes:** This species attacks the leaves and stems of *Phalaenopsis* species (Wang and Lin 1997).	Not known to occur	This species currently occurs from Japan to southern China (Nasu *et al.* 2004; Zhu and Zhang 2004). Association with the host provides ample opportunity for establishment and spread of this pest as nursery will be sold throughout Australia.	This species has been recorded as a pest of *Eucalyptus* plantations in Japan (Nasu *et al.* 2004). It is also considered to be one of the ten most important moths attacking tropical fruits in Southern China (Zhu and Zhang 2004).	**Yes**
Spodoptera exigua (Hübner) [Noctuidae]	Yes (CABI 2007)	**Yes:** *Spodoptera exigua* attacks foliage causing defoliation (Sahayaraj and Amalraj 2006). *Spodoptera litura* attacks the leaves and stems of *Phalaenopsis* species (BAPHIQ 2001).	Yes (AICN 2007)	Not assessed	Not assessed	No
Spodoptera litura (Fabricius) [Noctuidae]	Yes (BAPHIQ 2006)		Yes (AICN 2007)	Not assessed	Not assessed	No

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
Orthoptera						
Atractomorpha psittacina de Haan [Acrididae]	Yes (BAPHIQ 2006)	**Yes:** This species attacks the leaves and stems of *Phalaenopsis* species (BAPHIQ 2001).	Not known to occur	This species currently occurs in the Philippines (Amalin *et al.* 1991). Association with the host provides ample opportunity for establishment and spread of this pest as Inursery stock will be sold throughout Australia.	Hatai (1975) considered that this species has impacts in rice production; however, no information is available to confirm the impact that this species has on rice production, or on any other cropping system. Consequently it has not been considered further.	No
Thysanoptera						
Chaetanaphothrips orchidii (Moulton) [Thripidae]	Yes (CABI 2007)	**Yes:** Thrips are sap-sucking insects that feed on foliage or flowers (Rittershausen 1989).	Yes (AICN 2007)[8]	Not assessed	Not assessed	No
Dichromothrips corbetti (Priesner) [Thripidae]	Yes (BAPHIQ 2006)	**Yes:** Thrips are sap-sucking insects that feed on foliage or flowers (Rittershausen 1989; BAPHIQ 2001).	Yes (AICN 2007)[5]	Not assessed	Not assessed	No

[8] This species is of regional quarantine concern to Western Australia. A full pest risk analysis including assessment of its potential for establishment, spread and economic consequences was conducted in the *Final import risk analysis report for fresh unshu mandarin fruit from Shizuoka Prefecture in Japan* (Biosecurity Australia 2009). This policy review has not considered regional pests; however, the detection of any live insects (including regional pests) during the on arrival inspection will result in the failure of the consignment and remedial action, including methyl bromide fumigation if live insects are detected. In this regard, regional pests are managed in the proposed systems approach without having been directly addressed in the risk assessment.

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
Frankliniella intonsa (Trybom) [Thripidae]	Yes (BAPHIQ 2006)	**Yes:** Thrips are sap-sucking insects that feed on foliage or flowers (Rittershausen 1989). *Frankliniella intonsa* is associated with the flowers, leaves and stems of *Phalaenopsis* (BAPHIQ 2001).	Not known to occur	This species is polyphagous and its current reported distribution suggests that there are similar environments in parts of Australia that would be suitable for its establishment and spread.	Flower thrips cause distortion of fruit and reductions in quality (Buxton and Easterbrook 1988); discolouration resulting in sales losses on ornamental and cut flower varieties (Sauer 1997). Flower thrips will affect cut flower trade as various countries apply phytosanitary restrictions for flower thrips.	**Yes**
Thrips hawaiiensis (Morgan) [Thripidae]	Yes (BAPHIQ 2006)	**Yes:** Thrips are sap-sucking insects that feed on foliage or flowers (Rittershausen 1989). *Thrips hawaiiensis* is associated with the flowers, leaves and stems of *Phalaenopsis* (BAPHIQ 2001).	Yes (AICN 2007)	Not assessed	Not assessed	No
Thrips palmi Karny [Thripidae]	Yes (CABI 2007)		Yes (AICN 2007)[9]	Not assessed	Not assessed	No
MOLLUSCA: Gastropoda (Phylum: Class)						
Eupulmonata						
Bradybaena similaris (Ferussac) [Bradybaenidae]	Yes (BAPHIQ 2006)	**Yes:** These snails chew holes in foliage, flowers and fruit (USDA	Yes (AICN 2007)	Not assessed	Not assessed	No

[9] This species is of regional quarantine concern to Western Australia. A full pest risk analysis including assessment of its potential for establishment, spread and economic consequences was conducted in the *Final import risk analysis report for fresh unshu mandarin fruit from Shizuoka Prefecture in Japan* (Biosecurity Australia 2009). This policy review has not considered regional pests; however, the detection of any live insects (including regional pests) during the on arrival inspection will result in the failure of the consignment and remedial action, including methyl bromide fumigation if live insects are detected. In this regard, regional pests are managed in the proposed systems approach without having been directly addressed in the risk assessment.

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
Bradybaena tourannensis (Souleyet) [Bradybaenidae]	Yes (Anon. 2009)	2003). *Bradybaena similaris* is associated with the flowers, leaves and stems of *Phalaenopsis* (BAPHIQ 2001).	Not known to occur	Association with the host provides ample opportunity for establishment and spread of this pest as the product will be sold throughout Australia. Also, as this pest has a wide host range including plants from more than 10 families (Lai 1984). As snails are hermaphroditic this increases the probability of establishing a population from a small number of individuals imported.	Mollusc feeding reduces the visual quality of plant, the available photosynthetic surface area, and some clip succulent plant parts (Godan 1983; Ohlendorf 1999).	**Yes**
Laevicaulis alte (Ferussac) [Veronicellidae]	Yes (BAPHIQ 2006)	**Yes:** This species damages the foliage, flowers and roots of orchids (Liu *et al.* 1997; BAPHIQ 2001).	Yes (AICN 2007)	Not assessed	Not assessed	No
CHROMISTA (Kingdom)						
OOMYCOTA: Oomycetes (Phylum: Class)						
Peronosporales						
Phytophthora cactorum (Lebert & Cohn) J. Schröt. [Peronosporaceae]	Yes (CABI 2007)	**Yes:** *Phytophthora* species are soil-borne pathogens and are associated with foliar, root and stem disease (CABI 2007). *Phytophthora* species cause black rot. Infected areas, which can be any part of the plant, turn black and watery. *Phytophthora* species are associated with the leaves, stems and roots of *Phalaenopsis* (BAPHIQ 2001).	Yes (APPD 2007)	Not assessed	Not assessed	No
Phytophthora nicotianae Breda de Haan [Peronosporaceae]	Yes (CABI 2007)		Yes (APPD 2007)	Not assessed	Not assessed	No
Phytophthora nicotianae var. *parasitica* (Dastur) Waterh [Peronosporaceae]	Yes (BAPHIQ 2006)		Yes (APPD 2007)	Not assessed	Not assessed	No
Phytophthora palmivora (E.J. Butler) E.J. Butler [Peronosporaceae]	Yes (BAPHIQ 2006)		Yes (APPD 2007)	Not assessed	Not assessed	No

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
Pythiales						
Pythium ultimum Trow [Pythiaceae]	Yes (Farr *et al.* 2009)	**Yes:** Causes black rot. Infected areas, which can be any part of the plant, turn black and watery (Agrios 1997).	Yes (APPD 2007)	Not assessed	Not assessed	No
DOMAIN FUNGI						
INCERTAE SEDIS: Insertae sedis (Phylum: Class)						
Insertae sedis						
Sclerotium rolfsii Sacc. [Insertae sedis]	Yes (BAPHIQ 2006)	**Yes:** This species causes foliar, root and stem disease (CABI 2007). This species is associated with the stems and roots of *Phalaenopsis* (BAPHIQ 2001).	Yes (APPD 2007)	Not assessed	Not assessed	No
ASCOMYCOTA: Dothideomycetes (Phylum: Class)						
Botryosphaeriales						
Lasiodiplodia theobromae (Pat.) Griffon & Maubl. [Botryosphaeriaceae]	Yes (Farr *et al.* 2009)	**Yes:** This species causes rots, leaf spot and seed decay (Farr *et al.* 2009).	Yes (APPD 2007)	Not assessed	Not assessed	No
Phyllosticta capitalensis Henn. [Botryosphaeriaceae]	Yes (Farr *et al.* 2009)	**Yes:** Associated with foliage (Farr *et al.* 2009).	Yes (Farr *et al.* 2009)[5]	Not assessed	Not assessed	No
Capnodiales						
Cladosporium cladosporioides (Fresen.) G.A. de Vries [Davidiellaceae]	Yes (Farr *et al.* 2009)	**Yes:** This fungus causes blights on foliage (Farr *et al.* 2009).	Yes (APPD 2007)	Not assessed	Not assessed	No

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
Sphaerulina phalaenopsidis Sawada [Mycosphaerellaceae]	Yes (Sawada 1959; BAPHIQ 2006).	**Yes:** This fungus associated with the leaves of *Phalaenopsis* (BAPHIQ 2001).	Not known to occur	This species currently occurs in Taiwan (Sawada 1959). There are similar natural and built environments in parts of Australia that would be suitable for the establishment and spread of this fungus.	Leaf spot causing pathogens reduce visual quality and decrease the value of ornamental crops in addition to reducing the available photosynthetic area and reducing plant vigour (Agrios 1997; Pirone 1978).	**Yes**
Pleosporales						
Cochliobolus lunatus Nelson &. Haasis [Pleosporaceae]	Yes (CABI 2007)	**Yes:** This species is associated with foliage (CABI 2007; Sivanesan 1990).	Yes (APPD 2007)	Not assessed	Not assessed	No
ASCOMYCOTA: Leotiomycetes (Phylum: Class)						
Helotiales						
Botrytis cinerea Pers.:Fr. [Sclerotiniaceae]	Yes (BAPHIQ 2006)	**Yes:** This species causes grey mould and is associated with the leaves and stems of *Phalaenopsis* (BAPHIQ 2001).	Yes (APPD 2007)	Not assessed	Not assessed	No
Cylindrosporium phalaenopsidis Saw. [Incertae sedis]	Yes (BAPHIQ 2006)	**Yes:** This species causes black spot foliar disease (Lu *et al.* 1994; BAPHIQ 2001).	Not known to occur	This species currently occurs in China (Lu *et al.* 1994). There are similar natural and built environments in parts of Australia that would be suitable for the establishment and spread of this fungus.	This species is considered to be a serious disease of *Cymbidium* orchids in China (Lu *et al.* 1994).	**Yes**

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
ASCOMYCOTA: Sordariomycetes (Phylum: Class)						
Incertae sedis						
Colletotrichum gloeosporioides (Penz.) Penz. & Sacc.	Yes (BAPHIQ 2006)	**Yes:** A number of members of this genus have been isolated from the roots of orchid species (Otero *et al.* 2002).	Yes (APPD 2007)	Not assessed	Not assessed	No
Colletotrichum orchidearum Allesch. [Glomerellaceae]	Yes (Farr *et al.* 2009)		Not known to occur	Association with the host provides ample opportunity for establishment and spread of this pest as *Phalaenopsis* nursery stock will be sold throughout Australia.	This species causes anthracnose on orchids (Kannaiyan and Nene 1973), but it is not considered to be an important disease.	No
Hypocreales						
Fusarium oxysporum Schltdl. [Nectriaceae]	Yes (CABI 2007)	**Yes:** Members of this genus cause root rot, wilt disease and fruit rots (Farr *et al.* 2009; Westcott and Horst 2001).	Yes (APPD 2007)	Not assessed	Not assessed	No
Nectria haematococca Berkeley & Broome [Nectriaceae]	Yes (Farr *et al.* 2009)	**Yes:** This fungus causes collar rot in a number of species (Fischer *et al.* 2005).	Yes (APPD 2007)	Not assessed	Not assessed	No
Trichosphaeriales						
Khuskia oryzae H.J. Huds. [Insertae sedis]	Yes (Farr *et al.* 2009)	**Yes:** While this species causes cob and stalk rot of maize, it is saprophytic and a weak parasite of other plants (Farr *et al.* 2009).	Yes (APPD 2007)	Not assessed	Not assessed	No
Xylariales						
Pestalotiopsis palmarum (Cooke) Steyaert [Amphisphaeriaceae]	Yes (Farr *et al.* 2009)	**Yes:** This fungus causes foliar diseases (Kumar *et al.* 2006).	Yes (APPD 2007)	Not assessed	Not assessed	No

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
BASIDIOMYCOTA: Agaricomycetes (Phylum: Class)						
Cantharellales						
Rhizoctonia solani Kuhn [Ceratobasidiaceae]	Yes (Farr *et al.* 2009)	**Yes:** Root rot, damping off of seedlings, leaf and fruit rot in a variety of plants (Farr and Rossmann 2010).	Yes (APPD 2007)	Not assessed	Not assessed	No
BASIDIOMYCOTA: Pucciniomycetes (Phylum: Class)						
Pucciniales						
Coleosporium bletiae Dietel [Coleosporiaceae]	Yes (Farr *et al.* 2009)	**Yes:** This species is a rust fungus affecting foliage (Kaneko 1978).	Yes (Duff 1997)[5]	Not assessed	Not assessed	No
DOMAIN VIRUSES						
NEGATIVE SENSE ssRNA						
Capsicum chlorosis virus (CaCV) [Bunyaviridae: *Tospovirus*]	Yes (Zheng *et al.* 2008)	**Yes:** This virus causes chlorotic mottle symptoms in foliage and stunting (Jones and Sharman 2005).	Yes (Jones and Sharman 2005)	Not assessed	Not assessed	No
Phalaenopsis chlorotic spot virus (PhCSV) [Rhabdoviridae: *Potyvirus*]	Yes (Zheng *et al.* 2008)	**Yes:** This species causes chlorotic spots on foliage (Zheng *et al.* 2008).	Not known to occur	Association with the host provides ample opportunity for establishment and spread of this pest as *Phalaenopsis* nursery stock will be sold throughout Australia.	This virus was only described in 2006 (see Zheng *et al.* 2008). The species affects the marketability of *Phalaenopsis*; however, its full importance is still unknown.	**Yes**
Tomato spotted wilt virus (TSWV) [Bunyaviridae: *Tospovirus*]	Yes (CABI 2007)	**Yes:** This species causes wilting, foliar spots, lesions and leaf shape malformation (Brunt *et al.* 1996), and is associated with *Phalaenopsis* (BAPHIQ 2001).	Yes (APPD 2007)	Not assessed	Not assessed	No

Pest	Present in Taiwan	Potential to be on pathway	Present within Australia	Potential for establishment and spread	Potential for economic consequences	Consider further in PRA
POSITIVE SENSE ssRNA						
Carnation mottle virus (CarMV) [Tombusviridae: *Carmovirus*]	Yes (CABI 2007)	**Yes:** This species causes chlorotic spots on foliage (Brunt *et al.* 1996).	Yes (Moran *et al.* 1985)	Not assessed	Not assessed	No
Cucumber mosaic virus (CMV) [Bromoviridae: *Cucumovirus*]	Yes (BAPHIQ 2006; Zheng *et al.* 2008)	**Yes:** This species causes stunting and foliar mosaic symptoms (Brunt *et al.* 1996) and is associated with *Phalaenopsis* (BAPHIQ 2001).	Yes (APPD 2007)	Not assessed	Not assessed	No
Cymbidium mosaic virus (CymMV) [Flexiviridae: *Potexvirus*]	Yes (BAPHIQ 2006; Zheng *et al.* 2008)	**Yes:** This species causes foliar lesions (Brunt *et al.* 1996) and is associated with *Phalaenopsis* (BAPHIQ 2001).	Yes (Brunt *et al.* 1996)	Not assessed	Not assessed	No
Tobacco mosaic virus – Odontoglossum strain (TMV-O) [Unassigned: *Tobamovirus*]	Yes (BAPHIQ 2006; Zheng *et al.* 2008)	**Yes:** This species causes ring spot and mottle on foliage (Brunt *et al.* 1996) and is associated with *Phalaenopsis* (BAPHIQ 2001).	Yes (Brunt *et al.* 1996)	Not assessed	Not assessed	No

Appendix B Additional quarantine pest data

Quarantine pest	*Orgyia postica* Walker
Synonyms	*Lacida postica* (Walker) *Notolophus australis posticus* (Walker) *Notolophus postica* (Walker) *Notolophus posticus* (Walker) *Orgyia australis postica* (Walker) *Orgyia ceylanica* Nietner *Orgyia ocularis* Moore *Orgyia posticus* (Walker)
Common name(s)	Cocoa tussock moth
Main hosts	*Amherstia nobilis*, *Camellia sinensis* (tea), *Cinchona*, *Cinnamomum*, *Coffea* (coffee), *Durio zibethinus* (durian), *Erythrina* spp., *Euphorbia longana* (longan), *Garcinia mangostana* (mangosteen), *Glycine max* (soyabean), *Hevea brasiliensis* (rubber), *Lablab purpureus* (hyacinth bean), *Leucaena leucocephala* (leucaena), *Litchi chinensis* (lichi), *Malpighia glabra* (acerola), *Mangifera indica* (mango), *Nephelium lappaceum* (rambutan), Orchidaceae (orchids), *Populus deltoides* (poplar), *Pyrus communis* (European pear), *Ricinus communis* (castor bean), *Rosa* (roses), *Syzygium cumini* (black plum), *Theobroma cacao* (cocoa), *Vigna radiata* (mung bean), *Vitis vinifera* (grapevine), *Ziziphus jujuba* (common jujube) (CABI 2007).
Distribution	Bangladesh, Brunei Darussalam, China, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam (CABI 2007).
Quarantine pest	*Frankliniella intosa* Trybom
Synonyms	*Frankliniella intonsa* f. *norashensis* Yakhontov and Jurbanov *Thrips intonsa* Trybom *Frankliniella formosae* Moulton
Common name(s)	Flower thrips
Main hosts	*Abelmoschus esculentus* (okra), *Arachis hypogaea* (groundnut), *Asparagus officinalis* (asparagus), *Capsicum annuum* (capsicum), *Chrysanthemum indicum* (chrysanthemum), *Fragaria* (strawberry), *Glycine max* (soyabean), *Gossypium* (cotton), *Lycopersicon esculentum* (tomato), *Medicago sativa* (lucerne), *Oryza sativa* (rice), *Phaseolus vulgaris* (common bean), *Pisum sativum* (pea), *Prunus persica* (peach), *Vigna angularis* (adzuki bean) (CABI 2007).
Distribution	This species is distributed across Asia, Europe and North America (CABI 2007).
Quarantine pest	*Bradybaena tourannensis* (Souleyet)
Synonyms	*Acusta tourennensis* (Souleyet)
Common name(s)	Snail
Main hosts	This species is polyphagous and has a wide host range extending over 10 plant families (Lai 1984).
Distribution	Taiwan (BAPHIQ 2006).
Quarantine pest	*Cylindrosporium phalaenopsidis* Sawada
Synonyms	n/a
Common name(s)	Leaf spot, black spot
Main hosts	*Cymbidium sinensis* and *Phalaenopsis* spp. (Lu *et al.* 1994; USDA 2003). Lu *et al.* (1994) has also demonstrated the susceptibility of a further eight species of Orchidaceae on inoculation in China but if natural infection can occur is still unknown.
Distribution	China (USDA 2003) and Taiwan (BAPHIQ 2006; Farr *et al.* 2009).

Quarantine pest	*Sphaerulina phalaenopsidis* Sawada
Synonyms	n/a
Common name(s)	Leaf spot
Main hosts	Known only from *Phalaenopsis* spp. (USDA 2003).
Distribution	Taiwan (BAPHIQ 2006; Farr *et al.* 2009).
Quarantine pest	Phalaenopsis chlorotic spot *potyvirus*
Synonyms	n/a
Common name(s)	Phalaenopsis chlorotic spot
Main hosts	This species is newly described and is only known to occur on *Phalaenopsis* spp. (Zheng *et al.* 2008).
Distribution	Known only from Taiwan (Zheng *et al.* 2008).

Appendix C Modified[10] BAPHIQ work plan for *Phalaenopsis* spp. in growing media from Taiwan

1 Product Being Exported

1.1. These plants in compliance with this work plan may enter Australia without removing the approved growing medium from the roots, and are exempt from the mandatory on-arrival pesticide treatment and three months post-entry quarantine.

1.2 Approved growing media is perlite, vermiculite, inorganic fibres or sphagnum moss which has been pasteurized using hot water so that the core temperature or the sphagnum moss is held at 80 °C for 20–30 minutes.

1.3 Growing media must be new, not previously used.

1.4 The plants offered for importation into Australia shall be free of sand, soil, earth, or other unauthorized growing media.

2 Responsibilities

2.1. BAPHIQ Responsibilities

2.2.1 BAPHIQ shall follow all requirements of the work plan and applicable regulations.

2.2.2 BAPHIQ will conduct monthly inspections of approved facilities and the plants within. Any plants showing signs of disease shall not be exported to Australia.

2.2.3 BAPHIQ will conduct the phytosanitary inspections and issue Phytosanitary Certificates.

2.2.4 BAPHIQ shall advise growers of pest control procedures.

2.2.5 Add new greenhouses to the list of authorized facilities, provided the procedures and facilities are consistent with relevant parts of DAFF's approval of Quarantine Approved Premises (see appendix D).

2.2.6 BAPHIQ will perform inspections of greenhouse units that growers wish to have approval for exporting plants in growing media.

2.2.7 BAPHIQ will provide plant pest identification services as needed.

2.2. Grower Responsibilities

2.2.1 The grower will provide documents regarding the location, acreage of greenhouse and other relevant information required by BAPHIQ to apply for the certification.

[10]Modified after technical discussions held with BAPHIQ in Taiwan July 2009

2.2.1 The grower will abide by all requirements of the work plan and applicable regulations.

2.2.2 Approved growers shall enter into written compliance agreements with BAPHIQ agreeing to the following:

4.2.2.1 Comply with the requirements of this work plan.

4.2.2.2 Provide BAPHIQ access to the growing facility as necessary to monitor compliance with the provisions of this work plan.

2.2.3 The grower will formally request BAPHIQ for inspection of the greenhouse unit and also specifically identifying the unit(s) involved.

2.2.4 The grower will maintain accurate records of all activities, identify the growing sites and greenhouse unit(s), assign lot numbers to each of the plantings and identify the plant material.

2.2.5 The grower will formally request in writing to BAPHIQ any voluntary withdrawal of individual greenhouse units or of the entire facility.

3 Greenhouses

3.1 Plants to be established in an approved greenhouse may only enter the greenhouse in the following conditions:

3.1.1 Plantlets in tissue culture flasks.

3.2. Plants shall be grown throughout the growing period in greenhouses of such construction as to prevent the entry of pests and pathogens.

3.3 Sanitary procedures adequate to exclude plant pests and diseases, including cleaning and disinfection of floors, benches and tools, and the application of control measures to protect against any injurious plant diseases, injurious insect pests, and other plant pests shall be employed. Such measures that are not enumerated herein may be prescribed by BAPHIQ and/or DAFF.

3.4 All vents shall be covered with screening with openings no larger than 0.6 mm.

3.5 Entryways shall be equipped with automatic closing doors. Double or airlock doors are recommended.

3.6 The greenhouse shall be free of sand, soil, weeds, plant pests and debris.

3.7 All plants must be grown on raised benches (at least 46 cm above the floor) supported by legs that have copper plates wrapped around each leg or, an equivalent means of preventing mollusc infestation.

3.8 The growing media must also be stored and safeguarded in a manner that prevents any possible incursion by plant pests.

3.9 Packing materials and shipping containers must be safeguarded from pest infestations.

3.10 Plants must be watered only with rainwater that has been boiled or pasteurized, with clean well water, or with potable water.

3.11 Plants must be stored and packaged only in areas free of sand, soil, earth, weeds, and plant pests.

3.12 Plants transported outside of one approved greenhouse to another, the approved greenhouse or packing area must be adequately safeguarded to prevent the possibility of pest infestation.

4 Mother Stock and Growth Requirements

4.1 Plants must be developed from mother stock that was inspected and found free from evidence of diseases and pests by the BAPHIQ Inspector. Plants must be tested for Phalaenopsis chlorotic spot virus and found to be free of the virus.

4.2 Plants must be rooted and in an active state of foliar growth in approved greenhouse units producing plants in accordance with this work plan for at least four consecutive months immediately prior to importation into Australia.

5 Growing Season Inspection

5.1 BAPHIQ is responsible for inspection during the growing season and during packing.

5.2 Any shortcomings found should be corrected by the grower promptly. Follow-up re-inspections should be conducted by BAPHIQ to confirm compliance.

5.3 The grower must maintain accurate records of all activities, identification of the growing site or glasshouse, assign identifying marks or lot numbers to each planting, and identify plant material.

6 Greenhouse Approval and Withdrawal

6.1 Greenhouse Approval

6.1.1 Prior to greenhouse approval, the greenhouse must be free of plant debris, soil, weeds, and plant pests. Appropriate measures will be taken to ensure the greenhouse is disinfected/disinfested prior to approval and movement of program plants into the newly approved greenhouse.

6.1.2 BAPHIQ is responsible for inspecting and approving greenhouses for exports to Australia, ensuring that the grower and the greenhouse meet the requirements of this work plan.

6.1.3 BAPHIQ may add new growers or exporters to the authorized list provided that the procedures and notify DAFF.

6.1.4 Approved growers wishing to add new greenhouses to the program will formally request an inspection of the unit and also specifically identify the unit(s) involved. BAPHIQ will conduct the inspection.

6.1.5 BAPHIQ will notify the DAFF of any changes to the list.

6.2. Greenhouse Withdrawal

6.2.1 Voluntary withdrawal of the entire facility or individual greenhouses by a grower will be done formally in writing by the grower to BAPHIQ, who will notify DAFF.

6.2.2 BAPHIQ will also notify DAFF of involuntary withdrawals of individual greenhouse units or an entire facility.

7 Export Inspection

7.1 The plants and growing media will be inspected in the greenhouse and found free from evidence of plant pests and diseases by a BAPHIQ Inspector immediately prior to the date of export to Australia.

7.2 Plants will be immersed or drenched[11] in a broad spectrum insecticide and sprayed with a suitable fungicide no longer than 14 days prior to export, BAPHIQ will certify that these treatments have been applied on the phytosanitary certificate (PC).

7.3 After inspection, the plants must be safeguarded against reinfestation.

7.4 BAPHIQ will establish an appropriate level of sampling for export inspection.

7.5 Each shipment must be accompanied by a PC including an accurate Additional Declaration (AD) stating that the plants meet conditions of growing, storing, and shipping in compliance with this work plan. If approved plants are shipped via a third party, the name of the grower of the approved plants (i.e. the approved grower) must appear on the PC.

8 Program Review and Evaluation

8.1 The work plan may be reviewed or amended when necessary by DAFF and BAPHIQ.

8.1.1 DAFF will audit the production facilities annually to ensure continued compliance with the requirements set out for the export of *Phalaenopsis* orchids nursery stock to Taiwan.

[11] Where drenching is used as an insecticidal treatment for growing media, the plant will also need to be treated with an appropriate foliar insecticide to ensure that the whole plant is adequately treated prior to export.

Appendix D Closed quarantine facilities for medium risk nursery stock

Purpose

This document sets out the criteria which will achieve the structural requirements of a Class 6.1 Quarantine Approved Premises (QAP) under section 46A of the *Quarantine Act 1908*.

Scope

These criteria apply to any standard plant house that is to be used for quarantine of nursery stock. Closed quarantine facilities include glasshouses, polyhouses, igloos and tunnel houses, etc. (excludes screen houses).

Premises Location

- The premises are to be located within the metropolitan areas surrounding a proclaimed port in a city with a permanently based AQIS officer. AQIS defines 'metropolitan areas' on the basis of postcode. A list of valid metropolitan postcodes for quarantine purposes can be found on the AQIS website. Premises located outside of postcodes classified as 'metropolitan areas' will also have to show that they are able to comply with the additional criteria as outlined in the document, 'Criteria for the Approval of Premises in Non-Metropolitan Areas'. AQIS will consider the application on its individual merits with consideration being given to the quarantine risk and serviceability associated with each establishment's location.

Construction

a) The quarantine house must be of a size commensurate with the proposed quantity of imports to be quarantined at the facility and have a minimum of 10 m² of floor space.

b) All doors and doorways into the quarantine area are to be properly constructed and fitted with appropriate seals on the top, bottom and sides. The doors are to be provided with locks and handles enabling them to be opened and closed from either side. A self-closing fitting is required on either the internal or external door.

c) Where a facility is deemed to be insecure and adequate repairs cannot be carried out immediately, the plant material present must be ordered to a secure quarantine premises until all repairs have been carried out to the satisfaction of the AQIS Officer.

d) Access to the facility in which the plants are grown is to be restricted to those persons required to carry out essential work only. Members of the public and persons other than nursery staff are not permitted entry.

e) The quarantine house must be a separate unit used only for the post-entry quarantine of plants for which approval has been granted whilst it is approved for the introduction of plants. The quarantine house may adjacent to existing facilities provided a functional/structural barrier is maintained between each area. The barrier must effectively prevent the flow of air and the possible spread of fungal spores from the quarantine area to plants of a similar species.

f) Access to the quarantine house must not be through any other areas where plant material is being grown, i.e. the quarantine house must have its own entrance.

g) The quarantine house must be a substantial, properly constructed, insect-proof glasshouse, polyhouse, or approved tunnel house with an insect-proof door entrance, porch or 'lock'. The entrance porch or 'lock' must be of sufficient area to permit the entry of people, plants and trolleys into the 'lock', to ensure that only one door may be open at any one time.

h) The quarantine house and the quarantine 'lock' must be fully equipped with a concrete floor (or acceptable impervious substitute) that drains to a suitable soil trap which is connected to sewerage or septic tank. A footbath containing a suitable disinfect, e.g. copper oxychloride to a depth of 10 mm, must be maintained for the disinfection of footwear in the quarantine 'lock'.

i) The cladding must be substantial and affixed in an insect-proof manner. Whilst rigid material is preferred, film plastics may be used. The minimum requirement for film plastic cladding is a double layer of 200 micron thick poly film. Providing they meet the minimum requirements, plastic films can be approved by the office of the Senior Inspector. Renewal should only be made after an inspection to ascertain that the structure is in good condition and likely to remain intact for at least one year.

j) All openings (including evaporative cooling systems) in the facility must be covered with permanently fixed gauze with a maximum aperture of 0.5 mm or 500 microns. Whilst metal gauze is preferred, synthetic meshes may be used. Synthetic meshes can be approved by the AQIS officers, provided they retain the minimum aperture dimensions when fixed in place. For this reason welded mesh is preferred to woven mesh types. Where plastic mesh is used, the responsible officer must ensure that the mesh is maintained intact to specification for the duration of approval.

k) Plants in the quarantine house are to be held on a single-tiered mesh platform raised off the floor to allow adequate drainage and maintenance. Benches should be spaced to allow adequate access for quarantine inspection.

l) The quarantine plant-house is to be kept locked at all times except when access by authorised persons is required.

m) Fungicides are not to be used on the plants without AQIS approval.

n) All Quarantine Areas where goods subject to quarantine are stored or handled must display a quarantine sign to assist in effectively managing the security of these goods. These signs are to be:

- secured on a building/s, racks, fences, gates and/or doors and be visible at all times.
- permanently affixed,
- of a professional standard,
- made to state 'Quarantine Area - Authorised Persons Only, No Entry or Removal of Goods, Penalties Apply, (*Quarantine Act 1908*)' (or as directed for specific quarantine operations),
- on a yellow background, with black lettering.

Note: Cardboard and paper signs are not acceptable. Signs on external structures must be:

- a minimum 600 mm x 400 mm with lettering a minimum 25 mm height, and
- be weatherproof and resistant to the elements

Signs within structures must be a minimum 295 mm x 210 mm with lettering a minimum 8 mm height (example Attached).

Waste Disposal

a) An insect proof bin of an appropriate size, labelled 'Quarantine Waste', is to be provided for all quarantine waste, including packaging residue. Alternatively, quarantine waste must be double-bagged, clearly identified and securely stored while waiting for disposal.

b) All quarantine waste must be disposed of in a manner approved by AQIS.

Office and Record Requirements

a) Records are to be made available for inspection by AQIS officers. In addition, these records must be retained at these premises for a minimum period of 18 months during which time they will, upon request, be made available to an AQIS officer.

b) The premises must have a fully stocked and maintained first aid cabinet.

c) A register must be maintained recording incoming and outgoing plants, plant deaths and inspection dates.

d) Records (electronic or manual) for each consignment of goods must include:

- a copy of the Quarantine Entry;
- Import Permit number;
- name and address of owner;
- date of arrival;
- plant variety (including scientific name) and numbers;
- country of origin;
- treatment details;
- release details.

Administration

a) It is the responsibility of the applicant to ensure that the premises and all operations comply with all local, state and federal regulations and the relevant state Environmental Protection Agency requirements. Documented evidence of compliance with these requirements must be produced to AQIS upon request.

b) Premises must be securely locked when unattended and after hour access to the premises must be limited to authorised persons only.

c) It is a condition of approval that management ensures that all persons performing quarantine functions have successfully completed all required training to obtain and maintain Accredited Person status.

d) Non-compliance of the criteria or any breach of the *Quarantine Act 1908* may result in approval of the premises being withdrawn or suspended and legal action instigated.

e) Parking is to be made available for visiting AQIS officers.

f) Control and security of the quarantine area is the responsibility of the nominated senior person of the company. The name, designation/position title and contact details of the nominated person must be supplied with the application and at each renewal.

g) AQIS is to be notified in writing at least 30 days prior to changes in ownership, senior management, operating procedures/arrangements relating to quarantineable goods or where modifications to those parts of the premises where quarantineable goods are stored or treated are planned.

h) All quarantine instructions and relevant AQIS Import Permit conditions must be complied with. Where goods are handled for a third party, it is a requirement of approval that establishment operators have an arrangement in place that ensures they are aware of any relevant permit conditions. Please note that a breach of this clause may lead to suspension of the approval as a Quarantine Approved Premises.

i) All applications to be accompanied by scale drawings of the proposed area and facilities for treatments. In the case of new constructions these plans must be approved before any construction is undertaken.

Glossary

Term or abbreviation	Definition
Additional declaration	A statement that is required by an importing country to be entered on a phytosanitary certificate and which provides specific additional information on a consignment in relation to regulated pests (FAO 2009).
Appropriate level of protection (ALOP)	The level of protection deemed appropriate by the Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory (WTO 1995).
Area	An officially defined country, part of a country or all or parts of several countries (FAO 2009).
Area of low pest prevalence	An area, whether all of a country, part of a country, or all parts of several countries, as identified by the competent authorities, in which a specific pest occurs at low levels and which is subject to effective surveillance, control or eradication measures (FAO 2009).
Biosecurity Australia	The unit within the Biosecurity Services Group responsible for recommendations for the development of Australia's biosecurity policy.
Biosecurity Services Group	The group responsible for the delivery of biosecurity policy and quarantine services within the Department of Agriculture, Fisheries and Forestry.
Certificate	An official document which attests to the phytosanitary status of any consignment affected by phytosanitary regulations (FAO 2009).
Consignment	A quantity of plants, plant products and/or other articles being moved from one country to another and covered, when required, by a single phytosanitary certificate (a consignment may be composed of one or more commodities or lots) (FAO 2009).
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO 2009).
ELISA	Enzyme-linked immuno-sorbent assay.
Endangered area	An area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss (FAO 2009).
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 (FAO 2009).
Establishment	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO 2009).
Equivalence (of phytosanitary terms)	The situation where, for a specified pest, different phytosanitary measures achieve a contracting party's appropriate level of protection (FAO 2009).
Fresh	Living; not dried, deep-frozen or otherwise conserved (FAO 2009).
Host range	Species capable, under natural conditions, of sustaining a specific pest or other organism (FAO 2009).
Import permit	Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2009).
Import risk analysis	An administrative process through which quarantine policy is developed or reviewed, incorporating risk assessment, risk management and risk communication.
Infestation (of a commodity)	Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2009).
Inspection	Official visual examination of plants, plant products or other regulated articles to determine if pests are present and/or to determine compliance with phytosanitary regulations (FAO 2009).
Intended use	Declared purpose for which plants, plant products, or other regulated articles are imported, produced, or used (FAO 2009).
Interception (of a pest)	The detection of a pest during inspection or testing of an imported consignment (FAO 2009).

Term or abbreviation	Definition
International Standard for Phytosanitary Measures (ISPM)	An international standard adopted by the Conference of the Food and Agriculture Organization, the Interim Commission on phytosanitary measures or the Commission on phytosanitary measures, established under the IPPC (FAO 2009).
Introduction	The entry of a pest resulting in its establishment (FAO 2009).
Lot	A number of units of a single commodity, identifiable by its homogeneity of composition, origin etc., forming part of a consignment (FAO 2009).
National Plant Protection Organization (NPPO)	Official service established by a government to discharge the functions specified by the IPPC (FAO 2009).
Official control	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 (FAO 2009).
Pathway	Any means that allows the entry or spread of a pest (FAO 2009).
Pest	Any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products (FAO 2009).
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 (FAO 2009).
Pest free area (PFA)	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 (FAO 2009).
Pest free place of production	Place of production in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained for a defined period (FAO 2009).
Pest free production site	A defined portion of a place of production in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained for a defined period and that is managed as a separate unit in the same way as a pest free place of production (FAO 2009).
Pest risk analysis (PRA)	The process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it (FAO 2009).
Pest risk assessment (for quarantine pests)	Evaluation of the probability of the introduction and spread of a pest and of the associated potential economic consequences (FAO 2009).
Pest risk management (for quarantine pests)	Evaluation and selection of options to reduce the risk of introduction and spread of a pest (FAO 2009).
Phytosanitary certificate	Certificate patterned after the model certificates of the IPPC (FAO 2009).
Phytosanitary measure	Any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO 2009).
Phytosanitary regulation	Official rule to prevent the introduction and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests, including establishment of procedures for phytosanitary certification (FAO 2009).
Polyphagous	Feeding on a relatively large number of hosts from different genera.
PRA area	Area in relation to which a pest risk analysis is conducted (FAO 2009).
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 (FAO 2009).
Regulated article	Any plant, plant product, storage place, packing, conveyance, container, soil and any other organism, object or material capable of harbouring or spreading pests, deemed to require phytosanitary measures, particularly where international transportation is involved (FAO 2009).
Restricted risk	Risk estimate with phytosanitary measure(s) applied.

Term or abbreviation	Definition
Spread	Expansion of the geographical distribution of a pest within an area (FAO 2009).
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures (WTO 1995).
Stakeholders	Government agencies, individuals, community or industry groups or organizations, whether in Australia or overseas, including the proponent/applicant for a specific proposal, who have an interest in the policy issues.
Systems approach(es)	The integration of different risk management measures, at least two of which act independently, and which cumulatively achieve the appropriate level of protection against regulated pests (FAO 2009).
Unrestricted risk	Unrestricted risk estimates apply in the absence of risk mitigation measures.

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