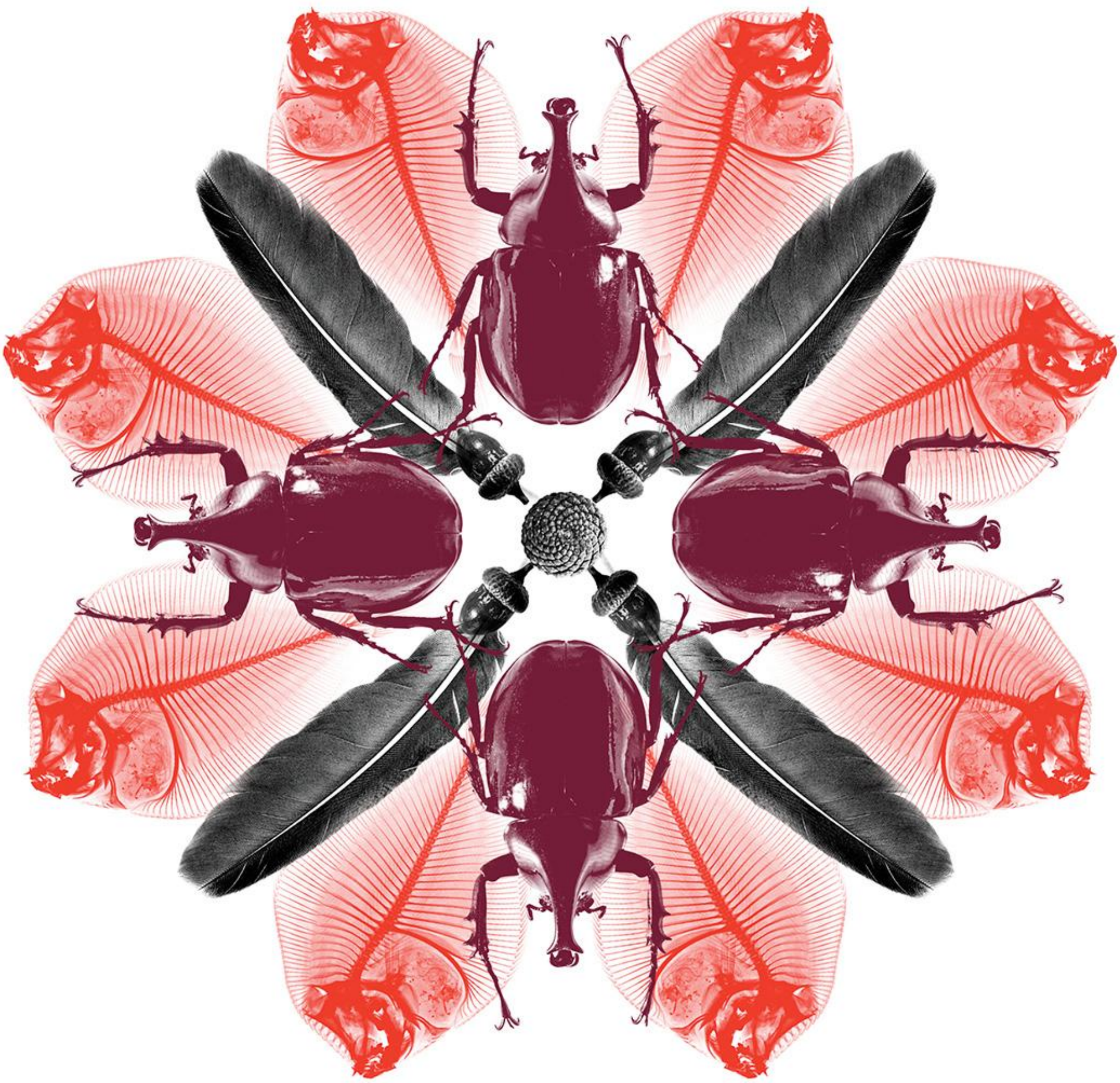
Australian Government
Department of Agriculture

Draft report for the non-regulated analysis of existing policy for fresh nectarine fruit from China

May 2015



Cataloguing data

Australian Government Department of Agriculture 2015, *Draft report for the non-regulated analysis of existing policy for fresh nectarine fruit from China*, Department of Agriculture, Canberra.

This publication is available at agriculture.gov.au.

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Stakeholder submissions on draft report

This draft report has been issued to give all interested parties an opportunity to comment on relevant technical biosecurity issues, with supporting rationale. The final report will then be produced taking into consideration any comments received.

Submissions should be sent to the Australian Department of Agriculture following the conditions specified within the related Biosecurity Advice, which is available at agriculture.gov.au/memos

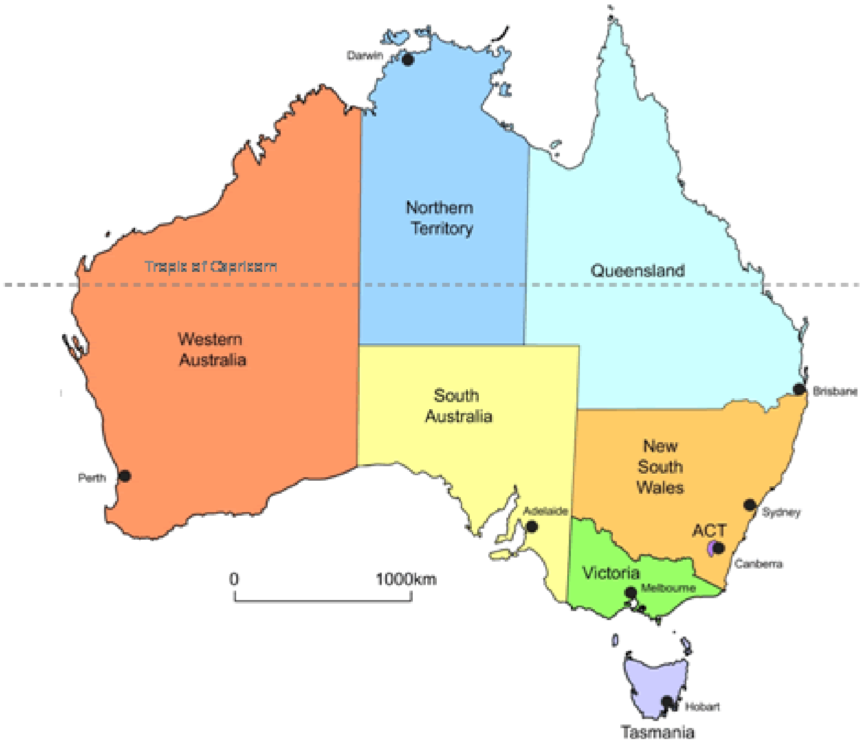
Contents

Figures

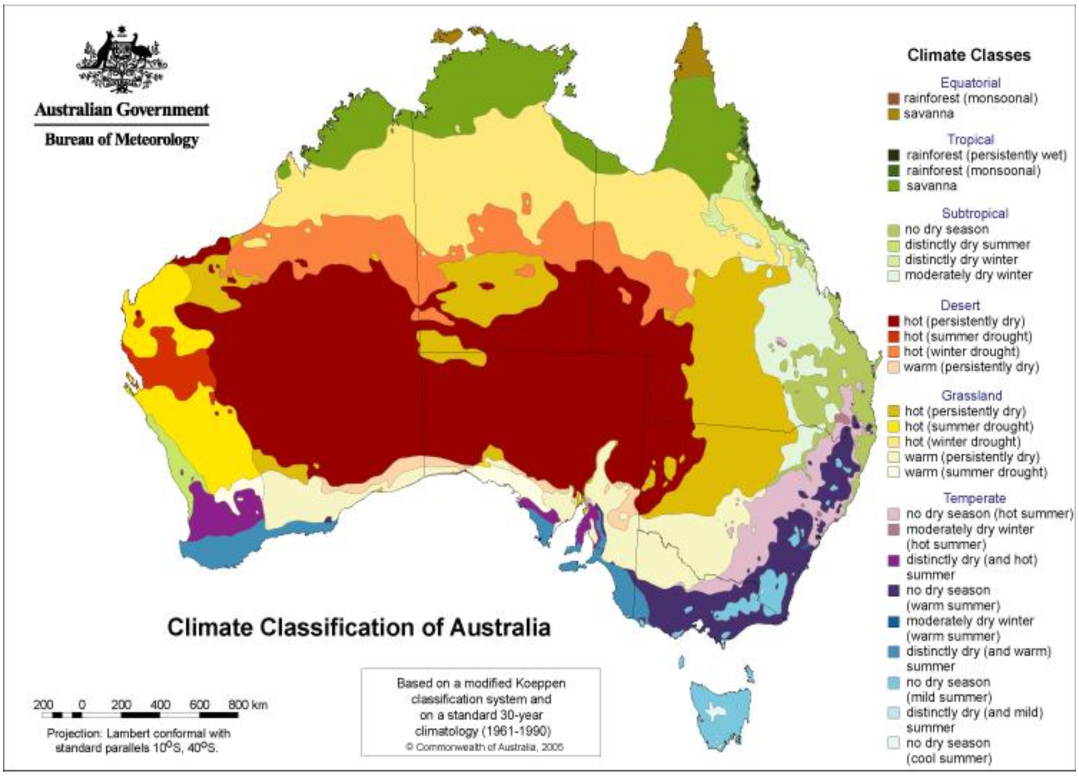
Tables

Maps

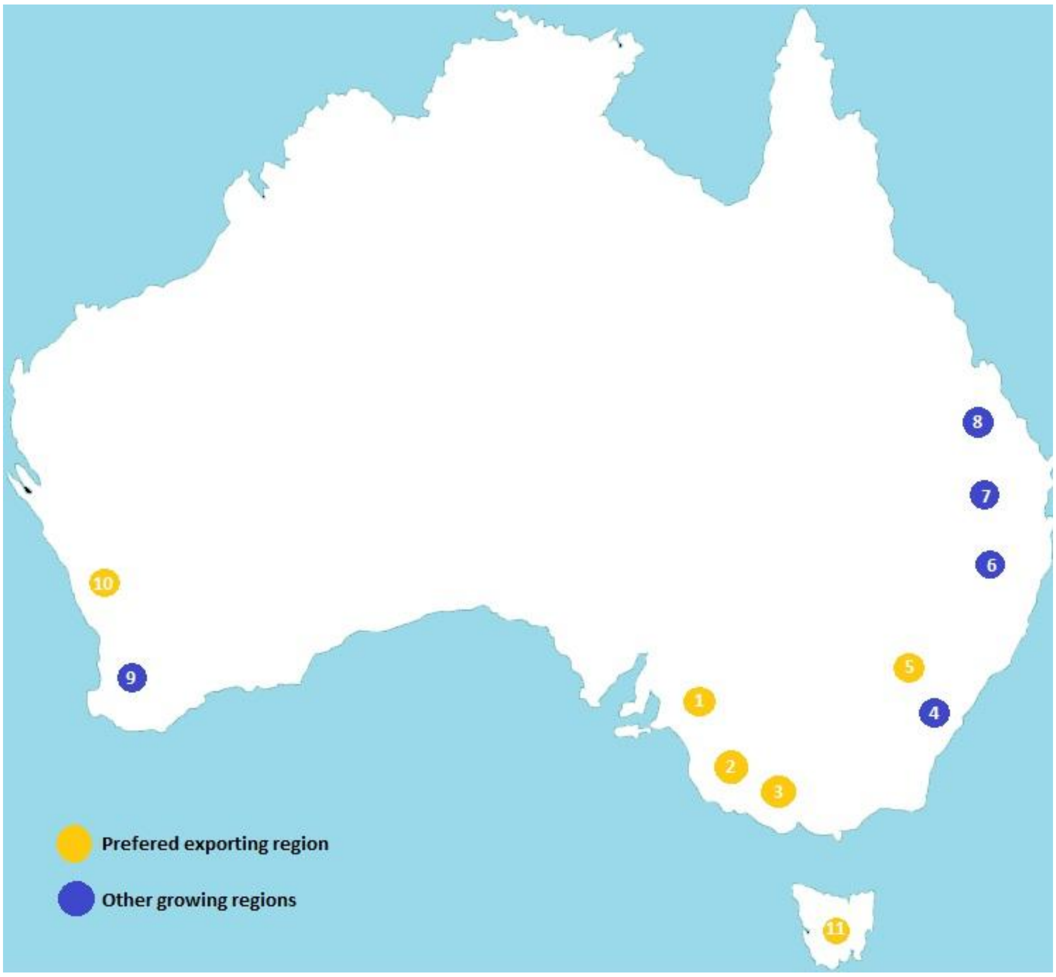
Map 1 Map of Australia



Map 2 A guide to Australia's bio-climatic zones



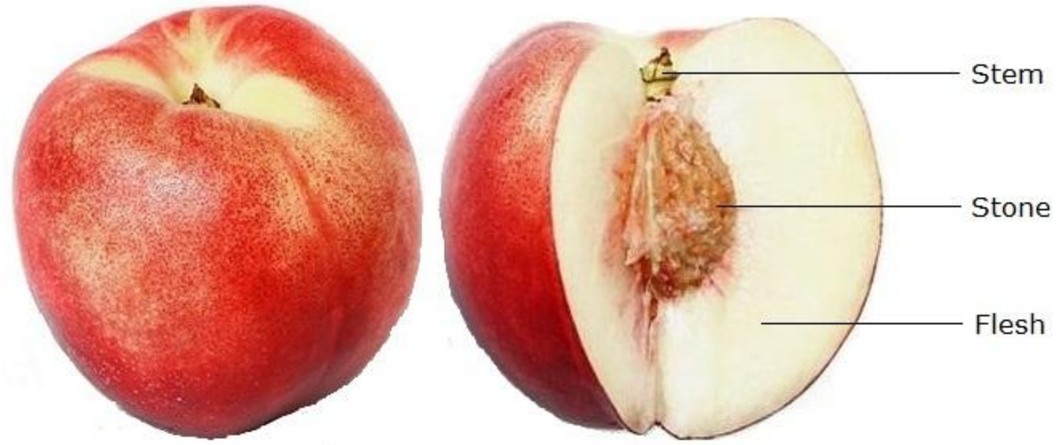
Map 3 Main nectarine production areas in Australia



1 Riverland, South Australia. **2** Sunraysia, Victoria. **3** Shepparton/Cobram, Victoria. **4** Sydney Hills, New South Wales. **5** Orange/Young Central New South Wales. **6** Northern New South Wales. **7** Stanthorpe, Queensland. **8** Sunshine Coast, Gatton, Kumbia, Queensland. **9** Donnybrook, Western Australia. **10** Perth Hills, Western Australia. **11** Tasmania.

Source: Information provided by Summerfruit Australia Ltd., August 2014

Figure 1 Diagram of fresh nectarine fruit



Acronyms and abbreviations

Term or abbreviation	Definition
ACT	Australian Capital Territory
ALOP	Appropriate level of protection
AQSIQ	General Administration for Quality Supervision, Inspection and Quarantine of the People's Republic of China (formerly CIQSA)
BA	Biosecurity Advice
CIQ	China Entry-Exit Inspection and Quarantine Bureau
CIQSA	State Administration for Entry-Exit Inspection and Quarantine of the People's Republic of China (now AQSIQ)
DAFF	Acronym of the former Australian Government Department of Agriculture, Fisheries and Forestry, which is now the Australian Government Department of Agriculture
DAFWA	Department of Agriculture and Food, Western Australia (formerly DAWA: Department of Agriculture, Western Australia)
EP	Existing policy
EPPO	European and Mediterranean Plant Protection Organisation
FAO	Food and Agriculture Organization of the United Nations
IPC	International Phytosanitary Certificate
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
ISPM	International Standard for Phytosanitary Measures
NPPO	National Plant Protection Organisation
NSW	New South Wales
NT	Northern Territory
PHA	Plant Health Australia Limited
PRA	Pest risk assessment
Qld	Queensland
SA	South Australia
SAL	Summerfruit Australia Limited

SPS	Sanitary and Phytosanitary
Tas.	Tasmania
USA	The United States of America
Vic.	Victoria
WA	Western Australia
WTO	World Trade Organization

Summary

The Australian Government Department of Agriculture has prepared this draft report to assess the proposal by China for market access to Australia for fresh nectarine fruit.

The draft report proposes that the importation of fresh nectarine fruit to Australia from all commercial production areas of China be permitted, subject to a range of quarantine conditions.

The draft report identifies 19 pests that require phytosanitary measures to manage risks to a very low level in order to achieve Australia's appropriate level of protection (ALOP). The pests requiring measures are *Amphitetranychus viennensis* (hawthorn spider mite), *Pseudococcus comstocki* (comstock mealybug), *Frankliniella intonsa* (Eurasian flower thrips), *Frankliniella occidentalis* (western flower thrips), *Bactrocera correcta* (guava fruit fly), *Bactrocera dorsalis* (Oriental fruit fly), *Drosophila suzukii* (spotted wing drosophila), *Adoxophyes orana* (summerfruit tortrix), *Argyrotaenia ljungiana* (grape tortrix), *Carposina sasakii* (peach fruit moth), *Grapholita funebrana* (plum fruit moth), *Grapholita molesta* (Oriental fruit moth), *Spilonota albicana* (white fruit moth), *Anarsia lineatella* (peach twig borer), *Monilinia fructigena* (brown rot), *Monilia mumecola* (brown rot), *Monilia polystroma* (brown rot), *Monilinia yunnanensis* (brown rot) and *Plum pox virus*.

The proposed phytosanitary measures take account of regional differences within Australia. Two pests that require risk mitigation, *Grapholita molesta* and *Frankliniella occidentalis* have been identified as a regional quarantine pest for Western Australia and Northern Territory respectively.

The draft report proposes a combination of risk management measures and operational systems that will reduce the risk associated with the importation of fresh nectarine fruit from China into Australia to achieve Australia's ALOP, that include:

- visual inspection and remedial action for leaf rollers, mealybug, spider mite and thrips
- area freedom or fruit treatment (cold disinfestation or irradiation) for fruit flies
- area freedom or fruit treatment (methyl bromide fumigation or irradiation) or a systems approach approved by the Australian Government Department of Agriculture for spotted wing drosophila
- area freedom or area of low pest prevalence or fruit treatment (methyl bromide fumigation or irradiation) or a system approach approved by the Australian Government Department of Agriculture for fruit borers
- area freedom or area of low pest prevalence or alternative measures approved by the Australian Government Department of Agriculture for brown rots
- area freedom or systems approach approved by the Australian Government Department of Agriculture for plum pox virus.

The draft report contains details of the risk assessments for the quarantine pests and the proposed phytosanitary measures in order to allow interested parties to provide comments and

submissions to the Australian Government Department of Agriculture within the consultation period.

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 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 risk analysis 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 new 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 stringent, 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 risk analyses are undertaken by the Australian Government Department of Agriculture using technical and scientific experts in relevant fields, and involve consultation with stakeholders at various stages during the process.

The Australian Government Department of Agriculture's assessment may take the form of an import risk analysis (IRA), a non-regulated analysis of existing policy, or technical advice.

Further information about Australia's biosecurity framework is provided in Appendix C of this report and in the *Import Risk Analysis Handbook 2011* located on the Australian Government Department of Agriculture website.

1.2 This import risk analysis

1.2.1 Background

The State Administration of Entry-Exit Inspection and Quarantine of the People's Republic of China (CIQSA), now known as the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ), requested market access for fresh peach fruit from Shandong province to Australia in 2001 (CIQSA 2001b). This submission included information on the pests associated with peach and nectarine crops in China, including the plant part affected, and some standard commercial production practices for fresh peach fruit in China.

In 2006, AQSIQ extended this market access to include peaches, nectarines, plums and apricot from all China (AQSIQ 2006b). In September 2014, AQSIQ confirmed that nectarine fruit is its top summerfruit priority.

On 4 February 2015, the Australian Government Department of Agriculture formally announced the commencement of this risk analysis, advising that it would be progressed as a non-regulated analysis of existing policy or review, using the process described in the *Import Risk Analysis Handbook 2011*.

1.2.2 Scope

The scope of this risk analysis is to consider the biosecurity risk that may be associated with the importation of commercially produced fresh nectarine fruit (*Prunus persica* var. *nectarina*), free from trash, from China, for human consumption in Australia.

In this risk analysis, nectarine fruit is defined as fruit with or without fruit stem (Figure 1). This risk analysis covers all commercially produced fresh nectarine fruit of all cultivars/varieties and the provinces or regions of China in which they are grown for export.

1.2.3 Existing policy

International policy

Import policy exists for fresh stonefruit including nectarines from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b) and New Zealand (Biosecurity Australia 2006b). The import of stonefruit including nectarines has occurred. Import policy also exists for apples, table grapes, pears and lychee and longan from China (DAFF 2004; Biosecurity Australia 2005b; Biosecurity Australia 2010a; Biosecurity Australia 2011). The import of apples, pears and lychee and longan has also occurred. The import requirements for these commodities can be found at the Australian Government Department of Agriculture website.

The Australian Government Department of Agriculture has previously considered all the pest groups in existing policies and where relevant, the information in these assessments has been taken into account in this risk analysis. The Australian Government Department of Agriculture recognises the similarity of other stonefruit species (apricot, peach and plum) and the significant overlap of pests associated with these additional species. This policy is likely to be the basis of import conditions for these similar risk commodities.

Domestic arrangements

The Commonwealth Government is responsible for regulating the movement of plants and plant products into and out of Australia. However, the state and territory governments are responsible for plant health controls within their individual jurisdiction. Legislation relating to resource management or plant health may be used by state and territory government agencies to control interstate movement of plants and their products. Once plant and plant products have been cleared by Australian biosecurity officers, they may be subject to interstate movement conditions. It is the importer's responsibility to identify, and ensure compliance with all requirements.

1.2.4 Contaminating pests

In addition to the pests of nectarine fruit from China that are assessed in this risk analysis, there are other organisms that may arrive with the imported commodity. These organisms could include pests of other crops or predators and parasitoids of other arthropods. The Australian Government Department of Agricultureconsiders these organisms to be contaminating pests that could pose sanitary and phytosanitary risks. These risks are addressed by existing operational procedures that require a 600 unit inspection of all consignments, or equivalent, and investigation of any pest that may be of quarantine concern to Australia.

1.2.5 Consultation

On 4 February 2015, the Australian Government Department of Agriculture notified stakeholders in Biosecurity Advice 2015/02 of the formal commencement of a non regulated analysis of existing policy to consider a proposal from China for market access to Australia for fresh nectarine fruit.

1.2.6 Next Steps

This draft report gives stakeholders the opportunity to comment and draw attention to any scientific, technical, or other gaps in the data, misinterpretations and errors.

The Australian Government Department of Agriculture will consider submissions received on the draft report and may consult informally with stakeholders. The department will revise the draft report as appropriate. The department will then prepare a final report, taking into account stakeholder comments.

The final report will be published on the department website along with a notice advising stakeholders of the release. The department will also notify the proposer, the registered stakeholders and the WTO Secretariat about the release of the final report. Publication of the final report represents the end of the process. The conditions recommended in the final report will be the basis of any import permits issued.

2 Method for pest risk analysis

This chapter sets out the method used for the pest risk analysis (PRA) in this report. The Australian Government Department of Agriculture has conducted this PRA in accordance with the International Standards for Phytosanitary Measures (ISPMs), including ISPM 2: *Framework for pest risk analysis* (FAO 2007b) and ISPM 11: *Pest risk analysis for quarantine pests* (FAO 2013) that have been developed under the SPS Agreement (WTO 1995).

A PRA is '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 2012). A pest is 'any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products' (FAO 2012).

Quarantine risk consists of two major components: the likelihood 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, on arrival in Australia, the Australian Government Department of Agriculturewill verify that the consignment received is as described on the commercial documents and its integrity has been maintained.

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/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests' (FAO 2012).

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

The PRAs are conducted in the following three consecutive stages: initiation, pest risk assessment and pest risk management.

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.

Appendix A of this risk analysis report lists the pests with the potential to be associated with the exported commodity produced using commercial production and packing procedures. Appendix A does not present a comprehensive list of all the pests associated with the entire plant, but concentrates on the pests that could be on the assessed commodity. Contaminating pests that have no specific relation to the commodity or the export pathway have not been listed and would be addressed by Australia's current approach to contaminating pests.

The identity of the pests is given in Appendix A. The species name is used in most instances but a lower taxonomic level is used where appropriate. Synonyms are provided where the current scientific name differs from that provided by the exporting country's National Plant Protection Organisation (NPPO) or where the cited literature used a different scientific name.

For this risk analysis, the 'PRA area' is defined as Australia for pests that are absent, or of limited distribution and under official control. For areas with regional freedom from a pest, the 'PRA area' may be defined on the basis of a state or territory of Australia or may be defined as a region of Australia consisting of parts of a state or territory or several states or territories.

For pests that had been considered by the Australian Government Department of Agriculturein 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 risk assessment was taken into consideration when developing the new policy.

2.2 Stage 2 Pest risk assessment

A pest risk assessment (for quarantine pests) is the 'evaluation of the likelihood of the introduction and spread of a pest and of the magnitude of the associated potential economic consequences' (FAO 2012).

The following three, consecutive steps were used in pest risk assessment:

2.2.1 Pest categorisation

Pest categorisation identifies which of the pests with the potential to be on the commodity are quarantine pests for Australia and require pest risk assessment. 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 (FAO 2012).

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 categorisation were carried forward for pest risk assessment and are listed in Table 4.1.

2.2.2 Assessment of the likelihood of entry, establishment and spread

Details of how to assess the 'likelihood of entry', 'likelihood of establishment' and 'likelihood of spread' of a pest are given in ISPM 11 (FAO 2013). A summary of this process is given below, followed by a description of the qualitative methodology used in this risk analysis.

Likelihood of entry

The likelihood of entry describes the likelihood 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 likelihood 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 Chapter 3. These practices are taken into consideration by the Australian Government Department of Agriculturewhen estimating the likelihood of entry.

For the purpose of considering the likelihood of entry, the Australian Government Department of Agriculturedivides this step into two components:

- **Likelihood of importation—**the likelihood that a pest will arrive in Australia when a given commodity is imported.
- **Likelihood of distribution—**the likelihood 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 likelihood 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
- mode of trade (for example, bulk, packed)
- 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 (for example, refrigeration) applied to consignments during transport and storage in the country of origin, and during transport to Australia.

Factors considered in the likelihood of distribution include:

- commercial procedures (for example, 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 (for example, for planting, processing or consumption)
- risks from by-products and waste.

Likelihood of establishment

Establishment is defined as the 'perpetuation for the foreseeable future, of a pest within an area after entry' (FAO 2012). In order to estimate the likelihood of establishment of a pest, reliable biological information (for example, lifecycle, host range, epidemiology, survival) 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 likelihood of establishment.

Factors considered in the likelihood 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.

Likelihood of spread

Spread is defined as 'the expansion of the geographical distribution of a pest within an area' (FAO 2012). The likelihood 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 likelihood 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 likelihood of spread.

Factors considered in the likelihood 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 entry, establishment and spread

In its qualitative PRAs, the Australian Government Department of Agricultureuses the term 'likelihood' for the descriptors it uses for its estimates of likelihood 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). Descriptive definitions for these descriptors and their indicative likelihood ranges are given in Table 2.1. The indicative likelihood ranges are only provided to illustrate the boundaries of the descriptors and are not used beyond this purpose in qualitative PRAs. These indicative likelihood ranges provide guidance to the risk analyst and promote consistency between different pest risk assessments.

Table 2.1 Nomenclature of qualitative likelihoods

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

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 likelihood of importation is assigned a descriptor of 'low' and the likelihood of distribution is assigned a descriptor of 'moderate', then they are combined to give a likelihood of 'low' for entry. The likelihood for entry is then combined with the likelihood assigned for establishment of 'high' to give a likelihood for entry and establishment of 'low'. The likelihood for entry and establishment is then combined with the likelihood assigned for spread of 'very low' to give the overall likelihood for entry, establishment and spread of 'very low'. This can be summarised as:

importation x distribution = entry [E] **low x moderate = low**

entry x [establishment = [EE] **low x high = low**

[EE] x spread = [EES] **low x very low = 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.

The Australian Government Department of Agriculturenormally 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 the Department of Agriculture'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 the department has an obligation to review the risk analysis and, if necessary, provide updated policy advice.

In assessing the volume of trade in this risk analysis, the Australian Government Department of Agricultureassumed that a substantial volume of trade will occur.

2.2.3 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 2012) and ISPM 11 (FAO 2013).

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
- domestic trade
- international trade
- 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.

The estimates of the magnitude of the potential consequences over the four geographic levels were translated into a qualitative impact score (A-G) using Table 2.3. For example, a consequence with a magnitude of 'significant' at the 'district' level will have a consequence impact score of D.

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

	Geographic scale			
Magnitude	Local	District	Region	Nation
Indiscernible	A	A	A	A
Minor significance	B	C	D	E
Significant	C	D	E	F
Major significance	D	E	F	G

Note: In earlier qualitative PRAs, 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 to F has been 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.

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
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

2.2.4 Estimation of the unrestricted risk

Once the assessment of the likelihood of entry, establishment and spread and for potential consequences 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 likelihood 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 (for example, 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	Consequences 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

2.2.5 Australia's appropriate level of protection (ALOP)

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

Like many other countries, Australia expresses its ALOP in qualitative terms. Australia's ALOP, which reflects community expectations through government policy, is currently expressed as providing a high level of sanitary or phytosanitary protection aimed at reducing risk to a very low level, but not to zero. 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 measures (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 2013) 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 likelihood of entry of the pest.

Examples given of measures commonly applied to traded commodities include:

- options for consignments—for example, 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—for example, 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 to the year, production in a certification scheme
- options ensuring that the area, place or site of production or crop is free from the pest—for example, pest-free area, pest-free place of production or pest-free production site
- options for other types of pathways—for example, consider natural spread, measures for human travellers and their baggage, cleaning or disinfestations of contaminated machinery
- options within the importing country—for example, 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 Chapter 5: Pest risk management, of this report.

3 China's commercial production practices for nectarines

This chapter provides information on the pre-harvest, harvest and post-harvest practices, considered to be standard practices in China for the production of fresh nectarine fruit for export. The export capability of China is also outlined.

3.1 Assumptions used in estimating unrestricted risk

China provided Australia with information on the standard commercial practices used in the production of peaches and nectarines in different regions and for all commercially produced peaches and nectarines varieties in China. This information was complemented with data from other sources and was taken into consideration when estimating the unrestricted risks of pests that may be associated with the import of nectarines.

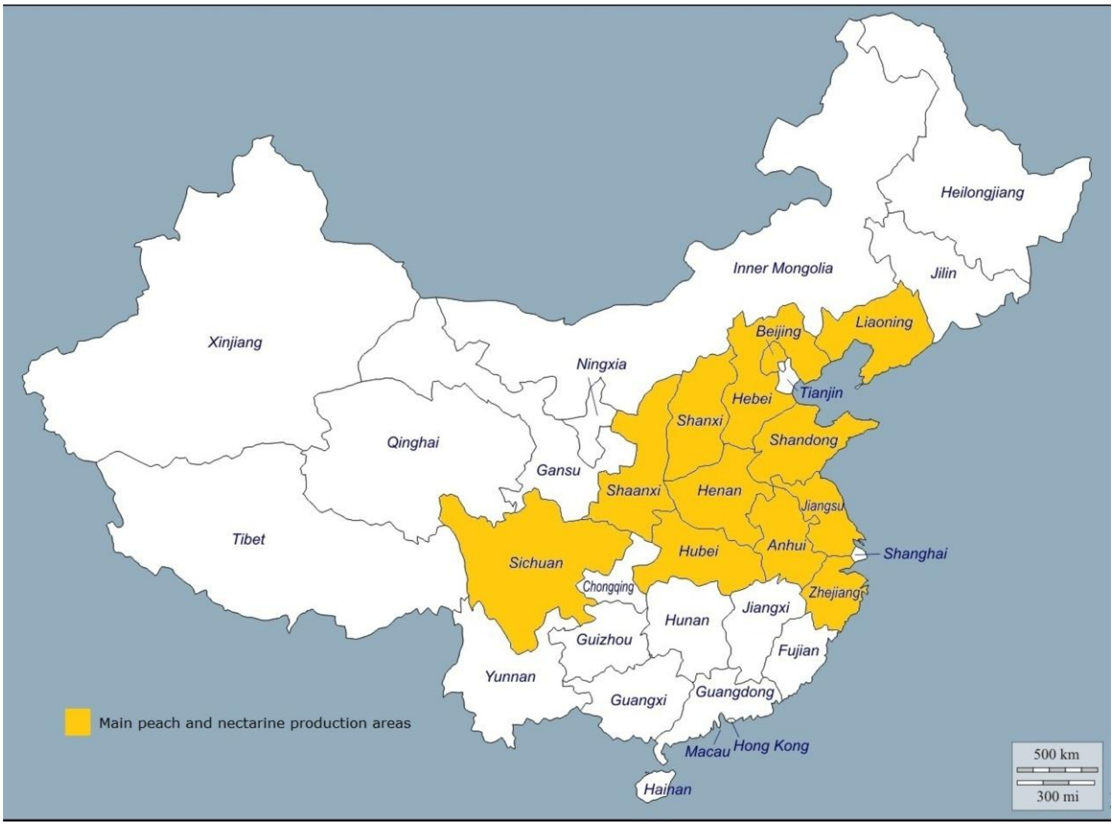
In estimating the likelihood of pest introduction, it was assumed that the pre-harvest, harvest and post-harvest production practices for peaches and nectarines as described in this chapter are implemented for all regions and for nectarine varieties within the scope of this analysis. Where a specific practice described in this chapter is not taken into account to estimate the unrestricted risk, it is clearly identified and explained in Chapter 4.

3.2 Climate in production areas

Peaches and nectarines are widely planted in China. China's main peach and nectarine production areas include Anhui, Beijing, Hebei, Henan, Hubei, Jiangsu, Liaoning, Shaanxi, Shandong, Shanxi, Sichuan and Zhejiang provinces (Moore *et al.*2012; Scott *et al.*2014)(Map 4).

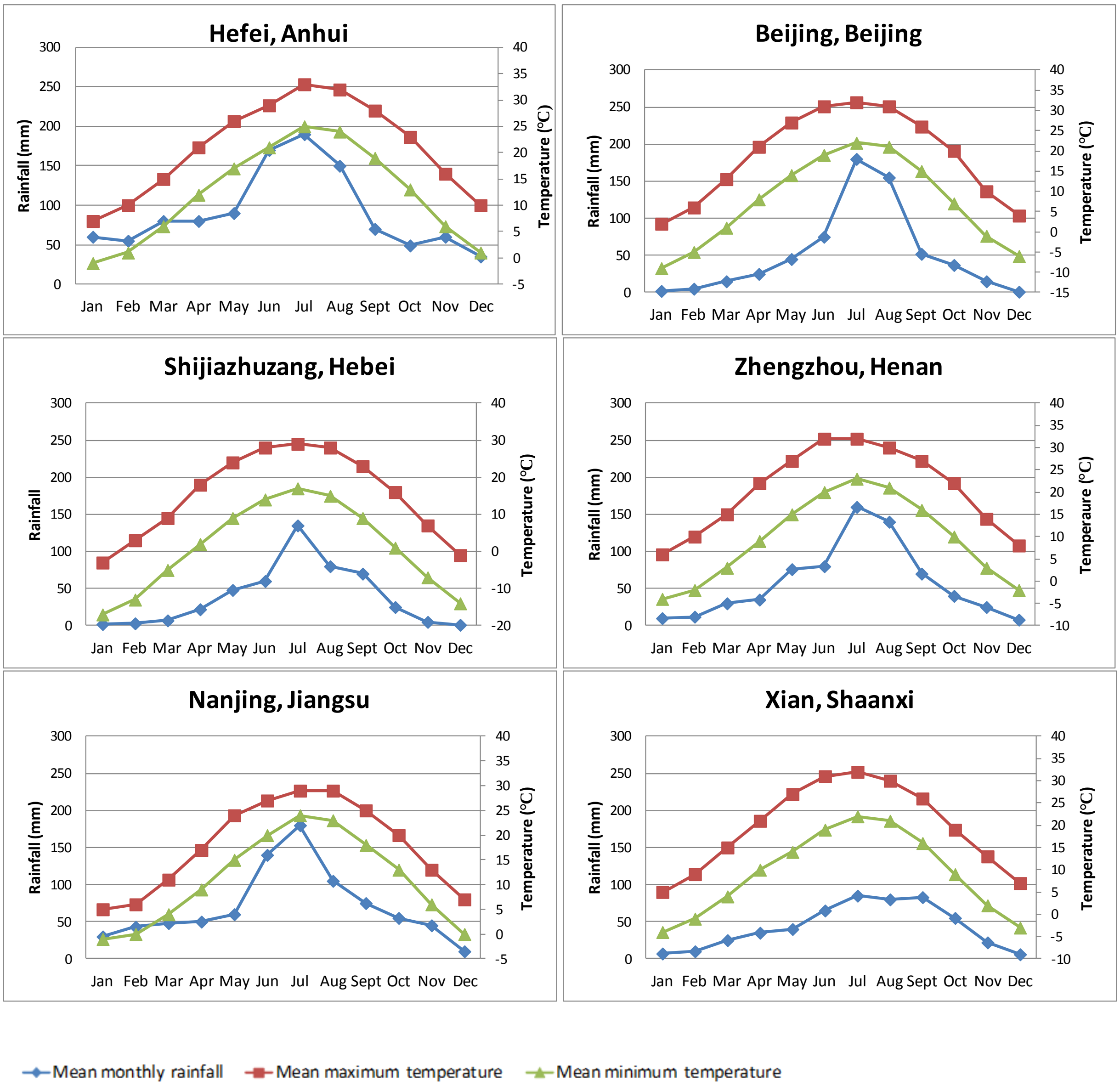
Climate data including the mean maximum and minimum temperatures and the mean monthly rainfall for these provinces of China are presented in Figure 2.

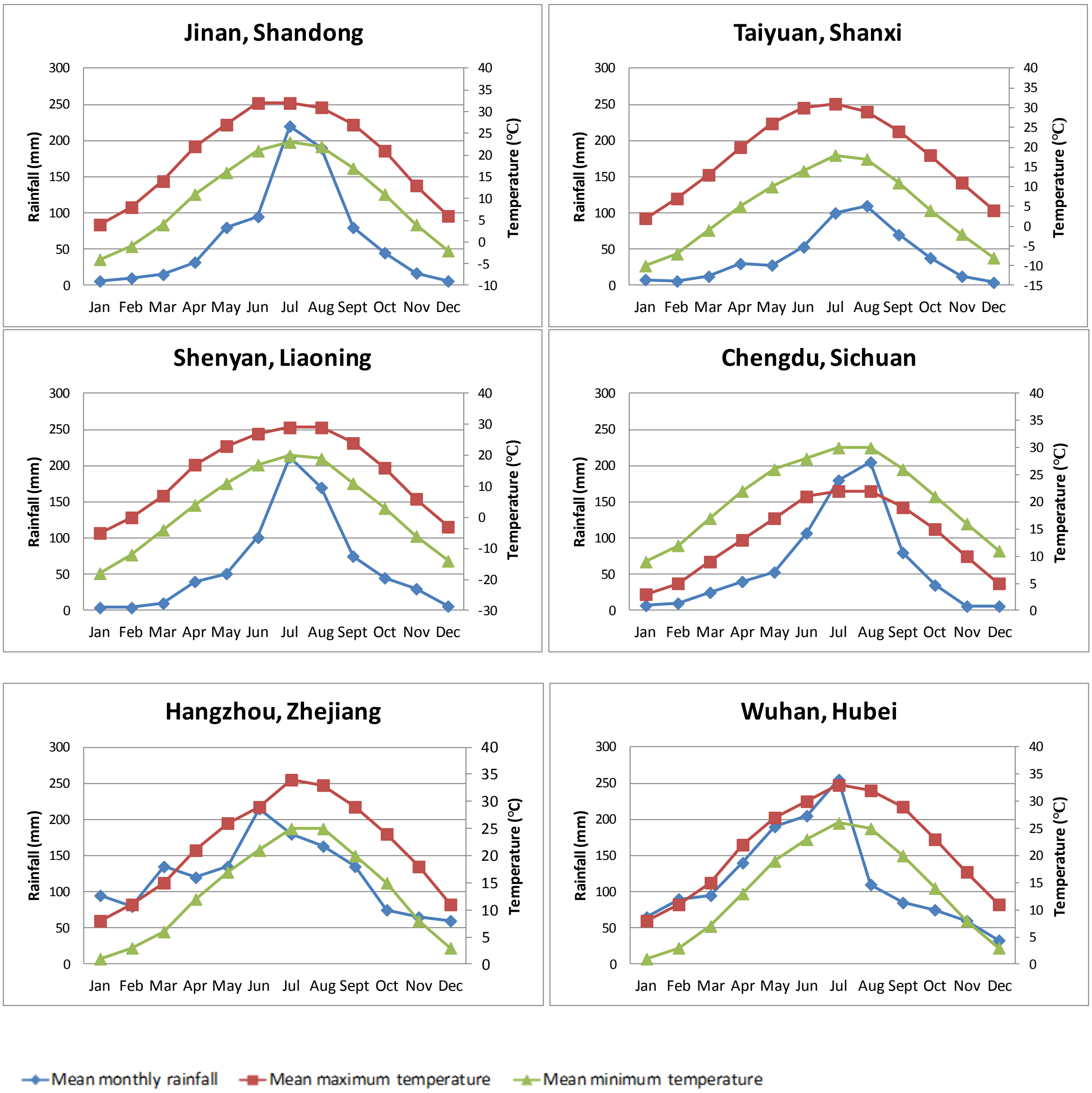
Map 4 Main peach and nectarine production areas in China



Source: (Scott *et al.*2014)

Figure 2 Mean monthly rainfall and mean maximum and minimum temperatures for the main nectarine producing provinces of China





Source: (World Weather Online 2015)

3.3 Pre-harvest

3.3.1 Cultivars

Peach (*Prunus persica* L.) has been grown in China for around 3 000 years. Peaches and nectarines are planted in most provinces. Varieties have been developed to accommodate diversified taste preferences in different localities. There are three major types of peaches, including common peach (*Prunus persica* (L.) Batsch), nectarine (*P .persica* var. *nectarina* Maxim) and flat peach (*P. persica* var. *compressa* Bean) (AQSIQ 2006b).

The main nectarine varieties grown in China include Qian Niang Hong, Zao Hong Zhu, Zao Hong Bao Shi, Shu Guang, Hua Gang, Yuang Guang, Zhong You series, Lui Guang series, Zao Hong 2, Mei Gui Hong, Shuang Xi Hong, Qin Nan (AQSIQ 2006b) and QinGuang series (China NorthWest A&F University, 2015, pers. comm., 3 February).

3.3.2 Cultivation practices

Stonefruit production in China is relatively labour intensive with pollination, bud thinning and pesticide and fertiliser applications commonly performed by hand. Limited in-field mechanisation permits relatively high planting densities and use of sloping ground that would be unsuitable for mechanised production.

Bagging of fruit is a common practice for the production of export quality peaches and nectarines and for some domestic production in China (Figure 3). Bagging provides protection from insects and diseases and physical damage (AQSIQ 2006b). Bagging also reduces the need for agrochemical inputs and minimises chemical residues and is encouraged by local and provincial agricultural departments. For some peach and nectarine varieties, bags are usually removed one to two weeks prior to harvest depending on the cultivar and weather and growing conditions, to permit fruit colour development. However, for yellow skin peaches and other varieties which formation of anthocyanin pigments (red colour) are not preferred, bags will remain intact until harvest.

Figure 3 Example of bagged peaches in China

Source: photo courtesy of China NorthWest A&F University, February 2015

There are two major types of nectarine fruit tree canopies in China: open centre canopy and central leader canopy forms. Central leader canopy for high-density orchards is widely used in newly planted orchards (Figure 4).

Other commercial export peach and nectarine orchard management practices include orchard hygiene, irrigation, fertiliser application and pest management.

Figure 4 Nectarine tree canopy forms in China—open centre canopy (left) and central leader canopy (right)

Source: photo courtesy of China NorthWest A&F University, February 2015

3.3.3 Pest management

Pest control programs (integrated pest management programs) may include physical, biological, cultural and chemical control. Good management of pests in the field is an important factor in reducing the number of pests associated with harvested fruit.

Common pest of concerns in peach and nectarine orchards include aphids, mites, moths, peach shot hole, Gummosis and peach trunk canker (CIQSA 2001b; Moore *et al.*2012).

While the specific practices in orchards vary according to local conditions, pest pressures and availability of equipment, there are common practices across the industry. These practices minimise the presence of pests on the harvested nectarine fruit.

The integrated pest and disease management (IPM and IDM) is often adopted to manage a range of pests and diseases that affect growth and development of fruit in peach and nectarine orchards. A range of effective, but low-toxicity and low-residue, insecticides and fungicides are used when required during the growing season to mitigate the impact of insects and diseases. Insect trapping devices and biological control agents are also used for surveillance and monitoring and control.

The orchard management measures are undertaken throughout the year. These measures comprise nine stages and include cultural, mechanical and chemical methods (CIQSA 2001b).

1) December to early March—orchard sanitation with removal of fallen leaves and twigs, winter pruning and management of dormant pests in the soil under the nectarine trees.
2) Mid to late March—prior to bud sprouting, fertilisers are applied to stimulate leaf growth and bud sprouting. Also, the recommended pesticides are applied to manage insects and diseases.
3) April—general orchard operations include fertiliser application, blossom thinning and pollination and removal of late shoots. Spray chemicals to manage aphids, shot hole, mites, moths, canker, peach brown rot and other pests.

4) May—fruit thinning, post-blooming fertiliser application, irrigation and removal of late shoots. Also for the mitigation of pests as listed above, a range of recommended pesticides and fungicides may be applied according to the pest prevalence.
5) June—Bordeaux mixture is commonly used before bagging and 10 days after bagging. Fruit bagging is completed by the end of June and the insects and pathogens (listed in May operations) are controlled, if required, with recommended pesticides. Harvesting of early season varieties may commence.
6) July—general orchard operations include orchard draining, branch thinning and fertiliser application. After fruit-bagging, pest management measures continue for pests and diseases including leaf rollers and fruit borers. Harvest of the early season varieties commence.
7) August—pest management practices are continued for the pests identified earlier in the season, if required. Withholding periods are observed to avoid potential chemical residues. Harvest may start for mid-season varieties.
8) September to October—harvest of late season varieties. Harvesting finishes and orchard operations such as branch thinning, orchard hygiene and winter irrigation are undertaken to safeguard fruit trees during the winter season.
9) November—complete cleaning of the orchards after leaf-fall.

Chemicals prohibited by China's Ministry of Agriculture are not permitted to be sold or used for control of pests on nectarines. Growers are allowed to purchase chemicals only from approved agents. Spraying in orchards is conducted under technical supervision.

3.4 Harvesting and handling procedures

Nectarines are harvested from May to October with the peak harvesting period between July and September. A small portion is grown in greenhouses with harvest starting in early May. Nectarine fruit usually have a thin peel, which may be damaged during the harvest and transportation process. Therefore, suitable containers must be used and care must be taken to minimise damage to fruits during harvesting and transportation to the packing houses.

The taste, quality and shelf life of nectarine fruit is greatly related to maturity. When fruit has reached a suitable size with specific colour and tight pulp, then it is time for harvest. Harvesting is done based on two standards in terms of maturity:

- Two harvesting periods: hard maturity and full maturity
- Four grades: 70 per cent mature, 80 per cent mature, 90 per cent mature and fully mature (100 per cent).

3.5 Post-harvest

3.5.1 Packing house

Fruit should be processed immediately after harvest. Packing house processes include pre-cooling, grading, packing and cold storage.

Pre-cooling—harvested fruits should be cooled as quickly as possible, normally within 2–3 hours and no more than 24 hours, to postpone the maturing process and maximise storage period.

Grading—during initial grading process, damaged, inferior, abnormal, dirty and perished fruit should be discarded, and then fruits are graded by size. For shipments with specific requirements, the fruits should be graded accordingly. There are usually three grade standards: grade one, grade two, and others.

Packing—to minimise damage, suitable containers must be used and be carefully handled during harvest. The most common containers used are cartons, wooden box and plastic box, with the capacity of 5–10 kilograms. The usual inner liner is bubble underlay.

Cold storage—packed and sealed cartons are palletised and put into the segregated post-processing cold storage rooms to bring the fruit temperature to 0.0 °C to 0.5 °C for short term storage.

3.5.2 Post-harvest treatments

To manage fruit rots, graded fruit is treated before storage. There are two commonly used post-harvest treatments:

- Fungicide dipping—dip nectarine fruit in 1:500 Mertect or Iprodione solution to manage peach brown rot and mild rot.
- Calcium chloride solution dipping—calcium can improve fruit quality. Dipping with two per cent calcium chloride solution can effectively manage losses to fruit quality and reduce fruit rots.

3.5.3 Quality assurance inspection

Packed cartons of nectarines are randomly selected from the line on a continuous basis. The fruits are checked on a designated inspection table by trained packing house staff for quality and the presence of quarantine pests identified by the importing country.

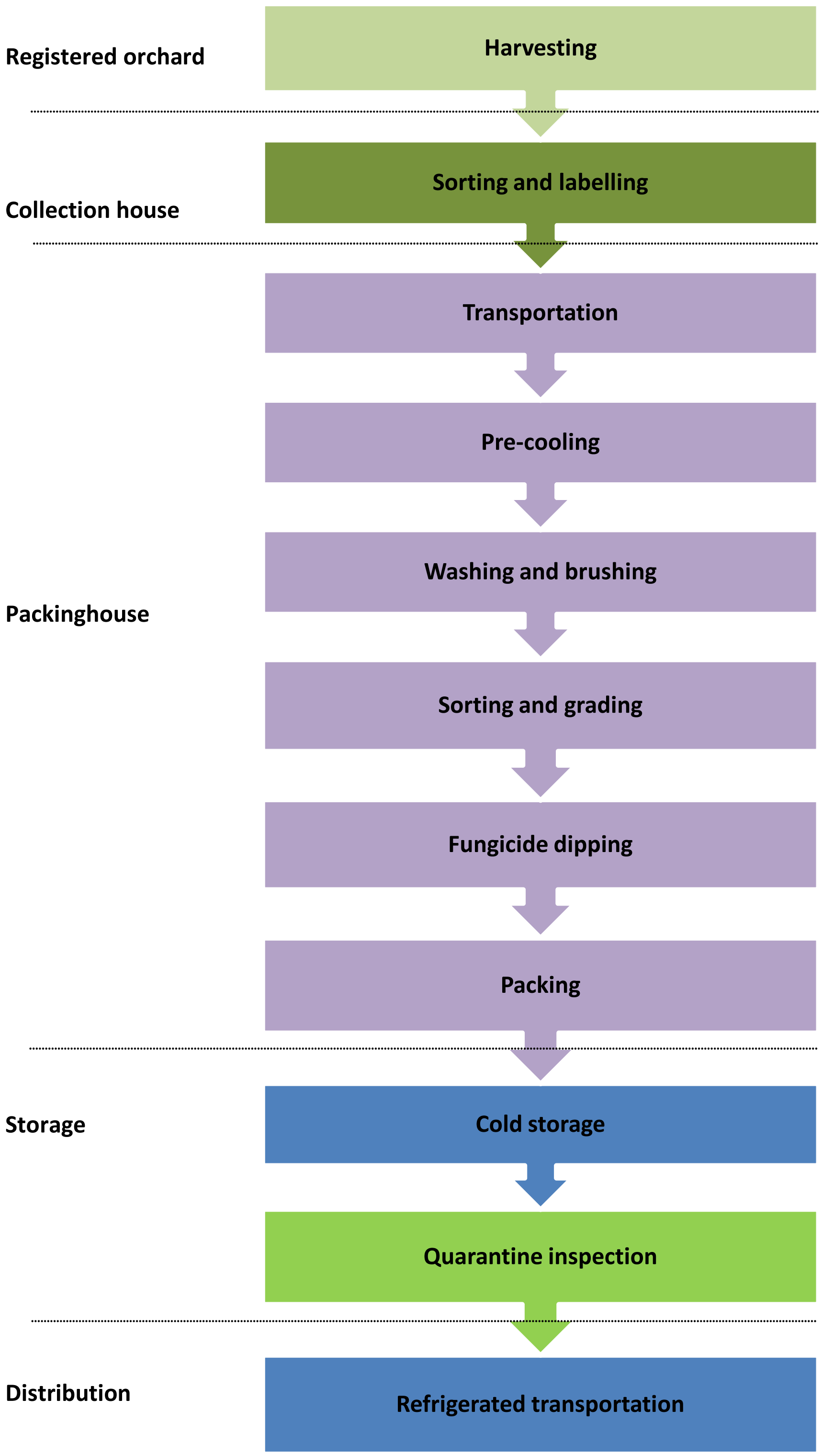
3.5.4 Transport

Packed and sealed cartons should be transported and stored in cold storage rooms immediately to maintain the commercial quality of the fruit.

A schematic diagram summarising the harvesting, processing, treatment and storage system for nectarines prior to export is shown in Figure 5.

While the unrestricted risk assessments undertaken in this policy review do not impose any mandatory measures during storage and transport, common commercial practices may impact on the survival of some pests.

Figure 5 Summary of orchard and post-harvest steps for peaches and nectarines grown in China for export



3.6 Export capability

3.6.1 Production statistics

China is the largest peach and nectarine producer in the world. China's main peach and nectarine production provinces are listed in Table 3.1. In 2012, the total peach/nectarine production area was 745 000 hectares which produced about 11.4 million tonnes of fruit, which accounts for more than 50 per cent of the world's total peach/nectarine production (Scott *et al.*2014).

Table 3.1 China's main peaches/nectarines production provinces

	2010		2011		2012	
Province	**Area ha (x1000)**	**Yield MT (x1000)**	**Area ha (x1000)**	**Yield MT (x1000)**	**Area ha (x1000)**	**Yield MT (x1000)**
Shandong	101.2	2,436	96.4	2401	100.2	2384
Hebei	85.8	1,462	82.6	1527	82.0	1573
Henan	73.9	1,017	75.5	1086	76.3	1106
Hubei	49.1	607	56.6	690	53.9	674
Shaanxi	31.2	594	30.4	567	30.9	641
Liaoning	25.1	537	23.9	568	22.2	610
Jiangsu	35.6	457	37.5	501	37.8	556
Shanxi	16.1	321	17.6	441	18.8	512
Anhui	24.1	430	27.0	424	30.5	478
Sichuan	45.1	416	47.0	449	47.2	451
Zhejiang	26.2	356	25.9	383	26.2	389
Beijing	20.9	386	20.4	404	20.0	373

ha hectare. **MT** million tonnes
Source: (Scott *et al.* 2014)

3.6.2 Export statistics

Despite the high production volume, China is not a major peach and nectarine exporter. In 2013, China exported about 50 000 tonnes of fresh peaches and nectarines (Scott *et al.*2014). China's main export markets include Southeast Asia countries (Hong Kong, Philippine, Malaysia, Singapore, Indonesia, Thailand), United Arab Emirates and Russia (AQSIQ 2006b; Scott *et al.*2013).

3.6.3 Export season

Peaches and nectarines are exported between May and October.

Transport of fruit to Australia from China would be either by air freight or by general sea freight, with the total time in transit, from orchard until arrival in Australia, expected to take from a few days to as long as 3–5 weeks (21–35 days) (China Shipping Australia 2014).

4 Pest risk assessments for quarantine pests

Quarantine pests associated with fresh nectarine fruit from China are identified in the pest categorisation process (Appendix A). This chapter assesses the likelihood of the entry, establishment and spread of these pests and the likelihood of associated potential economic, including environmental, consequences to provide an overall assessment of risk.

Pest categorisation identified 29 quarantine pests associated with fresh nectarine fruit from China. Of these, 26 pests are of national concern and 3 are of regional concern. Table 4.1 identifies these quarantine pests, and full details of the pest categorisation are given in Appendix A.

Pest risk assessments already exist for some of the pests considered here as they have been assessed previously by the Department of Agriculture. For these pests, the likelihood of entry (importation and/or distribution) could be different from the previous assessment due to differences in the commodity, country and commercial production practices in the export areas, and hence may need to be re-assessed. Unless there is new information to suggest otherwise, the likelihood of establishment and of spread in the PRA area, and the consequences the pests may cause will be the same for any commodity/country with which the pests are imported. Accordingly, there is no need to re-assess these components and the risk ratings given in the previous assessment will be adopted. For a pest that has previously been assessed and a policy already exists, this will be stated in the introduction of the pest risk assessment, and the acronym 'EP' (existing policy) is used to highlight this.

Some pests identified in this draft report have been recorded in some regions of Australia, and due to interstate quarantine regulations are considered pests of regional concern. These pests are identified with the acronym, such as 'WA' (Western Australia), for the state for which the regional pest status is considered.

The department is aware of the recent changes in fungal nomenclature which ended the separate naming of different states of fungi with a pleiomorphic life-cycle. However, as the nomenclature for these fungi is in a phase of transition, many priorities of names are still to be resolved and much of the primary literature uses the existing nomenclature, this report still uses dual names for most fungi. As official lists of accepted and rejected fungal names become available, these accepted names will be adopted.

Table 4.1 Quarantine pests for fresh nectarine fruit from China

Pest scientific name	Common name
Spider mites [Prostigmata: Tetranychidae]	
Amphitetranychus viennensis (EP)	Hawthorn spider mite
Tetranychus turkestani (EP)	Strawberry spider mite
Weevils [Coleoptera: Curcurlionidae]	
Rhynchites auratus (EP)	Cherry weevil
Rhynchites confragosicollis (EP)	Peach curculio
Rhynchites faldermanni (EP)	Peach weevil
Rhynchites heros (EP)	Pear leaf weevil
Fruit flies [Diptera: Tephritidae]	
Bactrocera correcta (EP)	Guava fruit fly
Bactrocera dorsalis (EP)	Oriental fruit fly
Fruit fly [Diptera: Drosophilidae]	
Drosophila suzukii (EP)	Spotted wing drosophila
Mealybugs [Hemiptera: Pseudococcidae]	
Pseudococcus comstocki (EP)	Comstock mealybug
Scales [Hemiptera: Diaspididae]	
Pseudaonidia duplex	Camphor scale
Pseudaulacaspis prunicola (EP)	Armoured scale
Moths [Lepidoptera: Tortricidae]	
Adoxophyes orana (EP)	Summerfruit tortrix
Argyrotaenia ljungiana (EP)	Grape tortrix
Grapholita funebrana (EP)	Plum fruit moth
Spilonota albicana (EP)	White fruit moth
Cydia pomonella (EP, WA)	Codling moth
Grapholita molesta (EP, WA)	Oriental fruit moth
Twig borer [Lepidoptera: Gelechiidae]	
Anarsia lineatella (EP)	Peach twig borer
Fruit borer [Lepidoptera: Carposinidae]	
Carposina sasakii (EP)	Peach fruit borer
Thrips [Thysanoptera: Thripidae]	
Frankliniella intonsa (EP)	Eurasian flower thrips
Frankliniella occidentalis (EP, NT)	Western flower thrips
Fungi	
Monilinia fructigena (EP)	Brown rot
Monilia mumecola	Brown rot
Monilia polystroma	Brown rot
Monilinia yunnanensis	Brown rot
Viroids and Viruses	
Apple scar skin viroid (EP)	ASSVd
Tobacco necrosis viruses (EP)	TNV
Plum pox virus (EP)	PPV

4.1 Hawthorn spider mite

Amphitetranychus viennensis (EP)

Amphitetranychus viennensis also known as *Tetranychus viennensis* (hawthorn spider mite) belongs to the Tetranychidae family. Mites of this family are commonly referred to as spider mites due to their habit of spinning protective silken webbing on plants under which they feed (Zhang 2003). Hawthorn spider mite has five life stages: egg, larva, two nymph stages (protonymph and deutonymph) and adult (Zhang 2003).

Amphitetranychus viennensis was assessed in the existing import policy for apples from China (Biosecurity Australia 2010a). The assessment of hawthorn spider mite presented here builds on this previous assessment.

The risk scenario of concern for *A. viennensis* is the presence of eggs, nymphs and/or adults on imported nectarines.

Differences in the commodity, horticultural practices, climatic conditions and the prevalence of *A. viennensis* between previous export areas in China make it necessary to reassess the likelihood that *A. viennensis* will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of apples from China. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for apples from China. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *A. viennensis* in Australia will be comparable regardless of the fresh fruit commodity in which *A. viennensis* is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *A. viennensis* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *A. viennensis* in the existing policy for apples from China (Biosecurity Australia 2010a). Therefore, those risk ratings will be adopted for this assessment.

4.1.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

4.1.2 Likelihood of importation

The likelihood that *A. viennensis* will arrive in Australia with the importation of fresh nectarines from China is: **Moderate**.

The following information provides supporting evidence for this assessment.

- Spider mites are associated with stonefruit (peach, nectarine, plum and apricot) production in China (Feng and Wang 2004). *Amphitetranychus viennensis* is widespread in China including Henan, Liaoning, Shaanxi and Shandong provinces where China's main stonefruit production areas are located (AQSIQ 2006b).
- Spider mite populations can rapidly increase, particularly in hot and dry conditions with severe infestations resulting in defoliation. The life cycle of spider mites depends on the species and environmental factors. For example, there are five generations of *A. viennensis* per year (Alford 2007; David'yan 2009) and on stonefruit in China spider mites produce from 6–10 generations a year depending on the conditions in the area of occurrence (Feng and Wang 2004).
- Spider mites are primarily found on the leaves of plants and are reported to both feed and lay eggs on leaves (Alford 2007). However, spider mites are highly mobile and have the capacity to move onto all parts of the plant and may move to other parts of the host plant when populations become high (Jeppson *et al.*1975).
- In colder climates, spider mites survive the winter temperatures by entering an inactive state or diapause. Only fertilised females overwinter under the bark or inside cracks on the stem and branches of the host plants (David'yan 2009). They emerge in early spring and lay eggs on the underside of the leaves (Alford 2007).
- Spider mites are very small and difficult to see without the aid of a hand lens. Adult females of *Amphitetranychus viennensis* range from 0.5 to 0.6 millimetres in length, males are 0.37 millimetres long and eggs are 0.17 millimetres in diameter (Alford 2007). The small size of spider mites and their eggs may make them difficult to detect, especially at low population levels and when they are present in the depression on the stem-end of fruit. The sorting, grading and packing processes may not reliably remove lightly infested fruit from the export pathway.
- All harvested nectarines are washed and brushed following harvest (AQSIQ 2006b). The brushing process would likely dislodge any mobile spider mites present on the surface of the fruit.
- The brushing process may not remove spider mites and/or eggs located in the depression in the stem-end of nectarine fruit. Mites associated with webbing at the stem-end of fruit have been observed during packing house process (Curtis *et al.*1992).
- After packing, nectarine fruit will be stored at 0.0 to 0.5 °C (AQSIQ 2006b). Fertilised female spider mites overwinter and survive sub-zero temperatures (Veerman 1985) and are likely to survive cold storage and transportation to Australia.
- There is a potential for spider mites to be associated with summer fruit after storage and transportation as live spider mites (*Tetranychus* spp.) have been intercepted numerous times on stonefruit exported from New Zealand to Australia. While the time in transit from China is likely to be longer than from New Zealand, the interception data demonstrates that spider mites can survive packing house procedures and in-transit cold storage.

Hawthorn spider mites are small and may be undetected during routine packing house processes. Fertilised female spider mites are likely to survive cold storage and transportation to Australia. However, although spider mites can be associated with fruit when populations are high, they are primarily found on the leaves of the hosts. The stem end of the infested fruit often forms spider web, when the population is high, which makes the infestation readily visible and is likely to be removed during packing house procedures. But when the fruit is lightly infested, they may remain undetected. This information supports a likelihood estimate for importation of 'moderate'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *A. viennensis* assessed here would be the same as that for *A. viennensis* for apples from China (Biosecurity Australia 2010a), that is **Moderate**.

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *A. viennensis* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Low**.

4.1.3 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and of spread for *A. viennensis* is based on the assessment for apples from China (Biosecurity Australia 2010a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from previous assessments are presented below:

Likelihood of establishment:	**High**
Likelihood of spread:	**Moderate**

4.1.4 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *A. viennensis* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **Low**.

4.1.5 Consequences

The consequences of the establishment of *A. viennensis* in Australia have been estimated previously for apples from China (Biosecurity Australia 2010a). The overall consequences have been estimated to be **Moderate**.

4.1.6 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Amphitetranychus viennensis*	
Overall likelihood of entry, establishment and spread	Low
Consequences	Moderate
Unrestricted risk	Low

As indicated, the unrestricted risk estimate for *A. viennensis* has been assessed as ‘low’, which is above Australia’s ALOP. Therefore, specific risk management measures are required for this pest.

4.2 Strawberry spider mite

Tetranychus turkestani (EP)

Tetranychus turkestani (strawberry spider mite) belongs to the Tetranychidae family. Mites of this family are commonly referred to as spider mites due to their habit of spinning protective silken webbing on plants under which they feed (Zhang 2003). Spider mites have five life stages: egg, larva, two nymph stages (protonymph and deutonymph) and adult (Zhang 2003).

The risk scenario of concern for *T. turkestani* is the presence of eggs, nymphs or adults on imported nectarines.

Tetranychus turkestani was assessed in the existing policy for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). The assessment presented here builds on the previous assessment.

Differences in horticultural practices, climatic conditions and the prevalence of *T. turkestani* between export areas in the US and China make it necessary to reassess the likelihood that *T. turkestani* will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of stonefruit from the USA. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for stonefruit from the USA. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *T. turkestani* in Australia will be comparable regardless of the fresh fruit commodity in which *T. turkestani* is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *T. turkestani* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *T. turkestani* in the existing policy for stonefruit from the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2010b). Therefore, those risk ratings will be adopted for this assessment.

4.2.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

4.2.2 Likelihood of importation

The likelihood that *T. turkestani* will arrive in Australia with the importation of fresh nectarines from China is: **Low**.

The following information provides supporting evidence for this assessment.

- *Tetranychus turkestani* has been reported on banana and cotton in Hainan (Zhang and Fu 2004; Migeon and Dorkeld 2012) and Xinjiang provinces (Gu *et al.*2010) of China, which does not coincide with China's major nectarine production regions. In addition, no report of *T. turkestani* on stonefruit was found in China.

- Peaches and nectarines are hosts of *T. turkestani* (Migeon and Dorkeld 2013). This mite feeds in colonies mainly on the lower surface of the leaf but the injury shows on the upper surface (Jeppson *et al.*1975).
- Spider mite populations can rapidly increase, particularly in hot and dry conditions with severe infestations resulting in defoliation. The life cycle of spider mites depends on the species and environmental factors.
- Spider mites are primarily found on the leaves of plants and are reported to both feed and lay eggs on leaves (Alford 2007; David'yan 2009). However, spider mites are highly mobile and have the capacity to move onto all parts of the plant (Jeppson *et al.*1975) and may move to other parts of the host plant when populations become high (Jeppson *et al.*1975).
- In colder climates, spider mites survive the winter temperatures by entering an inactive state or diapause stage. Only fertilised females overwinter under the bark or inside cracks on the stem and branches of the host plants (David'yan 2009). They emerge in early spring and lay eggs on the underside of the leaves (Alford 2007). Female mites may overwinter in the depression on the stem-end of the mature fruit (Curtis *et al.*1992).
- Spider mites are very small (0.25–0.5 millimetres) and difficult to see without the aid of a hand lens (Berry 1998). The small size of spider mites and their eggs may make them difficult to detect, especially at low population levels and when they are present in the depression on the stem-end of fruit. The sorting, grading and packing processes may not reliably remove lightly infested fruit from the export pathway.
- All harvested nectarines are washed and brushed following harvest (AQSIQ 2006b). The brushing process would likely dislodge any mobile spider mites present on the surface of the fruit.
- The brushing process may not remove spider mites and/or eggs located in the depression in the stem-end of mature fruit. Mites associated with webbing at the stem-end of fruit have been observed during packing house process (Curtis *et al.*1992).
- After packing, nectarine fruit will be stored at 0.0 °C to 0.5 °C (AQSIQ 2006b). Fertilised female spider mites overwinter and survive sub-zero temperatures (Veerman 1985) and are likely to survive cold storage and transportation to Australia.
- There is a potential for spider mites to be associated with stonefruit after storage and transportation as live spider mites (*Tetranychus* spp.) have been intercepted numerous times on stonefruit exported from New Zealand to Australia.
- While the time in transit from China is likely to be longer than from New Zealand, the interception data demonstrates that spider mites can survive packing house procedures and in-transit cold storage.

Spider mites are small and may be undetected during routine packing house processes. Fertilised female spider mites are likely to survive cold storage and transportation to Australia. However, the current distribution of the strawberry mite in China is limited and does not coincide with major nectarine production regions and no report of strawberry spider mite associated with stonefruit in China has been found. This information supports a likelihood estimate for importation of 'low'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *T. turkestani* assessed here would be the same as that for *T. turkestani* for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), that is **Moderate**.

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *T. turkestani* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Low**.

4.2.3 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and of spread for *T. turkestani* is based on the assessment for stonefruit from the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2010b). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from previous assessments are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.2.4 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *T. turkestani* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **Low**.

4.2.5 Consequences

The consequences of the establishment of *T. turkestani* in Australia have been estimated previously for stonefruit from the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2010b). The overall consequences have been estimated to be **Low**.

4.2.6 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Tetranychus turkestani*	
Overall likelihood of entry, establishment and spread	Low
Consequences	Low
Unrestricted risk	Very low

As indicated, the unrestricted risk estimate for *T. turkestani* has been assessed as ‘very low’, which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.3 Rhynchites weevils

***Rhynchites auratus* (EP), *Rhynchites confragosicollis*, *Rhynchites faldermani*, *Rhynchites heros* (EP)**

Rhynchites auratus (Korean pear weevil), *R. confragosicollis* (peach curculio), *R. faldermani* (peach weevil) and *R. heros* (pear leaf weevil) belong to the weevil family Rhynchitidae. Weevils of this family are distinguished from other beetles by their long snouts and mouth parts modified to allow them to chew into flower heads.

Rhynchites weevils have four life stages: egg, larva, pupa and adult (Booth *et al.*1990) and one generation per year and both adult and larval stages overwinter in the soil (USDA 1958; China Plant Pests 2007). In the northern hemisphere, overwintered adults emerge in April and start feeding on young foliage followed by mating within 3–4 days and egg laying starts two days later (USDA 1958).

The biology and taxonomy of these four *Rhynchites* weevil species are considered sufficiently similar to justify combining them into a single assessment. In this assessment, the term '*Rhynchites* weevils' is used to refer to these four species unless otherwise specified.

The risk scenario of concern for *R. auratus*, *R. cofragosicollis*, *R. faldermani* and *R. heros* is the presence of eggs and developing larvae within imported nectarines.

Rhynchites auratus and *R. heros* were assessed in the existing import policy for apples from China (Biosecurity Australia 2010a) while *R. heros* was also assessed in the final extension of policy for Chinese pears (Biosecurity Australia 2005b). It is considered that these previous assessments for *R. auratus* and *R. heros* can equally apply to *R. cofragosicollis* and *R. faldermani*. Therefore, the assessment of *Rhynchites* weevils presented here builds on these previous assessments.

Differences in commodity, horticultural practices, climatic conditions and the prevalence of *R. auratus* and *R. heros* between previous export areas in China make it necessary to reassess the likelihood that *R. auratus* and *R. heros* will be imported into Australia with nectarines from China.

Fresh nectarine fruit may be imported from China from May to October which is similar to the timing of the import of pears and apples from China. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for apples from China. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *R. auratus* and *R. heros* in Australia will be comparable regardless of the fresh fruit commodity in which *R. auratus* and *R. heros* are imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *R. auratus* and *R. heros* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

The establishment and of spread of *R. auratus* and *R. heros* in Australia will be comparable for any commodity from which these species are imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are largely independent of the importation pathway. Accordingly, there is no need to reassess these components, and the risk ratings for distribution, establishment, spread and consequences as set out for *R. auratus* and *R. heros* in the import risk analysis reports for apples and pears from China (Biosecurity Australia 2005a; Biosecurity Australia 2010a).

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *R. auratus* and *R. heros* in the existing policy for apples from China (Biosecurity Australia 2010a) and for Chinese pears (Biosecurity Australia 2005b). Therefore, those risk ratings will be adopted for this assessment.

4.3.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

4.3.2 Likelihood of importation

The likelihood that *R. auratus*, *R. cofragosicollis*, *R. faldermani* and *R. heros* will arrive in Australia with the importation of fresh nectarines from China is: **Very Low**.

The following information provides supporting evidence for this assessment.

- *Rhynchites* weevils are associated with summerfruit production in China and are widespread throughout the summerfruit production areas in China. *Rhynchites auratus* is a pest of peach in Xinjiang and Hebei Provinces (CAAS 1992; Wang *et al.*1998). *Rhynchites heros* has a wide host range including stonefruit and is widespread along the east coast and also extends to the west of China (Hanson 1963). *Rhynchites confragosicollis* is a pest of peach throughout southern China (Li *et al.*1997). *Rhynchites faldermani* is a pest of peach along the east coast and gradually spread towards inland including Sichuan province in southern west of China (China Plant Pests 2007). *Rhynchites confragosicollis* is an important pest of peach throughout Southern China (Li *et al.*1997).
- *Rhynchites* weevils lay eggs a few millimetres deep in the developing fruit and sever the stalk. The infested fruit usually falls from the tree within a few days to facilitate larvae entering and pupating in the soil (Hanson 1963).
- Some infested fruit may remain hanging on the tree for some time, although it will not develop due to injury made by the *Rhynchites* weevil female at the stalk and will shrink in size (Hanson 1963). The egg laying site is easily recognisable due to dark pigmentation that develops around it (INRA 2006). Such fruit is very likely to be removed during the harvesting and packing house procedures.
- Adult *Rhynchites* weevils are visible to the naked eye, for example *R. auratus* range from 5.5 to 9.5 millimetres in size (Alford 2007). Adult weevils feeding on the fruit will be disturbed and fall off the fruit. It is unlikely that the mature nectarines will be infested with adult *Rhynchites* weevils.
- After packing, nectarines will be stored at 0.0 °C to 0.5 °C (AQSIQ 2006b). *Rhynchites* weevil adults and larvae overwinter in cold climates (Alford 2007) and are likely to survive cold storage and transportation to Australia if they were associated with commercial fruit.

Rhynchites weevils are widely distributed in China and nectarine is one of the major hosts. *Rhynchites* weevil's ability to survive cold temperatures would allow immature life stages of weevils to survive cold transportation to Australia. However, since infested fruit typically drop from the tree prior to harvest this would significantly reduce the likelihood that weevils would be associated with commercial quality fruit. In addition, any infested fruit that remains on the tree has obvious signs of damage and is very likely to be removed during harvest and packing house procedures. This information supports a likelihood estimate for importation of 'very low'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *R. auratus* and *R. heros* assessed here would be the same as that for *R. auratus* and *R. heros* for apples from China (Biosecurity Australia 2010a) and it is considered that *R. cofragosicollis* and *R. faldermani* would have the same likelihood of distribution, that is **Moderate**.

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *R. auratus*, *R. cofragosicollis*, *R. faldermani* and *R. heros* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Very low**.

4.3.3 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and of spread for *R. auratus* and *R. heros* is based on the assessment for pears and apples from China (Biosecurity Australia 2005a; Biosecurity Australia 2010a). Those assessments used the same methodology as described in Chapter 2 of this report. It is considered that *R. cofragosicollis* and *R. faldermani* would have the same likelihood of establishment and spread. The ratings from the previous assessment are presented below:

Likelihood of establishment: **Moderate**

Likelihood of spread: **Moderate**

4.3.4 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *R. auratus*, *R. cofragosicollis*, *R. faldermani* and *R. heros* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **Very Low**.

4.3.5 Consequences

The consequences of the establishment of *R. auratus* and *R. heros* in Australia have been estimated previously for pears and apples from China (Biosecurity Australia 2005b; Biosecurity Australia 2010a). *Rhynchites cofragosicollis* and *R. faldermani* are considered to have similar impact (Li *et al.*1997). The overall consequences have been estimated to be **Moderate.**

4.3.6 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *R. auratus*, *R. cofragosicollis*, R*. faldermani* and *R. heros*	
Overall likelihood of entry, establishment and spread	Very low
Consequences	Moderate
Unrestricted risk	Very Low

As indicated, the unrestricted risk estimate for R*. auratus, R. cofragosicollis, R. faldermani* and *R. heros* has been assessed as 'very low', which achieves Australia's ALOP. Therefore, no specific risk management measures are required for these pests.

4.4 Oriental Fruit fly

Bactrocera dorsalis (EP)

Bactrocera dorsalis (Oriental fruit fly) belongs to the Tephritidae family which is a group of pests considered to be among the most damaging pests of horticultural crops.

Bactrocera dorsalis has four life stages: egg, larva, pupa and adult. Eggs deposited into the fruit hatch into larvae which feed and develop inside the fruit. There are three larval instars. Pupation occurs in the soil under the host plant. Adult fruit flies are long-lived and have high reproductive rates, producing several overlapping generations a year, depending on the temperature (White and Elson-Harris 1992).

The risk scenario of concern for *B. dorsalis* is the presence of eggs and developing larvae within imported nectarines.

Bactrocera dorsalis was assessed in the existing policy for longans and lychees from China and Thailand (DAFF 2004), mangoes from Taiwan and India (Biosecurity Australia 2006c; Biosecurity Australia 2008). Existing policy for *B. dorsalis* was also adopted for apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011). The assessment of *B. dorsalis* presented here builds on these previous assessments.

Differences in the commodity, horticultural practices, climatic conditions, and the prevalence of *B. dorsalis* between previous export areas (India, the Philippines, Taiwan and Thailand) and China make it necessary to reassess the likelihood that *B. dorsalis* will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of apples, table grapes, longan and lychee from China, mangoes from Taiwan and India and longan and lychee from Thailand. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for apples, table grapes, mangoes, longans and lychees. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *B. dorsalis* in Australia will be comparable regardless of the fresh fruit commodity in which *B. dorsalis* is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *B. dorsalis* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *B. dorsalis* in the existing policies for longans and lychees from China and Thailand (DAFF 2004), mangoes from Taiwan and India (Biosecurity Australia 2006c; Biosecurity Australia 2008), apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011). Therefore, those risk ratings will be adopted for this assessment.

4.4.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *Bactrocera dorsalis* will arrive in Australia with the importation of fresh nectarines from China is: **High**.

The following information provides supporting evidence for this assessment.

- *Bactrocera dorsalis* has a wide host range and peach and nectarine are major hosts (CABI 2014).
- *Bactrocera dorsalis* is widespread in tropical Asia including China where it is widespread in central, east, south and southwest regions (Yang 1991). It is found on the Xisa Islands (Parcel Islands) in the South China Sea and as far north on the mainland as 26 degrees north latitude. Studies indicate that the northernmost distribution of *B. dorsalis* distribution in China that would support permanent populations is 30 ± 2 degrees north latitude (Yang *et al.*1994; Hou and Zhang 2005; Wu 2005). It infests peach in Yunnan and Guangxi, and is present in the Guangzhou area (Yang 1991; Chen and Ye 2007).
- *Bactrocera dorsalis* infestations can occur throughout the year in southern provinces and only seasonally in the northern region of China (Chen *et al.*2006). Females deposit eggs beneath the skin of host fruit and after hatching the larvae feed within the fruit until they are ready to pupate (Dhillon *et al.*2005; Chen *et al.*2006).
- Fruit with infestation may show obvious signs of attack or tissue decay. Such fruit will be removed during sorting, packing and quality inspection procedures.
- However, newly infested fruit may not be distinguished from un-infested fruit. Such fruit is unlikely to be detected during sorting, packing and quality inspection procedures in the absence of visual blemishes, bruising or damage to the skin; eggs and/or larvae are likely to escape detection.
- Juvenile life stages are likely to survive the cold transportation to Australia from China as they are able to survive extended periods of cold (USDA 2010).

Bactrocera dorsalis is present in some of the major peach and nectarine production regions. Peach and nectarine are major hosts of *B. dorsalis*. Newly infested fruit may not be distinguished from un-infested fruit and such fruit is unlikely to be detected during sorting, packing and quality inspection procedures. The eggs and larvae are likely to survive the cold storage and transportation. This information supports a likelihood estimate for importation of 'high'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *B. dorsalis* assessed here would be the same as that for *B. dorsalis* for longans and lychees from China and Thailand (DAFF 2004), mangoes from Taiwan and India (Biosecurity Australia 2006c; Biosecurity Australia 2008), and apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011), that is **High.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *B. dorsalis* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **High**.

4.4.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and of spread for *Bactrocera dorsalis* is based on the assessment for longans and lychees from China and Thailand (DAFF 2004), mangoes from Taiwan and India (Biosecurity Australia 2006c; Biosecurity Australia 2008), apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011). The ratings from the previous assessments are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.4.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *Bactrocera dorsalis* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **High**.

4.4.4 Consequences

The consequences of the establishment of *Bactrocera dorsalis* in Australia have been estimated previously as high for longans and lychees from China and Thailand (DAFF 2004), mangoes from Taiwan and India (Biosecurity Australia 2006c; Biosecurity Australia 2008), apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011). The overall consequences have been estimated to be **High**.

4.4.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Bactrocera dorsalis*	
Overall likelihood of entry, establishment and spread	High
Consequences	High
Unrestricted risk	High

As indicated, the unrestricted risk estimate for *Bactrocera dorsalis* has been assessed as 'high', which is above Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.5 Guava fruit fly

Bactrocera correcta (EP)

Bactrocera correcta (guava fruit fly) belongs to the Tephritidae family which is a group considered to be among the most damaging pests of horticultural crops.

Bactrocera correcta has four life stages: egg, larva, pupa and adult. Eggs deposited into the fruit hatch into larvae which feed and develop inside the fruit. There are three larval instars. Pupation occurs in the soil under the host plant. Adult fruit flies are long-lived and have high reproductive rates, producing several overlapping generations a year, depending on the temperature (White and Elson-Harris 1992).

The risk scenario of concern for *B. correcta* is the presence of eggs and developing larvae within imported nectarines.

Bactrocera correcta was assessed in the existing policy for mangoes from India (Biosecurity Australia 2008). The assessment of *Bactrocera correcta* presented here builds on this previous assessment.

Differences in the commodity, horticultural practices, climatic conditions, and the prevalence of *B. correcta* between previous export areas (India) and China make it necessary to reassess the likelihood that *B. correcta* will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of mangoes from India. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for mangoes from India. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *B. correcta* in Australia will be comparable regardless of the fresh fruit commodity in which *B. correcta* is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *B. correcta* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *B. correcta* in the existing policy for mangoes from India (Biosecurity Australia 2008). Therefore, those risk ratings will be adopted for this assessment.

4.5.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *B. correcta* will arrive in Australia with the importation of fresh nectarines from China is: **Low**.

The following information provides supporting evidence for this assessment.

- *Bactrocera correcta* is a tropical species that is recorded from south and southwest China (Yang 1991) including Guangdong and Yunnan provinces which are not major peach and nectarine production areas (Liang *et al.*1993; Li *et al.*1997).
- *Bactrocera correcta* is a quarantine pest for China and is considered absent from northern regions of China.
- Peaches and nectarines are known hosts of *B. correcta* (Steck 2002) which are sometimes heavily infested as it is for example in India (Kapoor 2002).
- *Bactrocera correcta* has 4–5 generations per year in the Guangzhou area (Yang 1991) and in Yunnan *B. correcta* and *B. dorsalis* are present in mixed populations throughout the year (Liu and Ye 2009a).
- Females deposit eggs beneath the skin of host fruit and after hatching the larvae feed within the fruit until they are ready to pupate (Dhillon *et al.*2005; Chen *et al.*2006).
- Fruit with infestation normally show obvious signs of attack or tissue decay. Such fruit will be removed during sorting, packing and quality inspection procedures.
- However, newly infested fruit may not be distinguished from un-infested fruit. Such fruit is unlikely to be detected during sorting, packing and quality inspection procedures in the absence of visual blemishes, bruising or damage to the skin; eggs and/or larvae are likely to escape detection.
- Juvenile life stages are likely to survive the cold transportation to Australia from China although *B. correcta* is more sensitive to cold temperatures as it has higher developmental threshold temperatures compare to *B. dorsalis* (Liu and Ye 2009b).

Peach and nectarine are hosts of *B. correcta*. Newly infested fruit may not be distinguished from un-infested fruit and such fruit is unlikely to be detected during sorting, packing and quality inspection procedures. *Bactrocera correcta* is a tropical species and is sensitive to cold temperatures but some eggs and larvae would be likely to survive the cold storage and transportation. However, *Bactrocera correcta* is not present in major peach and nectarine production regions and is a regional quarantine pest of China. This information supports a likelihood estimate for importation of 'low'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *B. correcta* assessed here would be the same as that for *B. correcta* for mangoes from India (Biosecurity Australia 2008), that is **High.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *B. correcta* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Low**.

4.5.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and of spread for *Bactrocera correcta* is based on the assessment for mangoes from India (Biosecurity Australia 2008). The ratings from the previous assessment are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.5.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *Bactrocera correcta* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **Low**.

4.5.4 Consequences

The consequences of the establishment of *Bactrocera correcta* in Australia have been estimated previously as high for mangoes from India (Biosecurity Australia 2008). The overall consequences have been estimated to be **High**.

4.5.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Bactrocera correcta*	
Overall likelihood of entry, establishment and spread	Low
Consequences	High
Unrestricted risk	Moderate

As indicated, the unrestricted risk estimate for *Bactrocera correcta* has been assessed as 'moderate', which is above Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.6 Spotted wing drosophila

***Drosophila suzukii* (EP)**

The quarantine risks posed by *Drosophila suzukii* from all countries and for all commodities has been assessed in a separate pest risk analysis (DAFF Biosecurity 2013). This pest attacks a range of soft fruits including stonefruit (peaches, nectarines, plums, apricots and cherries). It is described as a major pest on cherry in China (Dai and Shi 2013). The pest risk analysis report identified fresh fruit imports as a potential pathway for the introduction of *Drosophila suzukii* with an unrestricted risk that exceeds Australia's appropriate level of protection (ALOP).

Drosophila suzukii is considered native to several Asian countries including China, where it is widespread (Anhui, Beijing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Shaanxi, Shandong, Shanghai, Shanxi, Sichuan, Yunnan, Zhejiang) (Hu *et al.*1993; CABI 2013; Dai and Shi 2013).

The risk scenario of concern for *D. suzukii* is the presence of the eggs and larvae in imported nectarines.

The likelihood estimates from the *Final pest risk analysis report for Drosophila suzukii* (DAFF Biosecurity 2013) are presented below.

4.6.1 Likelihood of entry, establishment and spread

Likelihood of importation: **High**

Likelihood of distribution: **High**

Overall likelihood of entry: **High**

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.6.2 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *Drosophila suzukii* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **High**.

4.6.3 Consequences

The consequences of the establishment of *Drosophila suzukii* in Australia have been estimated previously in the *Final pest risk analysis report for Drosophila suzukii* (DAFF Biosecurity 2013). The overall consequences are estimated to be **High**.

4.6.4 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Drosophila suzukii*	
Overall likelihood of entry, establishment and spread	High
Consequences	High
Unrestricted risk	High

As indicated, the unrestricted risk estimate for *Drosophila suzukii* has been assessed as 'high', which is above Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.7 Comstock mealybug

Pseudococcus comstocki **(EP)**

Pseudococcus comstocki (comstock mealybug) belongs to the Pseudococcidae or mealybug family. It has been recorded on *Prunus persica* (CABI 2014; Ben-Dov 2014b) and heavily infesting a peach and nectarine orchards in Europe after accidental introduction (Pellizzari *et al.*2012).

The risk scenario of concern for this mealybug is the presence of crawlers, immobile juveniles or adult mealybugs in the stem-end cavity of imported nectarines.

Pseudococcus comstocki was assessed in the existing import policies, such as for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), apples and tables from China (Biosecurity Australia 2010a; Biosecurity Australia 2011) and Unshu mandarins from Japan (Biosecurity Australia 2009). The assessment of *P. comstocki* presented here builds on these previous assessments.

Differences in horticultural practices, climatic conditions and the prevalence of *Pseudococcus comstocki* between previous export areas in Japan, the United States of America and China make it necessary to reassess the likelihood that *P. comstocki* will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of stonefruit from the USA (California, Idaho, Oregon and Washington) and apples and table grapes from China. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for stonefruit from the USA. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *P. comstocki* in Australia will be comparable regardless of the fresh fruit commodity in which *P. comstocki* is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *P. comstocki* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *P. comstocki* in the existing policies such as for stonefruit from the USA (Biosecurity Australia 2010b), apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011) and Unshu mandarins from Japan (Biosecurity Australia 2009). Therefore, those risk ratings will be adopted for this assessment.

4.7.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *P. comstocki* will arrive in Australia with the importation of fresh nectarines from China is: **High**.

The following information provides supporting evidence for this assessment.

- *Pseudococcus comstocki* is widely distributed in China's major peach/nectarine production regions including Beijing, Hebei, Henan, Liaoning, Shaanxi, Shandong, Shanxi (AQSIQ 2005; Yang *et al.*2011).
- Fruit bagging is not effective in preventing *P. comstocki* from infesting fruit as, with large populations, it still access to the fruit via the openings in the bag (Yang *et al.*2011).
- *Pseudococcus comstocki* has upto three generations a year in China and causes damage to nectarine and peach fruit, resulting in heavy economic loss (Yang *et al.*2011; Pellizzari *et al.*2012; Ben-Dov 2014b).
- Third instar mealybug nymphs seek sheltered feeding sites such as in the fruit stem cavity (Pellizzari *et al.*2012). Their small size (03-2.5 mm) makes them hard to detect (Taverner and Bailey 1995b; CABI 2014).
- Females search for sheltered places to lay their eggs often in the stem end of nectarines and peaches (Pellizzari *et al.*2012).
- The tendency to move from leaves to trunks, branches, fruits or other protected places increases in the second and third generation adult females, typically from the end of July to early August (Pellizzari *et al.*2012). There is potential for viable mealybug eggs, nymphs or adults to remain associated with fruit after harvesting.
- Mealybugs that may be firmly anchored to the fruit or that are hidden in the stem-end cavity of fruit (Taverner and Bailey 1995a) may not be removed by the washing and brushing processes in the packing houses. Eggs deposited in secluded places such as in the stem-end cavity of nectarine fruit also may not be removed by the brushing process.
- Sorting and grading would remove some mealybug infested fruit if clear symptoms of infestation are present. Low level infestations may be difficult to detect and it is expected that some infested fruit would remain undetected.
- Fruit is ideally stored at between 0 and 2 °C (Curtis *et al.*1992; Yokoyama and Miller 1999; Summerfruit Australia 2014). Overwintering egg masses of *Pseudococcus comstocki* have apparently not been affected by absolute minimum temperatures of –3.0 °C and –5.4 °C (Pellizzari *et al.*2012). *Pseudococcus comstocki* also overwinters on trunks and branches of vines in northern China (Li *et al.*2004; Zhang 2005) and would be likely to survive cold storage and transportation. A related species, *Pseudococcus affinis* (now *Pseudococcus viburni*), can survive for up to 42 days at 0 °C (Hoy and Whiting 1997) indicating that mealybugs are likely to survive cold storage during transportation to Australia.

Pseudococcus comstocki is widely distributed in China's major peach and nectarine production regions. Fruit bagging is not effective in reducing *P. comstocki* infestation. Packing house processes may not remove all *P. comstocki* from the infested fruit. The size of *P. comstocki* is small and it may not be detected during routine packing house processes.

Pseudococcus comstocki is likely to survive cold storage and transportation. This information supports a likelihood estimate for importation of 'high'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *P. comstocki* assessed here would be the same as that for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011) and Unshu mandarins from Japan (Biosecurity Australia 2009), that is **Moderate.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *P. comstocki* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Moderate**.

4.7.2 Likelihood of establishment and spread

The likelihood of establishment and spread for *P. comstocki* is based on the assessment for stonefruit from the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2010b), apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011) and Unshu mandarins from Japan (Biosecurity Australia 2009). Those assessments used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessments are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.7.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *P. comstocki* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **Moderate**.

4.7.4 Consequences

The consequences of the establishment of *P. comstocki* in Australia are being based on the assessments for stonefruit from the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2010b), apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011) and Unshu mandarins from Japan (Biosecurity Australia 2009). The overall consequences have been estimated to be **Low**.

4.7.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Pseudococcus comstocki*	
Overall likelihood of entry, establishment and spread	Moderate
Consequences	Low
Unrestricted risk	Low

As indicated, the unrestricted risk estimate for *P. comstocki* has been assessed as ‘low’, which is above Australia’s ALOP. Therefore, specific risk management measures are required for this pest.

4.8 Armoured scales

Pseudaonidia duplex **and** ***Pseudaulacaspis prunicola*** **(EP)**

Pseudaonidia duplex (camphor scale) and *Pseudaulacaspis prunicola* belong to the Diaspididae family. Scales of this family are commonly referred to as armoured scales due to the insect's production of a hard, fibrous, wax like covering that attaches the scale to the host plant (Carver *et al.*1991). These scale species share similar biology and taxonomy and cause similar impact on host plants.

Pseudaulacaspis prunicola was considered as a synonym of *Pseudaulacaspis pentagona* but was reinstated as a separate species in 1980 (Miller and Davidson 1990).

The biology and taxonomy of these two armoured scales species are considered sufficiently similar to justify combining them into a single assessment. In this assessment, the term 'armoured scales' is used to refer to both species unless otherwise specified.

The risk scenario of concern for armoured scales is the presence of mobile or immobile juveniles or adult scales in the depression at the stem end of imported nectarines.

Pseudaulacaspis prunicola was assessed in the existing import policy for stonefruit from the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2010b). Although *P. duplex* has not been assessed previously, it is considered that the previous assessment for *P. prunicola* could be equally applied to *P. duplex* due to the similarity of biology, taxonomy and economic impacts. Therefore, the assessment of *P. duplex and P. prunicola* presented here builds on the previous assessment for *Pseudaulacaspis prunicola*.

Differences in horticultural practices, climatic conditions and the prevalence of *P. prunicola* between the previous export area (the USA) and China make it necessary to reassess the likelihood that *P. prunicola* will be imported into Australia with nectarines from China.

Fresh nectarine fruit may be imported from China from May to October which is similar to the timing of the import of stonefruit from the USA. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for stonefruit from the USA. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *P. prunicola* in Australia will be comparable regardless of the fresh fruit commodity in which *P. prunicola* is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *P. prunicola* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *P. prunicola* in the existing policy for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). Therefore, those risk ratings will be adopted for this assessment.

4.8.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *Pseudaonidia duplex* and *Pseudaulacaspis prunicola* will arrive in Australia with the importation of fresh nectarines from China is: **Low**.

The following information provides supporting evidence for this assessment.

- The armoured scales assessed here are widely distributed and are important pests of tea tree, citrus and figs in China (Li *et al.*1997).
- *Pseudaonidia duplex* and *Pseudaulacaspis prunicola* attack a wide range of deciduous plants and fruit trees (CABI 2014). They feed, reproduce and develop on young shoots and leaves of their host plants, with occasional fruit infestation when the populations are high (Watson 2005b).
- No reports of *Pseudaonidia duplex* on peaches and nectarines in China were found. However, *P. duplex* was reported to occasionally infest peaches in the USA (Hodges 2005).
- *Pseudaulacaspis prunicola* primarily infests bark and fruit of host plants. It has been frequently confused with *P. pentagona* (Miller and Davidson 2005).
- Armoured scale infestations can cause visible symptoms on fruit and are likely to cause the fruit to be rejected during harvesting, sorting and packinghouse processes. However, armoured scales are small and low infestations in the stem end may remain undetected.
- The washing and brushing processes would likely dislodge crawlers and a proportion of the sessile armoured scales present on the surface of the fruit. However, the brushing process may not remove armoured scales and/or eggs located in the stem-end of nectarines.
- Armoured scales are likely to survive the cold temperatures during storage and transportation although low temperatures would slow development of scales. *Pseudaonidia duplex* and *Pseudaulacaspis prunicola* overwinter as fertilized females in contental climates (Li *et al.*1997).

The armoured scales are widely distributed in China. Peaches and nectarines are hosts of *Pseudaonidia duplex* and *Pseudaulacaspis prunicola*. Harvesting and packing house processes is unlikely to remove all armoured scales from the stem end of the infested fruit. Armoured scales are likely to survive the cold temperatures during storage and transportation. However, *Pseudaonidia duplex* and *Pseudaulacaspis prunicola* only occasionally infest commercial fruit when populations are high. No reports of *Pseudaonidia duplex* and *Pseudaulacaspis prunicola* on commercial nectarine fruit have been found in China. This information supports a likelihood estimate for importation of 'low'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *Pseudaulacaspis prunicola* assessed here would be the same as that for *Pseudaulacaspis prunicola* for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b) and *Pseudaonidia duple* is considered to have the same likelihood of distribution, that is **Low.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *Pseudaonidia duplex* and *Pseudaulacaspis prunicola* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Low**.

4.8.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and spread for *Pseudaulacaspis prunicola* is based on the assessment for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). That assessment used the same methodology as described in Chapter 2 of this report. *Pseudaonidia* duplex is considered to have the same likelihood of establishment and spread. The ratings from the previous assessment are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **Moderate**

4.8.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *Pseudaonidia duplex* and *Pseudaulacaspis prunicola* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **Very low**.

4.8.4 Consequences

The consequences of the establishment of *Pseudaulacaspis prunicola* are being based on the assessment for stonefruit from the USA (Biosecurity Australia 2010b) for *Pseudaulacaspis prunicola*. *Pseudaonidia duplex* is considered to have similar impact. The overall consequences have been estimated to be **Low**.

4.8.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Pseudaonidia duplex* and *Pseudaulacaspis prunicola*	
Overall likelihood of entry, establishment and spread	Very low
Consequences	Low
Unrestricted risk	Very Low

As indicated, the unrestricted risk estimate for *Pseudaonidia duplex* and *Pseudaulacaspis prunicola* has been assessed as ‘very low’, which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for these pests.

4.9 Leaf rollers

***Adoxophyes orana* (EP), *Argyrotaenia ljungiana* and *Spilonota albicana* (EP)**

Adoxophyes orana (summerfruit tortrix), *Argyrotaenia ljungiana* (grape tortrix) and *Spilonota albicana* (white fruit moth) belong to the Tortricidae family. Moths of this family are an economically important group commonly referred as leaf rollers due to their habit of spinning leaves together or rolling leaves of their host plants for shelter (Alford 2007).

Leaf rollers damage fruit crops through larval feeding on buds, foliage, bracts, fruitlets and fruit (Alford 2007; Ovsyannikova and Grichanov 2009). Leaf roller larval attack on maturing fruit causes considerable damage in quality rendering fruit blemished and unmarketable. Infestations of leaf rollers may also result in secondary infections by fungal pathogens causing fruit to rot (Alford 2007).

Leaf rollers have four life stages: egg, larva, pupa and adult. Females lay eggs in batches on leaves of the host plants. Newly hatched larvae feed on the underside of the leaves, close to the mid-rib. Once they have rolled or webbed leaves together with silk to form a shelter, the larvae feed more extensively, usually at the shoot tips. Foliage is often rolled or webbed against the fruit and fruitlets, which are then also attacked.

The biology and taxonomy of these three leafroller species and the impacts on host plants are considered sufficiently similar to justify combining them into a single assessment. In this assessment, the term 'leaf rollers' is used to refer to these three species unless otherwise specified.

The risk scenario of concern for leaf rollers is the presence of eggs on or larvae inside imported nectarines.

Adoxophyes orana and *S. albicana* were assessed in the existing import policy for apples from China (Biosecurity Australia 2010a). *Adoxophyes orana* was also assessed in the existing import policy for longan and lychees from China and Thailand (DAFF 2004). It is considered that these previous assessment for *A. orana* and *S. albicana* can also equally apply to *A. ljungiana*. Therefore, the assessment of the above-listed leaf rollers presented here builds on these previous assessments.

Differences in commodities, horticultural practices, climatic conditions and the prevalence of leaf rollers between previous export areas in China and Thailand and new export areas in China make it necessary to reassess the likelihood that leaf rollers will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of apples from China and longans and lychees from Thailand and China. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for these fresh fruit commodities. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *A. orana* and *S. albicana* in Australia will be comparable regardless of the fresh fruit commodity in which *A. orana* and *S. albicana* are imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *A. orana* and *S. albicana* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

The likelihood of establishment and of spread of the above-listed leaf rollers in Australia, and the consequences they may cause will be comparable for any fruit commodity from which these species are imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are largely independent of the importation pathway. Accordingly, there is no need to reassess these components.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out *A. orana* and *S. albicana* in the existing policy for apples from China (Biosecurity Australia 2010a). Therefore, those risk ratings will be adopted for this assessment.

4.9.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *Adoxophyes orana, Argyrotaenia ljungiana* and *Spilonota albicana* will arrive in Australia with the importation of fresh nectarines from China is: **Low**.

The following information provides supporting evidence for this assessment.

- *Adoxophyes orana, A. ljungiana* and *S. albicana* are widely distributed in China including major peach and nectarine production regions and are major pests of a range of horticultural commodities including stonefruit and apples (Ma 2006; Hua and Wang 2006).
- *Adoxophyes orana* females lay eggs on the surface of leaves or fruit of the host plants (Byun *et al.*2003). First instar larvae hatch in 8-20 days and feed under a silk web on the underside of a leaf. Later instars feed inside rolled leaves or web leaves to fruit and feed on the surface. Larvae complete five instars and pupation occurs in the final larval nest. Second or third instar larvae of the last generation hibernate until spring and complete development by feeding on buds and young leaves (Gilligan and Epstein 2014). External fruit damage (point-like holes in the fruit tissue and grazing damage on fruit surface (Noma *et al.*2010).
- *Argyrotaenia ljungiana* females deposit eggs in batches usually on the upper surface of host plant leaves. The newly hatched larvae skeletonise the undersides of leaves along the midrib, later dispersing to feed inside leaves spun together or against fruit (Meijerman and Ulenberg 2000b). Beginning from the 3rd instar, they live in rolled or folded leaves and damage buds or fruits adjoining to those leaves, gnawing out surface cavities in fruits (Afonin *et al.*2008). The infested fruit will be readily detected.
- Eggs laid on the surface of fruit would likely be dislodged by washing and brushing processes. However, *S. albicana* (mainly a pome fruit pest) females may lay eggs in the calyx of its host fruit (CAAS 1992). In the case of peach and nectarine fruit it may lay its eggs in the depression at the stem end and these eggs may not be dislodged during washing and brushing processes.

- Newly hatched later generations of *S. albicana* larvae may bore into fruit from the calyx or stem end of the fruit. A spot or swelling is formed on fruit surface because of congestion of frass and would be readily detected (Afonin *et al.*2008). However, newly infested fruit is less likely to have any obvious symptoms of presence of eggs or larvae on the fruit. Such fruit may escape detection during the packing house procedures.
- *Adoxophyes orana* and *S. albicana* are present in the far North East region in China (Byun *et al.*2003; Zhang and Li 2005). Their larvae survive the extreme winter temperatures in Liaoning and Heilongjiang respectively. This indicates that these species have the potential to survive cold temperatures during the transportation of nectarines from China to Australia, hence, are likely to survive storage and transportation.

Leaf rollers are widely distributed in China's major peach and nectarine production regions and are associated with peach and nectarine fruit. Leaf roller larvae and eggs are likely to survive the cold temperatures during storage and transportation. Visible symptoms on fruit significantly reduce the risk of these pests on the packed commercial quality fruit. This information supports a likelihood estimate for importation of 'low'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *A. orana* and *S. albicana* assessed here would be the same as that for *A. orana* and *S. albicana* for apples from China (Biosecurity Australia 2010a) and it is considered that *A. ljungiana* would have the same likelihood of distribution, that is **Moderate.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *A. orana, A. ljungiana* and *S. albicana* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Low**.

4.9.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and of spread for the above-listed leaf rollers is based on the assessment for *A. orana* and *S. albicana* for apples from China (Biosecurity Australia 2010a). It is considered that *A. ljungiana* would have the same likelihoods of establishment and spread. The ratings from the previous assessment are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.9.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that the above-listed leaf rollers will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **Low**.

4.9.4 Consequences

It is considered that the overall consequences of *A. ljungiana* would be similar as previously assessed for *A. orana* and *S. albicana*. The consequences of the establishment of *A. orana* and *S. albicana* in Australia have been estimated previously for apples from China (Biosecurity Australia 2010a). The overall consequences have been estimated to be **Moderate**.

4.9.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Adoxophyes orana*, *Argyrotaenia ljungiana* and *Spilonota albicana*	
Overall likelihood of entry, establishment and spread	Low
Consequences	Moderate
Unrestricted risk	Low

As indicated, the unrestricted risk estimate for *A. orana*, *A. ljungiana* and *S. albicana* has been assessed as ‘low’, which is above Australia’s ALOP. Therefore, specific risk management measures are required for these pests.

4.10 Codling moth

Cydia pomonella **(EP, WA)**

Cydia pomonella is not present in Western Australia and is pest of regional quarantine concern for that state. *Cydia pomonella* (codling moth) belongs to the Tortricidae family.

Cydia pomonella is a serious pest of pome fruit (apples and pears) throughout temperate regions of the world except Japan and Korea. It has also been shown to feed in nectarine and peach, as well as apricot, plum, quince and walnut (Alford 2007; Blomefield and Giliomee 2012; Neven 2013; Men *et al.*2013). *Cydia pomonella* is considered to occur only very rarely on stonefruit (Hely *et al.*1982; McLaren *et al.*1999). In China, it was first reported in 1957 and has since spread throughout Xinjiang, Gansu and Heilongjiang (Yang *et al.*2005; Men *et al.*2013).

The risk scenario of concern for *C. pomonella* is the presence of larvae inside imported nectarines.

Cydia pomonella was assessed in the existing policies for stonefruit from New Zealand and the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2006b; Biosecurity Australia 2010b) and apples from New Zealand and China (Biosecurity Australia 2006a; Biosecurity Australia 2010a).

Differences in commodities, horticultural practices, climatic conditions and the prevalence of codling moth between previous export areas (New Zealand, the USA and China) make it necessary to reassess the likelihood that codling moth will be imported into Western Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of apples from China and stonefruit from the USA. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for apples from China and stonefruits from the USA (California, Idaho, Oregon and Washington). Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *C. pomonella* in Australia will be comparable regardless of the fresh fruit commodity in which *C. pomonella* is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *C. pomonella* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *Cydia pomonella* in the existing policies for stonefruit from New Zealand and the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2006b; Biosecurity Australia 2010b) and apples from New Zealand and China (Biosecurity Australia 2006a; Biosecurity Australia 2010a). Therefore, those risk ratings will be adopted for this assessment.

4.10.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *Cydia pomonella* will arrive in Western Australia with the importation of fresh nectarines from China is: **Extremely low**.

The following information provides supporting evidence for this assessment.

- *Cydia pomonella* is widespread throughout Xinjiang, Gansu and Heilongjiang provinces in China (Men *et al.*2013).
- *Cydia pomonella* is a major pest of apple and pear worldwide but can also feed nectarine and peach as well as apricot, plum, quince and walnut under certain conditions (Alford 2007; Blomefield and Giliomee 2012; Neven 2013; Men *et al.*2013).
- There is no evidence that *C. pomonella* can maintain populations in orchards of *Prunus persica* (Barnes 1991).
- *Cydia pomonella* is considered to occur only very rarely on stonefruit and is essentially a pest of apple and pear fruit (Hely *et al.*1982; McLaren *et al.*1999).
- Fruit infested with *C. pomonella* can have prominent entry and exit holes. Such fruit will be removed during the sorting and grading procedures.
- Fully-grown larvae are 20 millimetres long and pupae are 8.0 to 11.5 millimetres. Consequently, there is a high likelihood that codling moth would be detected during packing house procedures. *Cydia pomonella* is very rarely found in fruit that has passed packinghouse procedures undetected.
- *Cydia pomonella* larvae feed internally within the fruit. The fruit infested at harvest time may not show any signs of infestation and may escape packing house procedures.
- *Cydia pomonella* larvae are reported to be cannibals. Rarely more than two young larvae penetrate the same fruit, however, only one survives to complete development (Chapman and Lienk 1971).
- Fifth instar *C. pomonella* larvae exit the fruit to diapause during winter in cocoons. Overwintering *C. pomonella* larvae survive severe winter temperatures in the Pacific North West region which may drop as low as –25 °C (Neven 1999). This indicates that this species would be able to survive cold temperatures during the transportation of nectarines from China to Australia.

Nectarine is a very poor host for *C. pomonella*. It is very unlikely the larvae would be present inside the nectarine fruit for export. In addition, infested fruit often show visible symptoms of damage and is very likely to be removed during the harvesting and packing house processes. This information supports a likelihood estimate for importation of ‘extremely low’.

Likelihood of distribution

As indicated above, the likelihood of distribution for *C. pomonella* assessed here would be the same as that for *C. pomonella* for stonefruit from New Zealand and the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2006b; Biosecurity Australia 2010b) and apples from New Zealand and China (Biosecurity Australia 2006a; Biosecurity Australia 2010a), that is **Moderate.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *C. pomonella* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Extremely low**.

4.10.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and of spread for *C. pomonella* is based on the assessment for stonefruit from New Zealand and the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2006b; Biosecurity Australia 2010b) and apples from New Zealand and China (Biosecurity Australia 2006a; Biosecurity Australia 2010a). The ratings from the previous assessments are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.10.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *C. pomonella* will enter Western Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia has been assessed as: **Extremely Low**.

4.10.4 Consequences

The consequences of the establishment of *C. pomonella* in Australia have been estimated previously for stonefruit from New Zealand and the USA (California, Idaho, Oregon and Washington)(Biosecurity Australia 2006b; Biosecurity Australia 2010b) and apples from New Zealand and China (Biosecurity Australia 2006a; Biosecurity Australia 2010a). The overall consequences are estimated to be **Moderate**.

4.10.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *C. pomonella*	
Overall likelihood of entry, establishment and spread	Extremely Low
Consequences	Moderate
Unrestricted risk	Negligible

As indicated, the unrestricted risk estimate for *C. pomonella* has been assessed as 'negligible', which is below Australia's ALOP. Therefore, no specific risk management measures are required for this pest.

4.11 Grapholita moths

Grapholita funebrana **and** ***Grapholita molesta*** **(EP, WA)**

Grapholita funebrana is absent from Australia and is a pest of quarantine concern for all of Australia, while *G. molesta* is not present in Western Australia and is a pest of regional concern for that state.

Grapholita funebrana (plum fruit moth) and *Grapholita molesta* (Oriental fruit moth) belong to the Tortricidae family. The larvae of the genus *Grapholita* feed internally on fruit and on twigs.

Grapholita moths have four life stages: egg, larva, pupa and adult. Larvae generally have four to five instars (Meijerman and Ulenberg 2004). Newly hatched larvae bore into the fruit, and larval feeding continues until they reach maturity (Meijerman and Ulenberg 2004). The full grown larvae of the first generation pupate in stem-end depressions on the fruit surface, in leaf axils or under bark, whereas the larvae of the later generation overwinter in cocoons in the soil, leaf litter or bark of the host plant, pupating the following spring (Brunner and Rice 1998; Meijerman and Ulenberg 2004).

The biology and taxonomy of these two *Grapholita* moth species and their impacts on hosts are considered sufficiently similar to justify combining them into a single assessment. In this assessment, the term '*Grapholita* moths' is used to refer to these two species unless otherwise specified.

The risk scenario of concern for *Grapholita* moths is the presence of eggs on fruit or larvae that have bored into fruit.

Grapholita molesta was assessed in the existing import policies for stonefruit from New Zealand (Biosecurity Australia 2006b) and the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), and for apples from New Zealand (Biosecurity Australia 2006a) and China (Biosecurity Australia 2010a). It is considered that these previous assessment for *G. molesta* can also equally apply to *G. funebrana*. The assessment of *G. funebrana* and *G. molesta* presented here builds on these previous assessments.

Differences in commodities within China and in horticultural practices, climatic conditions and the prevalence of *G. funebrana* and *G. molesta* between previous export areas (New Zealand, the USA) and China make it necessary to reassess the likelihood that *G. funebrana* and *G. molesta* will be imported into Australia or Western Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of apples from China and stonefruit from the USA. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for stonefruit from the USA and for apples from China. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *G. funebrana* in Australia and *G. molesta* in Western Australia will be comparable regardless of the fresh fruit commodity in which *G. funebrana* is imported into Australia and *G. molesta* is imported into Western Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *G. funebrana* in Australia and *G. molesta* in Western

Australia are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

The likelihood of establishment and spread of, and the consequences they may cause will be comparable for any commodity from which these species are imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are largely independent of the importation pathway. Accordingly, there is no need to reassess these components.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *Grapholita molesta* in the existing policies for stonefruit and apples from New Zealand (Biosecurity Australia 2006a; Biosecurity Australia 2006b) and stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). Therefore, those risk ratings will be adopted for this assessment.

4.11.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *G. funebrana* will arrive in Australia or *G. molesta* will arrive in Western Australia with the importation of fresh nectarines from China is: **Moderate**.

The following information provides supporting evidence for this assessment.

- *Grapholita funebrana* and *Grapholita molesta* are widely distributed in China including major peach and nectarine production regions and are important pests of stonefruit and pome fruit in China (Feng and Wang 2004; Ma 2006).
- *Grapholita funebrana* and *G. molesta* infest nectarines and peaches as well as plums and apricots (Oku *et al.*1988; CABI-EPPO 1997a; Alford 2007).
- *Grapholita* moths are significant pests of stonefruit (Murrell and Lo 1998). Larvae damage the host plants by feeding internally and tunnelling in the shoots and/or fruit (Meijerman and Ulenberg 2004; Alford 2007). Infestations on fruitlets cause them to drop prematurely (Alford 2007). Larvae bore into the fruit until they reach the seed. Severe infestations can lead to significant crop losses (Meijerman and Ulenberg 2004; Alford 2007).
- First generation *G. funebrana* usually lay eggs singly on fruitlets often close to the depression which passes from fruit stalk to fruit tip (Meijerman and Ulenberg 2004) or near the base of maturing fruit (Gilligan and Epstein 2012). *Grapholita molesta* eggs are also laid singly on the host plant. On the main stone-fruit hosts, the eggs are laid adjacent to young shoots, on the underside of leaves and sometimes on the smooth surface of newly developed twigs. Smooth surfaces are preferred to pubescent substrates, and eggs are rarely found on peach fruits (Meijerman and Ulenberg 2004).
- A *Grapholita* moth egg is about 0.8 millimetres in diameter (Meijerman and Ulenberg 2004). The eggs laid in the stem-end depression may escape detection during packing house procedures.

- *Grapholita funebrana* larvae feed within relatively large fruitlets. On entering the flesh, the young larva forms a narrow, winding tunnel under the surface, directed from the point of entry towards the fruit stalk (Meijerman and Ulenberg 2004). From near the stalk, the tunnel is then extended to the centre of the fruit and as the larva grows the flesh around the stone is eaten and replaced by masses of wet, brown frass. The mature larva escapes through the side of the fruit, leaving a small circular hole in the skin (Meijerman and Ulenberg 2004).
- First instar larvae of *G. molesta* may penetrate stonefruit through the side of the stem. Such fruit has no obvious sign of infestation and the larva may remain inside the fruit, feeding until it is ready to pupate (Howitt 1993). Such fruit is likely to escape detection during packing house procedures.
- Larval feeding on fruit nearing maturity leads to damaged pulp filled with frass and the subsequent development of secondary fungal infections causing extra damage to the fruit (Meijerman and Ulenberg 2004). In the case of *G. funebrana* attacked fruits ripen prematurely and are easily recognized amongst the developing crop. When infestations are initiated in nearly ripe fruits the larval tunnel runs directly from the point of entry to the stone. Resin oozes from the fruits damaged by this larval feeding (Meijerman and Ulenberg 2004). Fruit showing such obvious signs of infestation are likely to be rejected during routine quality inspections and packing house procedures.
- Any eggs laid directly on the surface of the fruit would likely be dislodged by washing and brushing processes in the packing house. However, *Grapholita funebrana* females often lay their eggs in the stem-end depression of fruit (Meijerman and Ulenberg 2004) and these eggs are unlikely to be dislodged during washing and brushing processes.
- *Grapholita* moth larvae are likely to survive storage and transportation. Mature larvae of *G. molesta* overwinter in northern China in the cracks of the branches and crown, or in the soil (Ma 2006). This indicates that this species would be able to survive cold temperatures during the transportation of nectarines from China to Australia.

Grapholita moths are widely distributed in China's major peach and nectarine production regions and are important pests of nectarine and peach. Eggs laid in the stem end depression of fruit are likely to remain during the packing house processes. Larvae of *Grapholita* moths may penetrate stonefruit and feed internally. Immature fruit infested early would drop or show obvious symptoms. However, fruit infested late may escape detection during packing houses procedures. This information supports a likelihood estimate for importation of 'moderate'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *G. molesta* assessed here would be the same as that for *G. molesta* for stonefruit from New Zealand (Biosecurity Australia 2006b) and the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), and for apples from New Zealand (Biosecurity Australia 2006a) and China (Biosecurity Australia 2010a). It is considered that *G. funebrana* would have the same likelihood of distribution that is **Moderate.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *G. funebrana* will enter Australia and *G. molesta* will enter Western Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Low.**

4.11.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and spread for *G. molesta* is based on the assessment of *G. molesta* for stonefruit from New Zealand (Biosecurity Australia 2006b) and the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), and for apples from New Zealand (Biosecurity Australia 2006a) and China (Biosecurity Australia 2010a). It is considered that *G. funebrana* would have the same likelihood of establishment and spread. The ratings from the previous assessments are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.11.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *G. funebrana* will enter Australia or *G. molesta* will enter Western Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia or Western Australia and subsequently spread within Australia or Western Australia has been assessed as: **Low**.

4.11.4 Consequences

It is considered that the overall consequences of *G. funebrana* would be similar as previously assessed for *G. molesta.* The consequences of the establishment of *G. molesta* in Australia have been estimated previously for stonefruit from New Zealand (Biosecurity Australia 2006b) and the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), and for apples from New Zealand (Biosecurity Australia 2006a) and China (Biosecurity Australia 2010a). The overall consequences are estimated to be **Moderate**.

4.11.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *G. funebrana* and *G. molesta*	
Overall likelihood of entry, establishment and spread	Low
Consequences	Moderate
Unrestricted risk	Low

As indicated, the unrestricted risk estimate for *G. funebrana* and *G. molesta* has been assessed as ‘low’, which is above Australia’s ALOP. Therefore specific risk management measures are required for these pests.

4.12 Peach twig borer

***Anarsia lineatella* (EP)**

Anarsia lineatella (peach twig borer) belongs to the Gelechiidae family and is a significant pest of stonefruit (Pickel *et al.*2006; Damos and Savopoulou-Soultani 2010).

Anarsia lineatella damages stonefruit by boring into buds, shoots, branches and fruit. First generation larvae primarily bore into buds and feed on young shoots, causing the leaves to wilt and eventually killing the terminals (Beljaev and Ponomarenko 2005; Alston and Murray 2007; Damos and Savopoulou-Soultani 2010). Later generation larvae mainly feed on fruit (CABI-EPPO 1997b). Larvae attack stonefruit primarily through the stem end of the fruit, or where it touches foliage, branches or another fruit (Reding and Alston 2003; Alston and Murray 2007), feeding beneath the skin and around the seed of the fruit (Pickel *et al.*2006; Alston and Murray 2007).

Anarsia lineatella has four life stages: egg, larva, pupa and adult and has 1–4 generations per year, depending on the climate (Beljaev and Ponomarenko 2005; Damos and Savopoulou-Soultani 2010).

The risk scenario of concern for *A. lineatella* is the presence of developing larvae within nectarines, and eggs or, in some cases, pupae in the stem-end depression of imported nectarines.

The assessment of *A. lineatella* presented here builds on the previous assessment for fresh stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b).

Differences in horticultural practices, climatic conditions and the prevalence of *A. lineatella* between export areas in the USA and China make it necessary to reassess the likelihood that *A. lineatella* will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of stonefruit from the USA. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for stonefruit from the USA. Therefore, it is unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *A. lineatella* in Australia will be comparable regardless of the fresh fruit commodity in which *A. lineatella* is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *A. lineatella* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *A. lineatella* in the existing policy for fresh stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). Therefore, those risk ratings will be adopted for this assessment.

4.12.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *Anarsia lineatella* will arrive in Australia with the importation of fresh nectarines from China is: **Moderate**.

The following information provides supporting evidence for this assessment.

- *Anarsia lineatella* is recorded in Guangdong (Kondo and Miyahara 1930), Shaanxi, Jilin (Park *et al.*2000) and Xinjiang (Yang *et al.*2005) in China. Shaanxi is a major peach and nectarine production region of China.
- *Anarsia lineatella* attacks both the shoots and fruit of stonefruit (Gencsoylu *et al.*2006; Bentley *et al.*2012). *Anarsia lineatella* females lay eggs at the base of buds, on the underside of leaves, on the shoots, on the bark of trunks and branches and on growing fruit.
- Depending on fruit maturity and population density, the second and subsequent generation *A. lineatella* adults may attack either branches or fruit (Bentley and Day 2012).
- Newly emerged larvae that hatch from eggs laid on fruit bore into the fruit and usually enter the fruit through the stem-end feeding just below the skin (Bentley and Day 2012).
- Larvae feeding just below the surface of the fruit cause clearly visible feeding damage (Weakley *et al.*1990). Infested fruit is also susceptible to infections by micro-organisms that causes fruit rotting (Reding and Alston 2003). Such fruit would be removed during the harvest and packing house procedures.
- Females also oviposit on stonefruit from the time of colour break to mature hard-ripe fruit (Sidney *et al.*2008). Fruit infested near harvest time is unlikely to show any signs of infestation and is unlikely to be detected by packing house procedures.
- First generation larvae pupate in bark cracks on the trunk or branches. Later generation larvae may pupate in the stem-end depression of stonefruit (Beljaev and Ponomarenko 2005).
- Eggs, larvae or pupae on the external surface of the fruit are likely to be removed by the washing and brushing processes. However, eggs, or larvae, that may have pupated in the stem-end depression of stonefruit (Beljaev and Ponomarenko 2005) may not be dislodged during washing and brushing processes.
- *Anarsia lineatella* eggs are very small in size and if laid in the stem-end depression of nectarine fruit are unlikely to be detected during harvest or even during packing house procedures.
- *Anarsia lineatella* overwinters in the first and second larval stages in northern China where winter conditions are quite severe, resuming their development when the temperature rises (Beljaev and Ponomarenko 2005). This indicates that these stages are likely to be the most cold tolerant (Bentley and Day 2012) and would be most likely to survive the cold temperatures experienced during the transportation of nectarines from China to Australia.

Anarsia lineatella is present in one of China's major peach and nectarine production regions. Early generations of *A. lineatella* mainly feed on vegetative tissues. Immature fruit damaged by later generation larvae often show obvious symptoms. However, fruit infested close to harvest time is unlikely to show any signs of infestation and is unlikely to be detected by packing house procedures. This information supports a likelihood estimate for importation of ‘moderate’.

Likelihood of distribution

As indicated above, the likelihood of distribution for *A. lineatella* assessed here would be the same as that for *A. lineatella* for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), that is **Low.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *A. lineatella* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Low.**

4.12.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and of spread for *A. lineatella* is based on the assessment of *A. lineatella* for fresh stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessment are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.12.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *A. lineatella* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **Low**.

4.12.4 Consequences

The consequences of the establishment of *A. lineatella* in Australia have been estimated previously for fresh stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). The overall consequences for *A. lineatella* are estimated to be **Moderate**.

4.12.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Anarsia lineatella*	
Overall likelihood of entry, establishment and spread	Low
Consequences	Moderate
Unrestricted risk	Low

As indicated, the unrestricted risk estimate for *Anarsia lineatella* has been assessed as ‘low’, which is above Australia’s ALOP. Therefore, specific risk management measures are required for this pest.

4.13 Peach fruit borer

***Carposina sasakii* (EP)**

Carposina sasakii (peach fruit borer) belongs to the Carposinidae family and is known as an important pest of peach and pome fruits (CABI 2014). *Carposina sasakii* larvae damage the host plants by feeding and tunnelling in the fruit (Shutova 1978).

Carposina sasakii has four life stages: egg, larva, pupa and adult (Ma 2006). Seasonal prevalence of *C. sasakii* is variable in China (Ma 2006). In the mountainous regions of Qingling of Shaanxi province, *C. sasakii* has only one generation per year (Baozhen *et al.*1998). However, in subtropical areas of China it may have three to four overlapping generations. Overwintering larvae can survive the severe cold climates of north China and Far East Russia where temperatures can drop to a minimum of –45 °C (Shutova 1978).

The risk scenario of concern for *C. sasakii* is the presence of larvae inside imported nectarines.

Carposina sasakii was assessed in the existing import policy for apples from China (Biosecurity Australia 2010a). The assessment presented here builds on this previous assessment.

Differences in commodities, horticultural practices, climatic conditions and the prevalence of *C. sasakii* between other export areas and new export areas in China make it necessary to reassess the likelihood that *C. sasakii* will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of Chinese apples. After importation, nectarines will be distributed throughout Australia for retail in a similar way for Chinese apples. Therefore, it is unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *C. sasakii* in Australia will be comparable regardless of the fresh fruit commodity in which *C. sasakii* is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *C. sasakii* are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *C. sasakii* in the existing policy for apples from China (Biosecurity Australia 2010a). Therefore, those risk ratings will be adopted for this assessment.

4.13.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *C. sasakii* will arrive in Australia with the importation of fresh nectarines from China is: **High**.

The following information provides supporting evidence for this assessment.

- *Carposina sasakii* is widely distributed in China including major peach and nectarine production regions Anhui, Hebei, Henan, Jiangsu, Liaoning, Shaanxi, Shandong, Shanxi, and Zheijiang (CABI 2014).
- *Carposina sasakii* is recorded as a major pest in China, where it damages a wide range of rosaceous fruit crops including nectarine and peach (Xu and Hua 2004; Feng *et al.*2004; CABI 2014).
- Females lay 1–10 eggs in the ribs of peach and apricot fruit (Shutova 1978). Several eggs may be laid on each fruit and it is notable that several larvae can survive in a single fruit, feeding on the flesh and seeds (CABI 2014). Larvae have a higher survivorship rate in early peach cultivars than late peach cultivars (Kim and Lee 2002).
- The larvae of *C. sasakii* feed deep in the fruit pulp without leaving any trace of infestation on the fruit skin until they make exit holes to leave the fruit for pupation (Ishiguri and Toyoshima 2006; Toyoshima *et al.*2010).
- *Carposina sasakii* may have up to four generations per year in warmer regions and larvae at different stages of development can be found in the fruit since these generations overlap (Shutova 1978). The fruit harvested late in the season may contain many larvae of *C. sasakii*. Such infested fruit, when larvae have not completed development and exited the fruit to pupate, do not show any obvious signs of infestation and is likely to escape detection during the packing house procedures.
- Overwintering larvae may pupate at any time between mid-May and late July in China (Xu and Hua 2004), depending on soil temperature and soil humidity. The full grown larvae overwinter in a thick cocoon in the soil (Shutova 1978; Toyoshima *et al.*2010). Overwintering larvae may sometimes diapause in the soil for two years (CABI 2014).
- *Carposina sasakii* larvae are likely to survive storage and transportation. Mature larvae of *C. sasakii* overwinter in cocoons and can survive temperatures as low as –45 °C (Shutova 1978). This indicates that *C. sasakii* larvae would be able to survive the cold temperatures during the transportation of nectarines from China to Australia.
- Larvae can survive for long periods in cold stored fruits. *Carposina sasakii* was intercepted almost every year on commercial fresh fruit from Japan and Korea to the USA (CABI 2014).

Carposina sasakii is widely distributed in China including almost all major peach and nectarine production regions. Fruit infested with immature larvae is very likely to escape detection as the infested fruit may not show any external sign of infestation and these larvae are likely to survive cold temperatures during cold storage and transportation and has been repeatly detected in commercial consignments of fresh fruit. This information supports a likelihood estimate for importation of ‘high’.

Likelihood of distribution

As indicated above, the likelihood of distribution for *C. sasakii* assessed here would be the same as that for *C. sasakii* for apples from China (Biosecurity Australia 2010a), that is **High.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *C. sasakii* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **High.**

4.13.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and of spread for *C. sasakii* is based on the assessment for apples from China (Biosecurity Australia 2010a). This assessment used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessment are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.13.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *C. sasakii* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **High**.

4.13.4 Consequences

The consequences of the establishment of *C. sasakii* in Australia have been estimated previously for apples from China (Biosecurity Australia 2010a). The overall consequences for *C. sasakii* have been estimated to be **Moderate**.

4.13.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Carposina sasakii*	
Overall likelihood of entry, establishment and spread	High
Consequences	Moderate
Unrestricted risk	Moderate

As indicated, the unrestricted risk estimate for *C. sasakii* has been assessed as ‘moderate’, which is above Australia’s ALOP. Therefore, specific risk management measures are required for this pest.

4.14 Thrips

***Frankliniella intonsa* (EP) and *Frankliniella occidentalis* (EP, NT)**

Frankliniella intonsa is absent from Australia and is a pest of quarantine concern for all of Australia. *Frankliniella occidentalis* is not known to be present in the Northern Territory and is a pest of regional concern and can be a potential vector for Impatiens necrotic spot virus (INSV) for all of Australia.

Frankliniella intonsa and *F. occidentalis* belong to the Thripidae family. Members of Thripidae have four main life stages: egg (that is inserted into the green tissue of plants), two active larval instars that feed, followed by two relatively inactive pupal instars that normally do not feed, and finally adults of one or both sexes which may be winged or wingless. (Jensen *et al.*1992; Roques 2006).

The biology and taxonomy of these two species and their impacts on host plants are considered sufficiently similar to justify combining them into a single assessment. In this assessment, the term 'thrips' is used to refer to these two species of Thripidae unless otherwise specified.

Frankliniella intonsa and *F. occidentalis* are also known as vectors of several tospoviruses (Morse and Hoddle 2006), some of which are of quarantine concern to Australia. Of the viruses that *F. intonsa* and *F. occidentalis* are able to vector, Tomato spotted wilt virus (TSWV) and Impatiens necrotic spot virus (INSV) are present in China (CABI 2013). Of these, INSV is not present in Australia and is a quarantine pest. Tospoviruses such as INSV are acquired by the first instar or early second-instar larvae when feeding on an infected plant, and are then transmitted only later when these larvae develop into adults; it is not possible for an adult to acquire and then transmit a tospovirus (Moritz *et al.*2004). Tospoviruses are persistently transmitted by thrips such as *F. occidentalis,* meaning that once the immature stage has acquired the virus it remains infective for life (Jones 2005; Persley *et al.*2006). Tospoviruses are transmitted to host plants via virus-laden saliva, injected during probing or feeding (Whitfield *et al.*2005). However, tospoviruses are not known to be transmitted between thrips, or passed on to the next generation through their eggs (Wijkamp *et al.*1996). Although *Prunus* has not been recorded as a host of tospoviruses, *F. occidentalis* can first acquire this virus from another host plant and may subsequently move onto nectarines prior to export, providing a pathway for the tosporivuses to enter Australia with the thrips.

The risk scenario of concern for *F. intonsa* and *F. occidentalis* is the presence of eggs, larvae and/or adult stages on nectarines from China.

Frankliniella intonsa and *F. occidentalis* have previously been assessed with the importation of stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b).

Differences in commodities, horticultural practices, climatic conditions and the prevalence of pests between previous export areas in China and the USA make it necessary to reassess the likelihood that *F. intonsa* will be imported into Australia and *F. occidentalis* will be imported into the Northern Territory with nectarines from export production areas in China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of stonefruit from the USA. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for stonefruit from the USA. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of *F. intonsa* in Australia and *F. occidentalis* in the Northern Territory will be comparable regardless of the fresh fruit commodity in which *F. intonsa* is imported into Australia and *F. occidentalis* is imported into the Northern Territory, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of *F. intonsa* in Australia and *F. occidentalis* in the Northern Territory are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

The likelihood of establishment and spread of *F. intonsa* in Australia and *F. occidentalis* in the Northern Territory, and the consequences it may cause will be comparable for any fruit commodity from which this species is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are largely independent of the importation pathway. Accordingly, there is no need to reassess these components.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *F. intonsa* and *F. occidentalis* in the existing policy for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). Therefore, those risk ratings will be adopted for this assessment.

4.14.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *Frankliniella intonsa* will arrive in Australia and *Frankliniella occidentalis* in the Northern Territory with the importation of fresh nectarines from China is: **High**.

The following information provides supporting evidence for this assessment.

- *Frankliniella intonsa* and *F. occidentalis* are widely distributed in China including some of the major peach and nectarine production regions (Li *et al.*1997; Ding and Gai 2000; Mirab-balou *et al.*2011; CABI 2014).
- *Frankliniella intonsa* feeds and lays eggs in fruit and is reported as a pest of peach (CABI 2012). *Frankliniella occidentalis* is one of the most important thrips pests in the world with nectarine and peach being major hosts (CABI 2013).
- Thrips can insert their eggs into the green tissue of plants, such as buds, furled leaves or around fruit stems (Dreistadt and Phillips 2007a), and including fruit (Palmer *et al.*1989; Morse and Hoddle 2006). *Frankliniella occidentalis* female can produce 20–40 eggs (Roques 2006). The eggs are very small (about 200 µm long) and may be laid on, or inserted under the skin of fruit or leaves (Mau and Martin Kessing 1993) which can make detection difficult. Feeding and egg-laying by thrips on plant material generally results in visible morphological changes in affected tissues and affected fruit is typically scarred on the surface (Lewis 1973). However, the damage thrips cause may be difficult to detect at low population levels.

- Adult and immature stages of *Frankliniella intonsa* and *F. occidentalis* are very small (usually less than 2 millimetres) (Roques 2006; CABI 2014) and tend to be inconspicuous, hiding in cryptic habitats such as the crevices found at the stem end of fruit, suggesting that they may not be removed from fruit during harvesting and packinghouse procedures.
- Thrips are opportunistic species well adapted to survive harsh climatic conditions and are known to survive temperatures below freezing over extended periods (McDonald *et al.*1997a). *Frankliniella occidentalis* overwinters in an active state, feeding and developing as temperatures and food availability allow (McDonald *et al.*1997a). It appears to have some ability to survive periods of cold and food deprivation under winter field conditions in England (McDonald *et al.*1997b). Therefore, thrips are likely to be capable of tolerating cold conditions and potentially survive cold storage and transportation.
- The lifecycle of *F. occidentalis* varies in length due to temperature (CABI-EPPO 1997d) with the optimum range from 26 °C to 29 °C. At lower temperatures, such as those that may be used in the transportation and storage of summerfruit being sent from China to Australia, thrips would have longer life cycles. Viable thrips could therefore still be present on shipments when they arrive in Australia.
- Thrips have been detected on stonefruit (apricots, nectarines, peaches) entering Australia from New Zealand, demonstrating that thrips are capable of surviving packing house procedures, cold storage and transport conditions.

Frankliniella intonsa and *F. occidentalis* are widely distributed in China's major peach and nectarine production regions and are likely to be associated with nectarine fruit. Thrips are very small and likely escape detection during packing house processes. Thrips are likely to survive cold storage and transportation. This information supports a likelihood estimate for importation of 'high'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *F. intonsa* in Australia and *F. occidentalis* in the Northern Territory assessed here would be the same as that for *F. intonsa* and *F. occidentalis* for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), that is **Moderate.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *F. intonsa* will enter Australia and *F. occidentalis* will enter Northern Territory as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Moderate.**

4.14.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and spread for *F. intonsa* in Australia and *F. occidentalis* in the Northern Territory is based on the assessment for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). This assessment used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessment are presented below:

Likelihood of establishment: **High**

Likelihood of spread: **High**

4.14.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihood of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The likelihood that *F. intonsa* will enter Australia or *F. occidentalis* will enter the Northern Territory, as a result of trade in fresh nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia has been assessed as: **Moderate**.

4.14.4 Consequences

The consequences of the establishment of *F. intonsa* in Australia or *F. occidentalis* in the Northern Territory have been estimated previously for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). The consequence ratings for *F. intonsa* and *F. occidentalis* were consistently rated as 'low' for both species. The overall consequences have been estimated to be **Low**.

4.14.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the likelihood of entry, establishment and spread with the estimate of consequences. Likelihoods and consequences are combined using the risk estimation matrix shown in Table 2.5.

Unrestricted risk estimate for *Frankliniella intonsa* and *Frankliniella occidentalis*	
Overall likelihood of entry, establishment and spread	Moderate
Consequences	Low
Unrestricted risk	Low

As indicated, the unrestricted risk estimate for *F. intonsa* and *F. occidentalis* has been assessed as 'low', which is above Australia's ALOP. Therefore, specific risk management measures are required for these pests.

In addition, *F. occidentalis* may be identified as a potential vector for Impatiens necrotic spot virus (INSV) for all of Australia. If detected during quarantine inspections, this potential vector would be managed under contaminating pest policy. If live *F. occidentalis* is detected during quarantine inspections, remedial actions must be taken for the relevant consignments.

4.15 Brown rot

Monilinia fructigena* (EP), *Monilinia yunnanensis*, *Monilia mumecola* and *Monilia polystroma

Brown rot is a fungal disease of stone and pome fruit caused by a number of closely related species of the genus *Monilinia.* The anamorph of the fungus is the genus *Monilia*. The genus belongs to family Sclerotiniaceae and it can cause severe losses and damage to stonefruit crops (Zhu *et al.*2011). The biology and taxonomy of the four species *Monilinia fructigena, M. yunnanensis, Monilia polystroma* and *M. mumecola* are considered sufficiently similar to justify combining them into a single assessment. The assessment of the four pathogens has been largely based on the scientific information on *M. fructigena* as it is predicted to pose a similar risk and require similar mitigation measures. Unless explicitly stated, the information presented is considered as applicable to all species. In this assessment, the common name brown rot is used to refer to all four species unless otherwise specified.

The risk scenario of concern for *Monilinia fructigena M. yunnanensis, Monilia polystroma* and *M mumecola* is that symptomless infected fruit might enter Australia and result in the establishment of these fungi in Australia.

Monilinia fructigena was assessed in the existing import policy for apples (Biosecurity Australia 2010a) and table grapes from China (Biosecurity Australia 2011). The assessment of *Monilinia fructigena, M. yunnanensis, Monilia polystroma* and *M mumecola* presented here builds on these existing policies.

Differences in commodity and horticultural practices for apples and table grapes and for nectarines from China make it necessary to reassess the likelihood that brown rot will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of apples and table grapes from China. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for apples and table grapes from China. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of brown rots in Australia will be comparable regardless of the fresh fruit commodity in which brown rots is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of brown rots are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *Monilinia fructigena* in the existing policy for apples (Biosecurity Australia 2010a) and table grapes (Biosecurity Australia 2011) from China. Therefore, those risk ratings will be adopted for this assessment.

4.15.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *Monilinia fructigena M. yunnanensis, Monilia polystroma* and *M mumecola* will arrive in Australia on nectarines from China is: **High**.

The following information provides supporting evidence for this assessment.

- Peaches and nectarines are major hosts of *Monilinia fructigena* (Byrde and Willets 1977; Farr and Rossman 2014).
- *Monilinia fructigena, M. yunnanensis* and *Monilia mumecola* have been reported on stonefruit including apricot, peach and nectarine from all major growing areas in China including Beijing, Hebei, Shandong, Henan, Liaoning, Shaanxi, Shanxi, Jiangsu, Anhui, Zhejiang, Sichuan, Fujian and Yunnan provinces (Zhu *et al.*2011; Hu *et al.*2011).
- *Monilia polystroma* was reported on plums in China and is an important pest (Zhu and Guo 2010). It has been recently reported causing fruit brown rot on peaches in Italy (Martini *et al.*2014).
- Brown rot fungi overwinter mainly in or on infected mummified fruit, either attached to the tree or on the ground (Byrde and Willets 1977). Mycelia can survive long periods of adverse environmental conditions within mummified fruits, twigs, cankers and other infected tissues. In spring or early summer when temperature, day length, moisture conditions and relative humidity are suitable for sporulation, sporodochia are formed on the surface of mummified fruit and other infected tissues and bear chains of conidia (Byrde and Willets 1977; Jones 1990).
- The conidia of *M. fructigena* are dry airborne spores, transported by wind, water or insects to young fruit (Jones 1990; Batra 1991).
- Initial infection by brown rot can be via wounds on fruit or on sound fruit and subsequent spread by contact between adjacent fruit is possible (Byrde and Willets 1977). Infected tissue can produce several crops of conidia throughout the year which can initiate secondary infection (Batra 1991).
- Brown rot fungi have the ability to cause latent infection in fruit (Gell *et al.*2009). The infected fruit do not produce symptoms of disease until the fruit begins to ripen during storage and transport, on the market shelf, or as the fruit senesces (Byrde and Willets 1977).
- At harvest, apparently healthy fruit can be contaminated with conidia (Ma 2006). Wounded fruit may also be contaminated with conidia during packing house processes via fruit to fruit contact (Xu and Robinson 2000). Fruit rots develop during the postharvest period.
- The mycelia of brown rot fungi survive long periods of adverse environmental conditions, particularly over winter. The fungi also survive within mummified fruit, infected twigs, cankers and other infected tissues (Byrde and Willets 1977). This suggests that in infected fruit fungi may survive cold storage and transportation processes.

Brown rot fungi are widely distributed in the major stonefruit growing regions in China and are important pests of stonefruit fruit. Brown rot fungi have the ability to cause latent infection in fruit, and symptomless infected fruit is likely to pass through packing house processes undetected. Brown rot mycelia in latently infected fruit are likely to survive cold storage and transportation. This information supports a likelihood estimate for importation of ‘high’.

Likelihood of distribution

As indicated above, the likelihood of distribution for *M. fructigena M. yunnanensis, Monilia polystroma* and *M. mumecola* assessed here would be similar assessed for *M. fructigena* for apples (Biosecurity Australia 2010a) and table grapes (Biosecurity Australia 2011) from China, that is **High.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that *M. fructigena M. yunnanensis, Monilia polystroma* and *M. mumecola* will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **High.**

4.15.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and spread for brown rot is based on the assessment for apples (Biosecurity Australia 2010a) and table grapes (Biosecurity Australia 2011) from China. Those assessments used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessments are presented below:

Likelihood of establishment:	**High**
Likelihood of spread:	**High**

4.15.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihoods of entry, of establishment and of spread using the matrix of rules for combining qualitative likelihoods shown in Table 2.2.

The likelihood that *Monilinia fructigena M. yunnanensis, Monilia polystroma* and *M mumecola* will enter Australia as a result of trade in nectarines from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **High**.

4.15.4 Consequences

The consequences of the establishment of *Monilinia fructigena* in Australia have been estimated previously for apples from China (Biosecurity Australia 2010a). *Monilinia yunnanensis, Monilia polystroma* and *M mumecola* are considered to have similar impact. The overall consequences have been estimated to be: **Moderate**.

4.15.5 Unrestricted risk estimate

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

Unrestricted risk estimate for *Monilinia fructigena*, *M. yunnanensis*, *Monilia polystroma* and *M. mumecola*	
Overall likelihood of entry, establishment and spread	High
Consequences	Moderate
Unrestricted risk	Moderate

As indicated, the unrestricted risk estimate for *Monilinia fructigena, M. yunnanensis, Monilia polystroma* and *M. mumecola* has been assessed as ‘moderate‘, which is above Australia‘s ALOP. Therefore, specific risk management measures are required for these pests.

4.16 Apple scar skin or apple dapple

Apple scar skin viroid (EP)

Apple scar skin or apple dapple disease is caused by *Apple scar skin viroid* (ASSVd). ASSVd is the type species of the genus *Apscaviroid* of the family *Pospiviroidae* (Koganezawa *et al.*2003).

The risk scenario of concern for *Apple scar skin viroid* is that symptomless infected fruit might enter Australia and result in the establishment of this viriod in Australia.

ASSVd was assessed in the existing import policy for apples from China (Biosecurity Australia 2010a). The assessment of ASSVd presented here builds on this existing policy.

Differences in commodity and horticultural practices for apples and for nectarines from China make it necessary to reassess the likelihood that ASSVd will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of apples from China. After importation, nectarines will be distributed throughout Australia for retail sale in the similar way for apples from China. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of ASSVd in Australia will be comparable regardless of the fresh fruit commodity in which ASSVd is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of ASSVd are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *Apple scar skin viroid* in the existing policy for apples from China (Biosecurity Australia 2010a). Therefore, those risk ratings will be adopted for this assessment.

4.16.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively

Likelihood of importation

The likelihood that *Apple scar skin viroid* will arrive in Australia with the importation of nectarine from China is: **Low.**

The following information provides supporting evidence for this assessment.

- ASSVd is primarily a pathogen of apple and pear (Han *et al.*2003). It was one of the most damaging apple and pear diseases in China in the 1950s and 1960s (Koganezawa *et al.*2003). However, the current status of ASSVd in China is not precisely known as ASSVd rarely occurs in modern apple orchards in China, probably due to the use of tolerant cultivars.

- There are only limited reports of ASSVd on stonefruit trees from Xinjiang, China including apricot and peach, on which ASSVd was detected on leaves (Zhao and Niu 2008a; Zhao and Niu 2008b; Wang *et al.*2012).
- The viroid is detected in most of the plant parts of apple including fruit skin, seed, flesh and pulp (Hadidi *et al.*1991). Although no reports of ASSVd on nectarine fruit were found, it is possible that ASSVd may be present in fruits from infected nectarine trees because it can move systemically in infected host plants.
- Seed transmission of ASSVd has been reported on apples with 7.7 per cent of seedlings raised from infected apple seeds showed ASSVd infection (Kim *et al.*2006). No ASSVd seed transmission on stonefruit has been reported.
- Nectarine may be washed and brushed prior to grading operations and packing for export. However, this would not remove the viroids from the fruits as ASSVd may be systemically distributed within the fruits.
- ASSVd can be symptomless and also may have a long incubation period. Many hosts may be infected for several years before symptoms become apparent (Koganezawa 1986; Desvignes *et al.*1999).
- Infected symptomless nectarine fruits would not be removed in the grading process and could be exported to Australia.

ASSVd was previously widely distributed in China but the current status of ASSVd in China is not precisely known. It is likely that symptomless infected fruit can pass through packing house processes undetected. However, there were very limited reports of ASSVd on stonefruit trees in China and no report of ASSVd on nectarine fruit was found. This information supports a risk rating for importation of “Low”.

Likelihood of distribution

As indicated above, the likelihood of distribution for ASSVd assessed here would be the same as that for ASSVd for for apples (Biosecurity Australia 2010a) from China, that is **High.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that ASSVd will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Low.**

4.16.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and spread for *Apple scar skin viroid* is based on the assessment for apples from China (Biosecurity Australia 2010a). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessment are presented below:

Likelihood of establishment	**Moderate**
Likelihood of spread	**Low**

4.16.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihoods of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The overall likelihood that *Apple scar skin viroid* will enter Australia as a result of trade in nectarine fruit from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **Very low**.

4.16.4 Consequences

The consequences of the establishment of *Apple scar skin viroid* in Australia have been estimated previously for apples from China (Biosecurity Australia 2010a). The overall consequences have been estimated to be: **Moderate**.

4.16.5 Unrestricted risk estimate

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

Unrestricted risk estimate for *Apple scar skin viroid*	
Overall likelihood of entry, establishment and spread	Very low
Consequences	Moderate
Unrestricted risk	Very low

As indicated, the unrestricted risk estimate for *Apple scar skin viroid* has been assessed as 'very low', which achieves Australia's ALOP. Therefore, no specific risk management measure is required for this pest.

4.17 Tobacco necrosis viruses

***Tobacco necrosis virus A* (TNV-A) and *Tobacco necrosis virus D* (TNV-D), tobacco necrosis virus Nebraska isolate or relate viruses.**

The taxonomy of 'tobacco necrosis virus' (TNV) has been revised. *Tobacco necrosis virus A* (TNV-A) and *Tobacco necrosis virus D* (TNV-D) have been recognised as distinct species in the Necrovirus genus (Meulewaeter *et al.*1990; Coutts *et al.*1991), as have *Chenopodium necrosis virus* (ChNV) and *Olive mild mosaic virus* (OMMV), which were previously considered TNV isolates (Tomlinson *et al.*1983; Cardoso *et al.*2005). TNV isolates from Nebraska and Toyama (TNV-NE and TNV-Toyama) represent another species in the genus, as yet not officially recognised (Zhang *et al.*1993; Saeki *et al.*2001) and molecular sequence data indicates some other necroviruses called 'tobacco necrosis viruses are also distinct species (NCBI 2009).

The risk scenario of concern for tobacco necrosis viruses (TNVs) is that symptomless infected fruit might enter Australia and result in the establishment of these viruses in Australia.

TNVs were assessed in the existing import policy for apples from China (Biosecurity Australia 2010a), stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b) and table grapes from China (Biosecurity Australia 2011).The assessment of TNVs presented here builds on these existing policies.

Differences in commodity and horticultural practices for apples and table grapes and for nectarines from China, and climate conditions and the prevalence of pests between previous export areas (for example the USA) make it necessary to reassess the likelihood that TVNs will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of stonefruit from the USA and apples and table grapes from China. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for stonefruit from the USA and apples and table grapes from China. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of TNVs in Australia will be comparable regardless of the fresh fruit commodity in which TNVs is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of TNVs are also independent of the importation pathway. However, the Australian Government Department of Agriculture has reassessed the consequences of a TNV species outbreak in Australia in light of the taxonomic changes and additional information.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment and spread as set out for *Tobacco necrosis viruses* in the existing policy for apples (Biosecurity Australia 2010a) and table grapes (Biosecurity Australia 2011) from China and stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). Therefore, those risk ratings will be adopted for this assessment.

4.17.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that Tobacco necrosis viruses will arrive in Australia with the importation of nectarines from China is: **Moderate.**

The following information provides supporting evidence for this assessment.

- TNVs have been reported in Xinjiang on soybean, mulberry, potato and melon since the 1980s (Huang *et al.*1984; Xi *et al.*2008).
- TNVs have a broad host range and have been reported on 298 species in 167 genera of 54 families (Staniulis 2003).
- TNVs have been isolated from trees of apple, pear, apricot (Uyemoto and Gilmer 1972), peach (Mitrofanova and Teslenko 1982) and plums (Paulechova and Baumgartenerova 1980) in Europe.
- Stonefruit trees are not often reported to be infected by TVNs and the infected trees were symptomless associated with the virus (NCPN-FT 2014).
- TNVs have been isolated from apple leaves and fruit of experimentally inoculated apple trees (Uyemoto and Gilmer 1972).
- If TVNs infect nectarines, the virus particles may be present within the fruit.
- Fruits with obvious symptoms will be discarded during grading process. However, if infected symptomless nectarine fruits were on the pathway, they would not be removed in the grading process and could be exported to Australia.

TVNs have a wide range of hosts and some TVNs infect stonefruit trees. Symptomless infected fruit would not be detected during picking and would pass packing house processes. However, no report of TVNs associated with commercial nectarine fruit was found. This information supports a risk rating for importation of 'Moderate'.

Likelihood of distribution

As indicated above, the likelihood of distribution for TVNs assessed here would be the same as that for TVNs for apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011) and stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), that is **Moderate.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that TVNs will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Low.**

4.17.2 Likelihood of establishment and spread

As indicated above, the likelihood of establishment and spread for tobacco necrosis viruses is based on the assessment for apples and table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011) and stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessment are presented below:

Likelihood of establishment **High**

Likelihood of spread **High**

4.17.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihoods of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The overall likelihood that Tobacco necrosis viruses will enter Australia as a result of trade in nectarines fruit from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **Low**.

4.17.4 Consequences

The consequences of the establishment of Tobacco necrosis viruses in Australia have been estimated to be 'Very low' previously for apples, table grapes from China (Biosecurity Australia 2010a; Biosecurity Australia 2011) and stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b).

The consequences of the establishment of Tobacco necrosis viruses in Australia have been reviewed in light of the taxonomic changes and additional information. The overall consequences have been estimated to be: **Low**.

The following information provides supporting evidence for this assessment.

Criterion	Estimate
DIRECT	
Plant life or health	**D** – significant at the district level Among the hosts in which TNVs cause disease, carrot, potato and strawberry are the most economically important in Australia. In 2009/10, the estimated value of the carrot, potato and strawberry crops is \$176m, \$614m and \$308m respectively (HAL 2012). TNVs cause sporadic diseases in vegetable and ornamental crops in some years (Kassanis 1970; Uyemoto 1981; Nemeth 1986; Smith *et al.* 1988; Zitikaite and Staniulis 2009). No reports of adverse effects on fruit trees have been found (Nemeth 1986). A disease in trembling aspen (*Populus tremuloides*) may be caused by TNVs (Hibben *et al.* 1979). TNVs cause rusty root disease of carrot, Augusta disease of tulip, stipple streak disease of common bean, and necrosis diseases of cabbage, cucumber, soybean and zucchini and ABC disease of potato (Uyemoto 1981; Smith *et al.* 1988; Xi *et al.* 2008; Zitikaite and Staniulis 2009). Losses between 20 per cent and 50 per cent have been reported in glasshouse grown

	cucumbers and in tulips (CABI 2014). Lower losses probably occur more frequently than such high losses. No estimates of losses in carrot, potato and strawberry have been found but it is possible that substantial losses occur sometimes. Symptomless viral infections of plants, in general, may cause no yield loss, but they may cause yield losses as high as 15 per cent (Gibbs and Harrison 1976; Bos 1999). Naturally infected vegetable crops show a range of symptoms, including spots, flecks, streaks, necrosis and stunting. In strawberry in the Czech Republic, TNV has caused dwarfing and leaf and root necrosis (Martin and Tzanetakis 2006). Stipple streak disease has been reported in Qld causing small yield losses (Teakle 1988), but no reports of TNVs causing other diseases in Australia have been found, suggesting that the combinations of virus strain, vector biotype and host plant cultivar that result in disease have not occurred in Australia. Strains have been distinguished by various characteristics, including the symptoms they cause, their host ranges and genetic sequences (Kassanis 1970). The diseases recorded in common bean and cucumber are probably caused by distinct TNV strains (Brunt and Teakle 1996; Zitikaite and Staniulis 2009). The TNV strains detected in apple caused lesions in tests with cowpea (*Vigna sinensis*) and *Chenopodium quinoa* (Uyemoto and Gilmer 1972), but no report of further investigation of their disease causing potential was found. A satellite virus replicates with some strains of TNV (Kassanis 1970; Uyemoto 1981) but no report has been found indicating greater disease when the satellite virus is present. Because the wide host range of TNVs and their chytrid vectors it is possible that some native plants will be susceptible, although no supporting evidence was found.
Other aspects of the environment	**A** – Indiscernible at the local level There are no known direct consequences of these species on other aspects of the environment.
INDIRECT	
Eradication, control etc.	**D** – significant at the district level Virus control measures in fields are limited and eradication may not be possible unless an outbreak is detected at an early stage. If detected at an early stage, an outbreak might be controlled or eradicated by removing host plants and deep burying or incinerating potentially infected plant material, then leaving the fields fallow and controlling weed hosts. Further action might be required including cropping with non-host species and altering and lengthening crop rotations. Resistant cultivars may be planted, if they are available (CABI 2014). Establishment and spread in a glasshouse may be controlled by reducing or eliminating Olpidium infestation of soil by chemical treatment or by heating by composting or soil pasteurisation (Asjes and Blom-Barnhoorn 2002; CABI 2014). This may add significantly to costs. TNVs tolerate temperatures as high as 95 C (Brunt and Teakle 1996), so the temperatures achieved by composting and pasteurisation may not eliminate the viruses. Propagation of virus free plants and careful sanitation may reduce the chance of outbreaks (Smith *et al.* 1988; CABI 2014).
Domestic trade	**C** – minor significance at the district level Australian states are unlikely to set up restrictions on interstate trade if a foreign TNV becomes established unless it causes significant disease, which is unlikely.
International trade	**C** – minor significance at the district level If a damaging foreign TNV became established in Australia, additional restrictions might be introduced on the international trade of some vegetables or ornamentals that might lead to the loss of markets and some industry adjustment.
Environment	**A** – Indiscernible at the local level

There are no known indirect consequences of these species on the environment.

4.17.5 Unrestricted risk estimate

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

Unrestricted risk estimate for *Tobacco necrosis viruses*	
Overall likelihood of entry, establishment and spread	Low
Consequences	Low
Unrestricted risk	Very low

As indicated, the unrestricted risk estimate for *Tobacco necrosis viruses* has been assessed as 'very low', which is achieves Australia's ALOP. Therefore, no specific risk management measure is required for this pest

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4.18 Plum pox virus

***Plum pox virus* (PPV)**

Plum pox virus (PPV) causes plum pox disease which is also commonly known as Sharka disease. PPV is the member of the genus *Potyvirus* in the Potyviridae family. There is wide genetic variability within PPV. Based on biology, serology, molecular properties and plant host ranges, eight major strains or subgroups of PPV are recognised (Wijkamp and van der Gaag 2011; Sochor *et al.*2012). The Dideron strain (PPV-D) is the most common strain and typically infects apricot, peach and plum. This strain is transmitted both by aphids and grafting. PPV-D was also found in peach grafted on infected rootstocks of other species or cultivars (such as *Prunus marianna*).

The risk posed by PPV is that infected fruits may enter Australia and result in the establishment of PPV in hosts in Australia.

PPV was assessed in the existing import policy for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). The assessment of PPV presented here builds on this existing policy.

Differences in horticultural practices and climate conditions and the prevalence of pests between China and the USA make it necessary to reassess the likelihood that PPV will be imported into Australia with nectarines from China.

Fresh nectarine fruit is expected to be imported from China from May to October which is similar to the timing of the import of stonefruit from the USA. After importation, nectarines will be distributed throughout Australia for retail sale in a similar way for stonefruit from the USA. Therefore, it is considered unnecessary to reassess the likelihood of distribution.

The likelihood of establishment and spread of PPV in Australia will be comparable regardless of the fresh fruit commodity in which PPV is imported into Australia, as these likelihoods relate specifically to events that occur in Australia and are independent of the importation pathway. The consequences of PPV are also independent of the importation pathway. Accordingly, there is no need to reassess these components of the risk.

In addition, the Australian Government Department of Agriculture has reviewed the latest literature and no new information is available that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *Plum pox virus* in the existing policy for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). Therefore, those risk ratings will be adopted for this assessment.

4.18.1 Likelihood of entry

The likelihood of entry is considered in two parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *Plum pox virus* will arrive in Australia with the importation of nectarine from China is: **Low**.

The following information provides supporting evidence for this assessment.

- The major hosts of PPV are fruit-producing species of Prunus which include nectarine (*P. persica* var. *nucipersica*) (Sochor *et al.*2012).
- PPV-D was reported on apricot in Hunan province in China (Navratil *et al.*2005) in the south of the country away from major stonefruit growing provinces. PPV has also been recently reported on peach in China without any technical details including the location of the detection (Li and Lu 2013).
- A survey, conducted during 2010 and 2011 in Hunan province and in the major stonefruit growing provinces of Shaanxi, Shandong, Hubei and Liaoning provinces, tested apricot, plum, peach or cherry orchards (Wei *et al.*2013). PPV was not detected in the survey which was completed by testing 10 864 samples by ELISA from 104 orchards. The survey methods were not reported. Nor was a statistical analysis found of the likely presence of PPV in China.
- Another field survey (Yu *et al.*2013) tested peach leaves from 12 provinces that included major peach growing regions found no infection of PPV. This survey was completed by testing more than 500 randomly obtained leaf samples.
- If PPV is present in these major stonefruit growing regions, the incidence rate is below the detection limit of the surveys conducted.
- Fruit has been demonstrated as a potential pathway for the movement of PPV (Gildow *et al.*2004; Wallis *et al.*2005), although it poses a lower risk than plant propagation materials.
- PPV symptoms may appear on the leaves, bark, fruits, flowers or seeds (Wang *et al.*2006; Schneider *et al.*2011). Infected fruits can show chlorotic spots or yellow rings or line patterns, and fruit can become deformed or irregular in shape and develop brown or necrotic areas (CABI-EPPO 2004). Diseased fruits have browned flesh (CABI-EPPO 2004). Symptomatic fruits can easily be detected and discarded during the production process or at packaging for export.
- Infected nectarine trees may be symptomless and infected trees may act as an unrecognised reservoir.
- The D strain of the virus has been detected in symptomless fruit (Gildow *et al.*2004). It is likely that asymptomatic fruit will escape detection during routine harvesting and packing house processes.
- PPV can survive in fruit transported either by air or sea freight to Australia, transportation may take a few days to weeks. PPV can survive in fruits and be transmitted at all stages of fruit ripening, including overripe/rotting fruits (Labonne and Quiot 2001).
- Cold storage treatment during transport does not eliminate the virus. PPV can be recovered from fruit stored for up to a month at 4 °C (CABI-EPPO 2004; Gildow *et al.*2004).

Two reports of *plum pox virus* in China indicate that the virus is present. *Plum pox virus* may be associated with asymptomatic nectarine fruit that is unlikely to be detected during packing houses processes. PPV may survive cold storage and transportation. However, two surveys that included the province in which plum pox virus was initially reported did not detect PPV. The surveys included China's major peach and nectarine production regions and indicates that the incidence rate of PPV in the major stonefruit growing regions is below the detection limit of these surveys. This information supports a likelihood estimate for importation of 'low'.

Likelihood of distribution

As indicated above, the likelihood of distribution for *Plum pox virus* assessed here would be the same as that for *Plum pox virus* for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b), that is **Low.**

Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation and of distribution using the matrix of rules shown in Table 2.2.

The likelihood that PPV will enter Australia as a result of trade in nectarines from China and be distributed in a viable state to a susceptible host is: **Very low.**

4.18.2 Likelihood of establishment and spread

As indicated, the likelihood of establishment and spread for *Plum pox virus* is based on the assessment for fresh stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). That assessment used the same methodology as described in Chapter 2 of this report. The ratings from the previous assessment of PPV are presented below:

Likelihood of establishment	**High**
Likelihood of spread	**High**

4.18.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihoods of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The overall likelihood that *Plum pox virus* will enter Australia as a result of trade in nectarine fruit from China, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **Very low**.

4.18.4 Consequences

The potential consequences of the establishment *Plum pox virus* in Australia have been estimated previously for fresh stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b). The overall consequences have been estimated to be: **High**.

4.18.5 Unrestricted risk estimate

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

Unrestricted risk estimate for *Plum pox virus*	
Overall likelihood of entry, establishment and spread	Very low
Consequences	High
Unrestricted risk	Low

As indicated, the unrestricted risk estimate for *Plum pox virus* has been assessed as ‘Low’, which is above Australia’s ALOP. Therefore, specific risk management measures are required for this pest.

4.19 Pest risk assessment conclusions

Key to Table 4.2 (starting next page)

Genus species (Acronym for state/territory): state/territory in which regional quarantine pests have been identified

Likelihoods for entry, establishment and spread

N	negligible
EL	extremely low
VL	very low
L	low
M	moderate
H	high
EES	overall likelihood of entry, establishment and spread
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 fresh nectarine fruit from China

Pest name	Likelihood of: Entry – Importation	Entry – Distribution	Entry – Overall	Establishment	Spread	P[EES]	Consequences	URE
Spider mites [Prostigmata: Tetranychidae]								
Amphitetranychus viennensis	M	M	**L**	H	M	L	M	**L**
Tetranychus turkestani	L	M	**L**	H	H	L	L	**VL**
Weevils [Coleoptera: Curcurlionidae]								
Rhynchites auratus *Rhynchites confragosicollis* *Rhynchites faldermanni* *Rhynchites heros*	VL	M	**VL**	M	M	VL	M	**VL**
Fruit flies [Diptera: Tephitidae]								
Bactrocera correcta	L	H	**L**	H	H	L	H	**M**
Bactrocera dorsalis	H	H	**H**	H	H	H	H	**H**
Fruit fly [Diptera: Drosophilidae]								
Drosophila suzukii	H	H	**H**	H	H	H	H	**H**
Mealybugs [Hemiptera: Pseudococcidae]								
Pseudococcus comstocki	H	M	**M**	H	H	M	L	**L**
Scales [Hemiptera: Diaspididae]								
Pseudaonidia duplex *Pseudaulacaspis prunicola*	L	L	**VL**	H	M	VL	L	**VL**
Moths [Lepidoptera: Tortricidae]								
Adoxophyes orana *Argyrotaenia ljungiana* *Spilonota albicana*	L	M	**L**	H	H	L	M	**L**
Cydia pomonella (WA)	EL	M	**EL**	H	H	EL	M	**N**

	Likelihood of						Consequences	URE
Pest name	**Entry**			**Establishment**	**Spread**	**P[EES]**		
	Importation	Distribution	**Overall**					
Grapholita molesta (WA) *Grapholita funebrana*	M	M	**L**	H	H	L	M	**L**
Twig borer [Lepidotera: Gelechiidae]								
Anarsia lineatella	M	L	**L**	H	H	L	M	**L**
Fruit borer [Lepidoptera: Carposinidae]								
Carposina sasakii	H	H	**H**	H	H	H	M	**M**
Thrips [Thysanoptera: Thripidae]								
Frankliniella intonsa *Frankliniella occidentalis* (NT)	H	M	**M**	H	H	M	L	**L**
Fungi								
Monilinia fructigena *Monilia mumecola* *Monilia polystroma* *Monilinia yunnanensis*	H	H	**H**	H	H	H	M	**M**
Viroids and Viruses								
Apple scar skin viroid	L	H	**L**	M	L	VL	M	**VL**
Tobacco necrosis viruses	M	M	**L**	H	H	L	L	**VL**
Plum pox virus	L	L	**VL**	H	H	VL	H	**L**

5 Pest risk management

This chapter provides information on the management of quarantine pests identified with an unrestricted risk exceeding Australia's appropriate level of protection (ALOP). The proposed phytosanitary measures are described in this chapter.

5.1 Pest risk management measures and phytosanitary procedures

Pest risk management evaluates and selects options for measures to reduce the risk of entry, establishment or spread of quarantine pests for Australia where they have been assessed to have an unrestricted risk above Australia's ALOP. In calculating the unrestricted risk, existing commercial production practices in China have been considered, as have post-harvest procedures and the packing of fruit.

In addition to China's existing commercial production practices for nectarine fruit and minimum border procedures in Australia, specific pest risk management measures, including operational systems, are proposed to achieve Australia's ALOP.

In this chapter, the Australian Government Department of Agriculture has identified risk management measures that may be applied to consignments of nectarine fruit sourced from China. Finalisation of the quarantine conditions may be undertaken with input from the Australian states and territories as appropriate.

5.1.1 Pest risk management for quarantine pests

The pest risk analysis identified the quarantine pests listed in Table 5.1 as having an unrestricted risk above Australia's ALOP.

Table 5.1 Phytosanitary measures proposed for quarantine pests for fresh nectarine fruit from China

Pest	Common name	Measures
Amphitetranychus viennensis (EP) *Pseudococcus comstocki* (EP) *Frankliniella intonsa* (EP) *Frankliniella occidentalis* (EP, NT) *Adoxophyes orana* (EP) *Argyrotaenia ljungiana* *Spilonota albicana* (EP)	hawthorn spider mite comstock mealybug Eurasian flower thrips western flower thrips summerfruit tortrix grape tortrix white fruit moth	Visual inspection and if detected, remedial action **b** (for example methyl bromide fumigation)
Bactrocera correcta (EP) *Bactrocera dorsalis* (EP)	guava fruit fly Oriental fruit fly	Area freedom **a** OR Cold disinfestation treatment OR Irradiation
Drosophila suzukii (EP)	spotted wing drosophila (SWD)	Area freedom **a** OR Methyl bromide fumigation OR Irradiation OR A systems approach proposed by China and approved by the Department of Agriculture.
Carposina sasakii (EP) *Grapholita funebrana* *Grapholita molesta* (EP, WA)	peach fruit borer plum fruit moth Oriental fruit moth	Area freedom **a** OR Areas of low pest prevalence OR Methyl bromide fumigation OR Irradiation OR Systems approach: Orchard surveillance and control Fruit bagging Visual inspection and if detected, remedial action **b** (for example methyl bromide fumigation)

Pest	Common name	Measures
Anarsia lineatella (EP)	peach twig borer	Area freedom **a** OR Areas of low pest prevalence OR Methyl bromide fumigation OR Irradiation OR Systems approach: Dormant spray and bloom spray Orchard monitoring and treatment Pre-harvest orchard inspections Pre-harvesting fruit cutting Fruit cutting during packing house procedures
Monilinia fructigena (EP) *Monilia mumecola* *Monilia polystroma* *Monilinia yunnanensis*	brown rot	Area freedom **a** OR Areas of low pest prevalence OR Alternative measures proposed by China and approved by the Australian Government Department of Agriculture
Plum pox virus (EP)	PPV	Area freedom **a** OR Systems approach proposed by China and approved by the Australian Government Department of Agriculture

a Area freedom may include pest free areas, pest free places of production sites. **b** Remedial action (depending on the location of the inspection) may include treatment of the consignment to ensure that the pest is no longer viable or withdrawing the consignment from export to Australia. **EP** (existing policy) pests that have previously been assessed by Australia and policy already exist. **NT** pests of quarantine concern for Northern Territory. **WA** pests of quarantine concern for Western Australia.

The acronym 'EP' (existing policy) is used for pests that have previously been assessed by Australia and a policy already exists

This non-regulated analysis of existing policy builds on the existing policies including the import of fresh stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b) and from New Zealand to Western Australia (Biosecurity Australia 2006b); and for apples (Biosecurity Australia 2010a) and table grapes (Biosecurity Australia 2011) from China. These policies include all of the pest groups identified in Table 5.1.

Considerable trade in stonefruit including nectarines from the USA (California, Idaho, Oregon and Washington) and from New Zealand and in apples from China to Australia has taken place.

Equivalent management measures have been considered for the same or similar pests and proposed in this report. Thus, the management options proposed in this report are consistent with the existing policies. Where there are differences in the proposed risk management measures among the existing policies, those recommended for stonefruit from the USA and from New Zealand to Western Australia and for apples from China were proposed in this report for nectarines from China because the efficacy of those measures have been further supported by considerable trade.

The proposed risk management measures for nectarines from China include:

- visual inspection and remedial action for leaf rollers, mealybug, spider mite and thrips
- area freedom or fruit treatment (cold disinfestation or irradiation) for fruit flies
- area freedom or fruit treatment (methyl bromide fumigation or irradiation) or a systems approach approved by the Australian Government Department of Agriculture for spotted wing drosophila
- area freedom or area of low pest prevalence or fruit treatments (methyl bromide fumigation or irradiation) or a system approach approved by the Australian Government Department of Agriculture for fruit borers
- area freedom or area of low pest prevalence or alternative measures approved by the Australian Government Department of Agriculture for brown rots
- area freedom or systems approach approved by the Australian Government Department of Agriculture for plum pox virus.

Management for *Frankliniella intonsa, Frankliniella occidentalis*, *Pseudococcus comstocki*, *Amphitetranychus viennensis, Tetranychus turkestani, Adoxophyes orana, Argyrotaenia ljungiana* and *Spilonota albicana*

Frankliniella intonsa (Eurasian flower thrips), *Frankliniella occidentalis* (western flower thrips), *Pseudococcus comstocki* (comstock's mealybug), *Amphitetranychus viennensis* (hawthron spider mite), *Tetranychus turkestani* (strawberry spider mite), *Adoxophyes orana* (summerfruit tortrix), *Argyrotaenia ljungiana* (grape tortrix) and *Spilonota albicana* (white fruit moth) were assessed to have an unrestricted risk estimate that exceeds Australia's ALOP. Measures are therefore required to manage the risk.

The Australian Government Department of Agriculture proposes visual inspection and remedial action as a measure for these pests. The objective of the proposed visual inspection is to ensure that any consignments of nectarine fruit from China infested with these pests are identified and subjected to appropriate remedial action. This measure is considered to reduce the risk associated with these pests to at least 'very low', which would achieve Australia's ALOP.

The proposed measures are consistent with the existing policy for fresh stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b) and from New Zealand to Western Australia (Biosecurity Australia 2006b). The efficacy of visual inspection and remedial action is supported by considerable trade of stonefruit including nectarines from the USA (California, Idaho, Oregon and Washington) to Australia since 2010.

Pre-export visual inspection and remedial action by AQSIQ/CIQ

All nectarine fruit consignments for export to Australia must be inspected by AQSIQ/CIQ and found free of these quarantine arthropod pests. Export lots or consignments found to contain any of these pests must be subject to remedial action. Remedial action may include withdrawing the consignment from export to Australia or, if available, approved treatment of the export consignment to ensure that the pest is no longer viable.

Management *for Bactrocera dorsalis* and *Bactrocera correcta*

Bactrocera dorsalis (Oriental fruit fly) and *Bactrocera correcta* (guava fruit fly) were assessed to have an unrestricted risk estimate that exceeds Australia's ALOP. Measures are therefore required to manage the risks.

The proposed measures are consistent with the existing policies including those for apples (Biosecurity Australia 2010a) and table grapes (Biosecurity Australia 2011) from China. The Australian Government Department of Agriculture proposes the options of area freedom or fruit treatment (cold disinfestations or irradiation) as management measures. The objective of each of these measures is to reduce the survival of *B. dorsalis* and *B. correcta* thus reducing the likelihood of importation to at least 'extremely low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Area freedom

Area freedom is a measure that might be applied to manage the risk posed by *B. dorsalis* and *B. correcta*. The requirements for establishing pest free areas or pest free places of production are set out in ISPM 4: *Establishment of pest free areas* (FAO 1995) and ISPM 10: *Requirements for the* *establishment of pest free places of production and pest free production sites* (FAO 1999) and more specifically in ISPM 26: *Establishment of pest free areas for fruit flies* (Tephritidae) (FAO 2006).

Current requirements for the import of pears, apples and table grapes include monitoring and trapping of fruit flies in export orchards and packing houses. Monitoring and trapping of fruit flies in the specific nectarine export orchards and packing houses of northern China (as for current apple, pear and table grapes export) would be required.

The Australian Government Department of Agriculture is currently considering China's request for recognition of northern China for area freedom for *B. dorsalis, B. correcta* and other economically significant fruit flies based on China's National Fruit Flies Trapping Network. If area freedom for these fruit flies and other economically significant fruit flies is accepted by Australia for northern China, China's existing National Fruit Flies Trapping Network would be required to be maintained in all areas including production areas where nectarines are to be sourced for export to Australia. However, additional monitoring and trapping of fruit flies in the specific export orchards and packing houses may not be required.

Under either of the two area freedom situations (that is monitoring and trapping of export orchards or based on the National Fruit Flies Trapping Network), AQSIQ would be required to notify the Australian Government Department of Agriculture of the detection of any fruit fly species (Tephritidae) of economic importance in the regions within 48 hours. The Australian Government Department of Agriculture would then assess the species and number of individual flies detected and the circumstances of the detection, before advising AQSIQ of the action to be taken. If fruit flies are detected at offshore pre-shipment inspection or on-arrival inspection, trade would stop immediately, pending the outcome of an investigation.

Cold disinfestation treatments

For nectarine fruit sourced from outside the recognised fruit fly pest free areas, cold disinfestations treatments must be undertaken. Cold treatments can be conducted pre-export in China or in-transit.

Treatment regimes consistent with the *USDA Treatment Manual* (USDA 2010) for *B. dorsalis* on a range of commodities are proposed for the disinfestation of *B. dorsalis and B. correcta* on nectarine fruit. Cold treatments which are effective for *B. dorsalis* are considered to be effective for *B. correcta* as *B. correcta* is more sensitive to cold than *B. dorsalis* (Liu and Ye 2009b). The Australian Government Department of Agriculture proposes the following treatment regimes for *B. dorsalis and B. correcta* on nectarines from China:

- 0.99 °C or below for 15 days, or
- 1.38 °C or below for 18 days

These measures are consistent with the policies for lychee from Taiwan (DAFF 2013). The same conditions have been implemented for longan and lychee from Thailand and China since 2013.

Irradiation

Irradiation treatment is considered a suitable measure option for *B. correcta* and *B. dorsalis*. The treatment schedule of 150 gray minimum absorbed dose is specified in ISPM 28 Annex 7: *Irradiation treatment for fruit flies of the family Tephritidae (generic)* (FAO 2009).

Alternative measures

Measures for *B. dorsalis* and *B. correcta* could also include other equivalent measures, subject to the provision and acceptance of suitable efficacy data.

Management for *Drosophila suzukii*

Drosophila suzukii (spotted wing drosophila) was assessed to have an unrestricted risk estimate that exceeds Australia's ALOP. Therefore, measures are required to manage the risks.

Options recommended for this pest in the *Final pest risk analysis report for Drosophila suzukii* (DAFF Biosecurity 2013) are area freedom, systems approach, or fruit treatment known to be effective against all life stages of *D. suzukii*. The objective of each of these measures is to reduce the survival of *D. suzukii* thus reducing the likelihood of importation to at least 'extremely low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Area freedom

Area freedom is a measure that might be applied to manage the risk posed by *D. suzukii*. The requirements for establishing pest free areas or pest free places of production are set out in ISPM 4: *Requirements for the establishment of pest free areas* (FAO 1995) and ISPM 10: *Requirements for the establishment of pest free places of production and pest free production sites* (FAO 1999).

Drosophila suzukii is considered to be widespread in China (Hu *et al.*1993; Dai and Shi 2013); therefore, area freedom may not be a viable option for China.

Methyl bromide fumigation

The Australian Government Department of Agriculture proposes the following methyl bromide fumigation against *D. suzukii* on nectarines. This measure is also used to manage *D. suzukii* in nectarines from the USA:

- 48 grams per meter cubed for two hours at a pulp temperature of 13.9 °C or greater at not more than 38 per cent chamber load.

Additional post-treatment security measures may be required to limit post-treatment contamination by flies that are attracted to ripe fruit.

Irradiation

Irradiation treatment is considered a suitable measure option for *D. suzukii* (Follett *et al.*2014). The treatment schedule of 150 gray minimum absorbed dose is specified in ISPM 28 Annex 7: *Irradiation treatment for fruit flies of the family Tephritidae (generic)* (FAO 2009).

Alternative measures

Other treatments, demonstrated to be effective against all life stages of *D. suzukii* for nectarine fruit, will be considered by the Australian Government Department of Agriculture if proposed by AQSIQ.

Should China wish to use a systems approach as a measure to manage the risk posed by *D. suzukii*, AQSIQ would need to submit to Australia a proposal outlining components of the system and how these components will address the risks posed by this pest. The Australian Government Department of Agriculture will consider the effectiveness of any system proposed by AQSIQ.

Management for *Carposina sasakii, Grapholita molesta* and *Grapholita funebrana*

Carposina sasakii (peach fruit borer), *Grapholita funebrana* (Plum fruit moth) and *Grapholita molesta* (Oriental fruit moth) were assessed to have an unrestricted risk estimate that exceeds Australia's ALOP. Therefore, measures are required to manage the risks. *Grapholita molesta* (Oriental fruit moth) is a quarantine pest only for Western Australia.

The Australian Government Department of Agriculture proposes the options of area freedom or low pest prevalence areas or fruit treatment (methyl bromide fumigation or irradiation) or systems approach approved by the Australian Government Department of Agricultureas management measures. The objective of each of these measures is to reduce the likelihood of importation of these pests to at least 'very low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

The proposed measures are consistent with the existing policies including those for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b) and New Zealand (Biosecurity Australia 2006b) and for apples (Biosecurity Australia 2010a) and table grapes (Biosecurity Australia 2011) from China.

Area freedom

Area freedom is a measure that might be applied to manage the risk posed by *Carposina sasakii*, *Grapholita molesta* and *Grapholita funebrana*. The requirements for establishing pest free areas or pest free places of production are set out in ISPM 4: *Requirements for the establishment of pest free areas* (FAO 1995) and ISPM 10: *Requirements for the establishment of pest free places of production and pest free production sites* (FAO 1999).

Should China wish to use area freedom option, AQSIQ would need to demonstrate the establishment of areas freedom of these pests in according to ISPM 4 (FAO 1995) and ISPM 10 (FAO 1999).

Areas of low pest prevalence

Low pest prevalence area is a measure that might be applied to manage the risk posed by *Carposina sasakii*, *Grapholita funebrana* and *Grapholita molesta*. The requirements for establishing areas of low pest prevalence are set out in ISPM 22: *Requirements for the establishment of areas of low pest prevalence* (FAO 2005)and ISPM 29: *Recognition of pest free areas and areas of low pest prevalence* (FAO 2007a).

Should China wish to use Areas of low pest prevalence option, AQSIQ would need to demonstrate the establishment of areas of low pest prevalence for these pests in according to ISPM 22 (FAO 2005) and ISPM 29 (FAO 2007a).

Methyl bromide fumigation

The fumigation treatment schedules set out below are those currently applied to reduce the risk of importation of oriental fruit moth on stonefruit from the USA (California, Idaho, Oregon and Washington) and New Zealand. This measure is also used to manage leaf rollers and *Grapholita* moths in stonefruit from the USA.

It is proposed that where fumigation with methyl bromide is utilised, it must be carried out for duration of two hours according to the specifications below:

- 32 grams per meter cubed at a fruit pulp temperature of 21 °C or greater, or
- 40 grams per meter cubed at a fruit pulp temperature of 16 °C or greater, or
- 48 grams per meter cubed at a fruit pulp temperature of 11 °C or greater

Irradiation

Irradiation treatment is considered a suitable measure option for *Carposina sasakii*, *Grapholita molesta* and *Grapholita funebrana.* The Australian Government Department of Agriculture proposes that 400 gray as minimum generic dose rate for the class Insecta (except pupae and adults of the Order Lepidoptera) (USDA 2015).

Systems approach

The Australian Government Department of Agriculture proposes the following systems approach based on orchard control and surveillance, fruit bagging, and visual inspection and remedial actions to reduce the risk associated with these arthropods pests to meet Australia's ALOP.

Orchard control and surveillance

Registered growers would implement an orchard control program (for example integrated pest management (IPM) programs for export nectarines). Programs would be approved by AQSIQ/CIQ, and incorporate field sanitation and appropriate pesticide applications for the management of quarantine arthropod pests.

AQSIQ/CIQ would be responsible for ensuring that export nectarine growers are aware of pests of quarantine concern to Australia and that the export orchards are subject to field sanitation and control measures. Registered growers would be required to keep records of control measures for auditing. Details of the control program would need to be provided to the Australian Government Department of Agricultureby AQSIQ before trade commences.

Monitoring/detection surveys for pests that require orchard management measures must be conducted regularly by AQSIQ/CIQ in orchards registered for export to verify the effectiveness of the measures. AQSIQ/CIQ will maintain annual survey results using a standard reporting format. These results will be made available to the Australian Government Department of Agricultureif requested.

Fruit bagging

Fruit bagging has been shown in China to be effective in providing some protection to the developing fruit and reducing damage by pests.

The Australia Department of Agriculture proposes mandatory fruit bagging as a risk management measure (as part of the systems approach) for *Carposina sasakii*, *Grapholita molesta* and *Grapholita funebrana*.

Fruit bagging is also part of the systems approach for managing arthropod pests in apples, pears and table grapes from China.

For nectarines from China, paper bags would be required to be placed over individual nectarine fruit when the fruit is immature, to minimise the risk of early exposure to these pests. Pest control measures are applied at a suitable time prior to bagging to ensure that the orchards in general and the developing fruit in particular, are free from pests when bagged. Depending on the variety and weather and orchard conditions, the outer bags are removed approximately one to two weeks before harvesting to allow gradual exposure of nectarine fruit to the sun, and the inner bag removed one week before harvesting to allow the fruit to develop colour. In some areas, both bags may be removed at once about one to two weeks before harvesting (China NorthWest A&F University, 2015, pers. comm., 3 February).

Visual inspection and remedial action

The objective of visual inspection is to ensure that consignments of nectarines from China infested with these pests are identified and subjected to appropriate remedial action. Visual inspection and remedial action will reduce the risk associated with these pests to a very low level.

The consignment would not be released from quarantine until the remedial action has been undertaken.

Other potential measures

The Australian Government Department of Agriculture would also consider any other treatment that AQSIQ may propose, providing that it provides an equivalent level of protection.

However, development of final import conditions will be depend on AQSIQ providing information supporting the efficacy of treatments against these pests that reduce the level of risk to achieve Australia's ALOP.

Management of *Anarsia lineatella*

Anarsia lineatella (peach twig borer) was assessed to have an unrestricted risk estimate that exceeds Australia's ALOP. Therefore, measures are required to manage the risks.

The Australian Government Department of Agriculture proposes the options of area freedom, areas of low pest prevalence or fruit treatment (methyl bromide fumigation or irradiation) or a systems approach as management measures. The objective of each of these measures is to reduce the likelihood of importation of peach twig borer to at least 'very low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Area freedom

Area freedom is a measure that might be applied to manage the risk posed by *Anarsia lineatella*. The requirements for establishing pest free areas or pest free places of production are set out in

ISPM 4: *Requirements for the establishment of pest free areas* (FAO 1995) and ISPM 10: *Requirements for the establishment of pest free places of production and pest free production sites* (FAO 1999).

Should China wish to use area freedom option, AQSIQ would need to demonstrate the establishment of areas freedom of these pests in according to ISPM 4 (FAO 1995) and ISPM 10 (FAO 1999).

Areas of low pest prevalence

Low pest prevalence area is a measure that might be applied to manage the risk posed by *Anarsia lineatella*. The requirements for establishing areas of low pest prevalence are set out in ISPM 22: *Requirements for the establishment of areas of low pest prevalence* (FAO 2005) and ISPM 29: *Recognition of pest free areas and areas of low pest prevalence* (FAO 2007a).

Should China wish to use areas of low pest prevalence option, AQSIQ would need to demonstrate the establishment of areas of low pest prevalence for these pests in according to ISPM 22 (FAO 2005) and ISPM 29 (FAO 2007a).

Irradiation

Irradiation treatment is considered a suitable measure option for *Anarsia lineatella. The* Australian Government Department of Agriculture proposes that 400 gray as minimum generic dose rate for the class Insecta (except pupae and adults of the Order Lepidoptera) (USDA 2015).

Methyl bromide fumigation

It is proposed that where fumigation with methyl bromide is utilised, it must be carried out for duration of two hours according to the specifications below:

- 32 grams per meter cubed at a fruit pulp temperature of 21 °C or greater, or
- 40 grams per meter cubed at a fruit pulp temperature of 16 °C or greater, or
- 48 grams per meter cubed at a fruit pulp temperature of 11 °C or greater

This measure is also used to manage *Anarsia lineatella* on stonefruit from the USA.

Systems approach

The Australian Government Department of Agriculture proposes a systems approach consists of a dormant spray and bloom spray, orchard monitoring and treatment, pre-harvest monitoring, pre-harvest fruit cutting, fruit cutting in the packing house and regulatory inspection. The proposed systems approach is consistent with the existing policies including those for stonefruit from the USA (California, Idaho, Oregon and Washington) (Biosecurity Australia 2010b).

The Australian Government Department of Agriculture will consider alternative systems approach proposed by AQSIQ to manage the risk posed by *Anarsia lineatella,* providing that it achieves an equivalent level of quarantine protection.

Dormant and bloom sprays

A dormant or delayed dormant spray targeted at peach twig borer must be applied before first bloom. A bloom spray targeted at peach twig borer must be applied prior to the one-inch leaf growth stage.

Orchard monitoring and treatment

Peach twig borer specific pheromone traps are used in orchards to determine when the adult flight season for each generation of peach twig borer commences. The flight season is determined to have commenced when two peach twig borer moths are caught in any of the traps in an orchard or block. Control measures (insecticide sprays) are applied for peach twig borer between 400 and 500 degree-days after the flight season commences. If fruit has begun to colour, control measures will be applied at 300 degree-days.

Pre-harvest monitoring and fruit cutting

A specified number of trees in the orchard are selected for sampling according to the size of the orchard or block. Each tree selected for sampling is checked for any evidence of shoot strikes (symptom). If there is more than an average of two shoot strikes per tree, the orchard or block is determined to be ineligible for export under this systems approach for the remainder of the season.

Five fruits are taken from each of a specified number of trees, randomly selected based on orchard or block size, and cut open to examine for *Anarsia lineatella* larvae. If any *Anarsia lineatella* larvae are found during the fruit cutting, the variety lot will be ineligible for export under this systems approach for the remainder of the season. A variety lot is defined as a continuous planting as a single nectarine variety (commonly referred to as a block within an orchard).

Fruit cutting in the packing house

A total of 300 fruit per variety lot per day are cut and examined for *Anarsia lineatella* larvae. The fruit may be taken from the 'cull' fruit.

If any *Anarsia lineatella* larvae are detected during the fruit cut, the variety lot to be suspended from exporting fruit to Australia under this systems approach for the remainder of the season.

Regardless of whether any *Anarsia lineatella* larvae are found, the entire 300 unit cut must be completed, unless the grower elects to remove the variety lot from the export program for the season.

Regulatory inspection

Australia requires a 600 unit inspection (1 unit = 1 nectarine fruit) (Refer to section 5.2.6). Five per cent of those fruit, plus any fruit showing signs of insect infestation, are cut to look for internal feeding pests.

If any *Anarsia lineatella* is found during regulatory inspection, the relevant orchard will be suspended from exporting fruit to Australia under this systems approach for the remainder of the season.

Management of *Monilinia fructigena, Monilinia yunnanensis, Monilia mumecola* and *Monilia polystorma*

Monilinia fructigena, *M. yunnanensis*, *Monilia mumecola* and *M. polystorma* were assessed to have an unrestricted risk estimate that exceeds Australia's ALOP. Measures are therefore required to manage these risks.

The Australian Government Department of Agriculture proposes the options of area freedom or areas of low pest prevalence or alternative measures proposed by China and approved by the Australian Government Department of Agricultureas management measures. The objective of each of these measures is to reduce the likelihood of importation of these pests to at least 'very low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

The proposed measures are consistent with the existing policies including those for apples from China (Biosecurity Australia 2010a).

Area freedom

Area freedom (may include pest free areas and pest free places of production) is a measure that might be applied to manage the risk posed by *Monilinia fructigena*, *M. yunnanensis*, *Monilia mumecola* and *M. polystorma*. The requirements for establishing pest free areas or pest free places of production are set out in ISPM 4: *Requirements for the establishment of pest free areas* (FAO 1995) and ISPM 10: *Requirements for the establishment of pest free places of production and pest free production sites* (FAO 1999).

Nectarine fruit for export to Australia would need to be sourced from export orchards free of these diseases. This measure would require systems to be put in place for the establishment, maintenance and verification of orchard freedom from *Monilinia fructigena*, *M. yunnanensis*, *Monilia mumecola* and *M. polystorma* under the supervision of CIQ and the responsibility of AQSIQ. The inspection and monitoring of trees in the export orchard at appropriate times to detect evidence of these pathogens must be undertaken and supported by appropriate documentation. The inspection method appropriate for these diseases, including details of the timing and size of the sampling to be undertaken for each orchard, would be developed by AQSIQ and subject to approval by the Department of Agriculture. Results of the inspections would subsequently be made available to the Australian Government Department of Agriculturefor auditing purposes.

If *Monilinia fructigena*, *M. yunnanensis*, *Monilia mumecola* and *M. polystorma* is detected in any export orchard, fruit from that export orchard will not be eligible for the export program to Australia.

To manage any potential contamination from the processing of fruit destined to domestic or other export markets, processing equipment in packing houses must be suitably cleaned prior to the commencement of processing fruit for export to Australia.

Areas of low pest prevalence

Low pest prevalence area is a measure that might be applied to manage the risk posed by *Monilinia fructigena*, *M. yunnanensis*, *Monilia mumecola* and *M. polystorma*. The requirements for establishing areas of low pest prevalence are set out in ISPM 22: *Requirements for the establishment of areas of low pest prevalence* (FAO 2005) and ISPM 29: *Recognition of pest free areas and areas of low pest prevalence* (FAO 2007a).

Should China wish to use areas of low pest prevalence option, AQSIQ would need to demonstrate the establishment of areas of low pest prevalence for *Monilinia fructigena*, *M. yunnanensis*, *Monilia mumecola* and *M. polystorma* in according to ISPM 22 (FAO 2005) and ISPM 29 (FAO 2007a).

Other potential measures

The Australian Government Department of Agriculturewill consider any alternative measure (for example, infield control and post harvest fungicide dipping) proposed by AQSIQ, providing that it achieves an equivalent level of quarantine protection. Evaluation of such measures or treatments will require a technical submission from AQSIQ that details the proposed treatment and includes suitable information supporting the efficacy of the treatment.

Management of *Plum pox virus*

Plum pox virus was assessed to have an unrestricted risk estimate that exceeds Australia's ALOP. Measures are therefore required to manage this virus.

The Australian Government Department of Agriculture proposes the options of area freedom or systems approach proposed by China and approved by the Australian Government Department of Agriculture as management measures. The objective of each of these measures is to reduce the likelihood of importation of this pest to at least 'extremely low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Area freedom

Area freedom is a measure that might be applied to manage the risk posed by *Plum pox virus*. The requirements for establishing pest free areas are set out in ISPM 4: *Requirements for the establishment of pest free areas* (FAO 1995).

Should China wish to use area freedom option, AQSIQ would need to demonstrate the establishment of areas freedom of *Plum pox virus* in according to ISPM 4 (FAO 1995) and ISPM 10 (FAO 1999).

If *Plum pox virus* is detected in any export orchard, fruit from that export area will not be eligible for the export program to Australia.

Systems approach

The Australian Government Department of Agriculture considers a systems approach to address the risks posed by *Plum pox virus* may be feasible. The approach could be based on a combination of orchard control of vectors, and orchard monitoring and plant sample testing to ensure that the orchards registered for export to Australia have been tested and found free of *Plum pox virus*.

The inspection, monitoring of trees and testing of plant tissues in the registered export orchards at appropriate times to detect evidence of the virus must be undertaken and supported by appropriate documentation. The inspection and testing method appropriate for this virus, including details of the timing and size of the sampling to be undertaken for each orchard, would be developed by AQSIQ and subject to approval by the Australian Government Department of Agriculture. Results of the inspections would subsequently be made available to the Australian Government Department of Agriculture for auditing purposes.

Should China wish to use a systems approach as a measure to manage the risk posed by *Plum pox virus*, AQSIQ would need to submit to Australia a proposal outlining components of the system and how these components will address the risks posed by this pest. The Australian Government Department of Agriculture will consider the effectiveness of any system proposed by AQSIQ.

5.1.2 Consideration of alternative measures

Consistent with the principle of equivalence detailed in ISPM 11: *Pest risk analysis for quarantine pests* (FAO 2013), the Australian Government Department of Agriculture will consider any alternative measure proposed by AQSIQ, providing that it achieves Australia's ALOP. Evaluation of such measures or treatments will require a technical submission from AQSIQ that details the proposed treatment and including data from suitable treatment trials to demonstrate efficacy.

5.2 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 nectarine fruit from China. This is to ensure that the proposed risk management measures have been met and are maintained.

5.2.1 Registration of orchards by AQSIQ

The objectives of this recommended procedure are to ensure that:

- nectarine fruit are sourced only from AQSIQ/CIQ registered export orchards producing commercial quality fruit
- export orchards from which nectarine fruit are sourced can be identified so investigation and corrective action can be targeted rather than applying it to all contributing export orchards in the event that live pests are intercepted.

It is proposed that all orchards supplying nectarine fruit for export to Australia are registered with AQSIQ/CIQ at the start of each nectarine growing season. AQSIQ/CIQ would be responsible for ensuring that export nectarine growers are aware of pests of quarantine concern to Australia, orchard monitoring and control measures. The hygiene of export orchards must be maintained. Registered orchards would be required to keep records of control measures for auditing purposes. The records of the pest control program would need to be made available to the Australian Government Department of Agriculture, if requested.

5.2.2 Registration of packing house and treatment providers and auditing of procedures

The objectives of this proposed procedure are to ensure that:

- nectarines are sourced only from AQSIQ/CIQ registered packing houses, processing commercial quality fruit
- references to the packing house and the orchard source (by name or a number code) are clearly stated on cartons of nectarines destined for export to Australia for trace back and auditing purposes.

It is proposed that export packing houses and treatment providers (if applicable) are registered with AQSIQ/CIQ before the commencement of harvest each season. The list of registered packing houses and treatment providers must be kept by AQSIQ/CIQ, and would need to be made available to the Australian Government Department of Agriculture, if requested.

AQSIQ/CIQ would be required to audit packing houses and the registered providers to ensure that these facilities are suitably equipped to carry out the specified phytosanitary activities and treatments. Records of AQSIQ/CIQ audits would be made available to the Australian Government Department of Agriculture upon request. Once a high level of compliance has been established, audits may not be necessary each season.

Packing houses will be required to identify individual orchards with a unique identifying system and identify fruit from individual orchards by marking cartons or pallets with a unique number or identification provided by AQSIQ/CIQ.

Where nectarines undergo fruit treatment prior to export, this process could only be undertaken by the treatment providers that have been registered with and audited by AQSIQ/CIQ for the purpose.

AQSIQ/CIQ must immediately suspend exports of nectarines to Australia from packing houses/treatment providers found to be non-compliant and must notify the Australian Government Department of Agriculture of the suspension.

Suspended packing houses/treatment providers may only be reinstated for processing of nectarines for export to Australia when AQSIQ/CIQ and the Australian Government Department of Agriculture are satisfied that non-compliance issues have been adequately addressed.

5.2.3 Packaging and labelling

The objectives of this recommended procedure are to ensure that:

- nectarines proposed for export to Australia and all associated packaging is not contaminated by quarantine pests or regulated articles
  - regulated articles are any items other than nectarine fruit. Regulated articles may include plant, plant product, soil and any other organisms, object or material capable of harbouring or spreading pests, deemed to require phytosanitary measures, particularly where international transportation is involved
  - in this report, nectarines are defined as nectarine fruit with or without stalk, but not other plant parts (section 1.2.2)
- unprocessed packing material—which may vector pests identified as not being on the pathway and pests not known to be associated with nectarine fruit—is not imported with the nectarine fruit
- all wood material used in packaging of nectarines complies with the Australian Government Department of Agriculture conditions
- secure packaging is used during storage and transport to Australia and must meet Australia's general import conditions for fresh fruits and vegetables, available on the Australian Government Department of Agriculture website
- the packaged nectarines are labelled with the orchard registration number, packing house registration number for the purposes of trace-back
- the phytosanitary status of nectarines must be clearly identified.

5.2.4 Specific conditions for storage and movement

The objectives of this recommended procedure are to ensure that:

- nectarines for export to Australia that have been treated and/or inspected are kept secure and segregated at all times from any fruit for domestic or other markets, untreated/non pre-inspected product, to prevent mixing or cross-contamination
- the quarantine integrity of the commodity during storage and movement is maintained.

5.2.5 Freedom from trash

All nectarines for export must be free from trash (for example, stem and leaf material, seeds, soil, animal matter/parts or other extraneous material) and foreign matter. Freedom from trash will be confirmed by the inspection procedures. Export lots or consignments found to contain trash or foreign matter should be withdrawn from export unless approved remedial action such as reconditioning is made available and applied to the export consignment and then re-inspected.

5.2.6 Pre-export phytosanitary inspection and certification by AQSIQ/CIQ

The objectives of this proposed procedure are to ensure that:

- all consignments have been inspected in accordance with official procedures for all visually detectable quarantine pests and other regulated articles (including soil, animal and plant debris) at a standard 600 unit sampling rate per phytosanitary certificate
- an international phytosanitary certificate (IPC) is issued for each consignment upon completion of pre-export inspection and treatment to verify that the relevant measures have been undertaken offshore
- each IPC includes:
  - a description of the consignment (including orchard registration number or reference code and packing house details)
  - details of disinfestation treatments (for example, methyl bromide fumigation) which includes date, concentration, temperature, duration, and/or attach fumigation certificate (as appropriate)

and

- an additional declaration that '*The fruit in this consignment has been produced in country in accordance with the conditions governing entry of fresh nectarine fruit to Australia and inspected and found free of quarantine pests*'.

5.2.7 Verification by the Australian Government Department of Agriculture

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

- all consignments comply with Australian import requirements
- consignments are as described on the phytosanitary certificate and quarantine integrity has been maintained.

To ensure that phytosanitary status of consignments of nectarines from China meet Australia's import conditions, the Australian Government Department of Agriculture completes a verification inspection of all consignments of nectarines.

A 600 unit inspection will be conducted in accordance with the Australian Government Department of Agriculture standard inspection protocol for nectarines, using optical enhancement where necessary.

The inspection may be undertaken on arrival into Australia of nectarine consignments or may be undertaken in China as offshore pre-shipment inspection, subject to availability of departmental staff.

Under offshore pre-shipment inspection arrangements, officers from the Australian Government Department of Agriculture will conduct a verification inspection once all measures have been applied, including the regulatory inspection by AQSIQ/CIQ.

On arrival, the Australian Government Department of Agriculture also undertakes a documentation compliance examination to verify that the consignment is as described on the phytosanitary certificate and that the required phytosanitary actions have been undertaken and that product security has been maintained.

5.2.8 Remedial action(s) for non-compliance

The objectives of remedial action(s) for non-compliance are to ensure that:

- any quarantine risk is addressed by remedial action, as appropriate
- non-compliance with import requirements is addressed, as appropriate.

Any consignment that fails to meet Australia's import conditions must be subject to a suitable remedial treatment, if one is available, re-exported from Australia, or destroyed.

Separate to the corrective measures mentioned, there may be other breach actions necessary depending on the specific pest intercepted and the risk management strategy put in place against that pest in the protocol.

If product repeatedly fails inspection, the Australian Government Department of Agriculturereserves the right to suspend the export program and conduct an audit of the risk management systems. The program will recommence only when the department is satisfied that appropriate corrective action has been taken.

5.3 Uncategorised pests

If an organism, including contaminant pests, is detected on nectarine fruit either in China or on-arrival in Australia that has not been categorised, it will require assessment by the Australian Government Department of Agricultureto determine its quarantine status and whether phytosanitary action is required. Assessment is also required if the detected species was categorised as not likely to be on the import pathway. If the detected species was categorised as on the pathway but assessed as having an unrestricted risk that achieves Australia's ALOP due to the rating for likelihood of importation, then it would require reassessment. The detection of any pests of quarantine concern not already identified in the analysis may result in remedial action and/or temporary suspension of trade while a review is conducted to ensure that existing measures continue to provide the appropriate level of protection for Australia.

5.4 Review of processes

5.4.1 Verification of protocol

Prior to or during the first season of trade, the Australian Government Department of Agriculture will verify the implementation of agreed import conditions and phytosanitary measures including registration, operational procedures and treatment providers, where applicable. This may involve representatives from the Australian Government Department of Agriculture visiting areas in China that produce nectarine fruit for export to Australia.

5.4.2 Review of policy

The Australian Government Department of Agriculture reserves the right to review the import policy after the first year of trade or when there is reason to believe that the pest or phytosanitary status in China has changed.

AQSIQ must inform the Australian Government Department of Agriculture immediately on detection in country of any new pests of nectarine fruit that are of potential quarantine concern to Australia.

5.5 Meeting Australia's food standards

Imported food for human consumption must satisfy Australia's food standards. Australian law requires that all food, including imported food, meets the standards set out in the Australia New Zealand Food Standards Code (hereafter referred to as 'the Code'). Food Standards Australia New Zealand (FSANZ) is responsible for developing and maintaining the Code, including Standard 1.4.2, maximum residue limits (MRLs), available on the ComLaw website. The standards apply to all food in Australia, irrespective of whether it is grown domestically or imported.

If a specific chemical is used on imported foods to control pests and diseases, then any resulting residues must not exceed the specific MRLs in Standard 1.4.2 of the Code for that food.

If there is no MRL listed in the Code for a specific food (or a composite, processed food), then there must be no detectable residues in that specific food.

Where an exporting country uses a chemical for which there is no current listed Australian MRL, there are mechanisms to consider establishing an Australian MRL by harmonising with an MRL established by the Codex Alimentarius Commission (Codex) or by a regulatory authority in a recognised jurisdiction. The mechanisms include applications, submissions or consideration as part of a FSANZ proposal to vary the Code. The application process, including the explanation of establishment of MRLs in Australia, is described at the Food Standards Australia New Zealand website.

6 Conclusion

The findings of this *Draft report for a non-regulated analysis of existing policy for nectarines from China* are based on a comprehensive scientific analysis of relevant literature.

The Australian Government Department of Agriculture considers that the risk management measures proposed in this report will provide an appropriate level of protection against the pests identified as associated with the trade of nectarine fruit from China.

Appendix A Initiation and categorisation for pests of fresh nectarine fruit from China

The steps in the initiation and categorisation processes are considered sequentially, with the assessment terminating at 'Yes' for column 3 (except for pests that are present, but under official control and/or pests of regional concern) or the first 'No' for columns 4, 5 or 6.

In the final column of the table (column 7) the acronyms 'EP', 'NT' and 'WA' are used. The acronym 'EP' (existing policy) is used for pests that have previously been assessed by Australia and a policy already exists. The acronym for the state for which regional pest status is considered, such as 'NT' (Northern Territory) or 'WA' (Western Australia), is used to identify organisms that have been recorded in some regions of Australia, and due to interstate quarantine regulations are considered pests of regional concern.

This pest categorisation table only lists pests that are likely to be directly associated with the export pathway of fresh nectarine fruit and reference to pests that are not directly related to the export pathway, such as soilborne nematodes, soilborne pathogens, wood borer pests, root pests or pathogens and secondary pests have not been listed or have been deleted from the table, as they are not directly related to the export pathway of fresh nectarine fruit and would be addressed by Australia's current approach to contaminating pests.

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
ARTHROPODS						
Acari (Prostigmata)						
Aculus fockeui (Nalepa and Trouessart, 1891) [Eriophyidae] Plum rust mite, peach silver mite	Yes (Huang *et al.* 1994; CABI 2014)	Yes. NSW, Tas., Vic., WA (Plant Health Australia 2001; CSIRO 2005; Halliday 2013)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Amphitetranychus viennensis (Zacher, 1920) Synonym: *Tetranychus viennensis* Zacher, 1920 [Tetranychidae] Hawthorn spider mite	Yes (AQSIQ 2006b)	No records found	Yes. Associated with *P. persica* (Migeon and Dorkeld 2013). Primarily feeds on the underside of leaves (Jeppson *et al.* 1975). Has been intercepted in South Africa on imported *Prunus* fruit from Spain (DAFF RSA 2014).	Yes. This species is polyphagous. Hosts include peanut, quince, fig, strawberry, cotton, apple, cherry, plum, peach, pear and raspberry (Migeon and Dorkeld 2013; CABI 2014). These hosts are widely available throughout Australia. This species is found in many parts of temperate Asia and Europe (Migeon and Dorkeld 2013). Many parts of temperate Australia have similar climatic conditions to regions where the pest is currently established.	Yes. This species is an important pest of apple, peach, pear, apricot, plum, hawthorn, cherry, sweet cherry and raspberry in Asia and Europe (Jeppson *et al.* 1975).	Yes (EP)
Bryobia rubrioculus (Schenten, 1857) [Tetranychidae] Brown spider mite	Yes (Wang 1981; Yang *et al.*2005)	Yes. NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001; Poole 2010; Halliday 2013)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Eotetranychus boreus Ehara, 1969 [Tetranychidae] Apricot spider mite	Yes (Ehara 1969; Wang *et al.*1981)	No records found	No. Associated with *P. persica* (Ehara 1969; Wang *et al.*1981). *Eotetranychus* species feed on the under surfaces of leaves, usually along the veins forming small colonies where they generally produce webbing (Jeppson *et al.*1975). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Eotetranychus pruni (Oudemans, 1931) [Tetranychidae] Chestnut spider mite	Yes (Wang 1981; Yang *et al.*2005)	No records found	No. Associated with *P. persica* (Migeon and Dorkeld 2013). Adults and nymphs generally congregate on the under surface of leaves close to the midrib and veins, their feeding often resulting in premature leaf drop (Jeppson *et al.*1975). Females lay eggs covered with webbing along the veins on the under surface of leaves (David'yan 2009). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Eotetranychus sexmaculatus (Riley, 1890) [Tetranychidae] Six-spotted spider mite	Yes (Wang 1981; Li *et al.*1997)	Yes. NSW, Qld, SA, WA (CSIRO 2005; Fisher and Learmonth 2006; Halliday 2013)	Assessment not required	Assessment not required	Assessment not required	No
Eotetranychus smithi (Pritchard and Baker, 1955) [Tetranychidae] Smith spider mite	Yes (Wang 1981)	No records found	No. Associated with *P. persica* (Migeon and Dorkeld 2013). It feeds in colonies near the midrib on leaves (Jeppson *et al.*1975). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Eutetranychus orientalis (Klein, 1936) [Tetranychidae] Oriental red spider mite	Yes (Shun *et al.*1996; Zhou *et al.*2006a)	Yes. NSW, NT, Qld, WA (Halliday 2000; Plant Health Australia 2001; Halliday 2013)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Panonychus citri (McGregor, 1916) [Tetranychidae] Citrus red mite	Yes (Wang 1981; Manson 1987; Li *et al.*1997)	Yes. NSW, SA (CSIRO 2005; Halliday 2013). Listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	No. No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Panonychus ulmi (Koch, 1836) [Tetranychidae] European red mite	Yes (AQSIQ 2006c)	Yes. NSW, SA, Tas., Vic., WA (Plant Health Australia 2001; Botha and Learmonth 2005; Halliday 2013)	Assessment not required	Assessment not required	Assessment not required	No
Tetranychus cinnabarinus (Boisduval, 1867) [Tetranychidae] Carmine spider mite	Yes (Wang 1981; Li *et al.*1997; Ma *et al.*2005)	Yes. All states and territories (CSIRO 2005; Halliday 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Tetranychus kanzawai Kishida, 1927 [Tetranychidae] Kanzawa spider mite	Yes (Wang *et al.*1981; Li *et al.*1997)	Yes. NSW, Qld (Navajas *et al.*2001; CSIRO 2005; Halliday 2013). This species is not present in WA and was not identified as a quarantine pest for WA and on the fresh summerfruit pathway in its pest risk analysis for fresh summerfruit from the eastern states (Poole *et al.*2011).	Assessment not required	Assessment not required	Assessment not required	No
Tetranychus ludeni Zacher, 1913 [Tetranychidae] Bean spider mite, dark-red spider mite	Yes (Wang 1981)	Yes. All states and territories (CSIRO 2005; Halliday 2013)	Assessment not required	Assessment not required	Assessment not required	No
Tetranychus mexicanus (McGregor, 1950) [Tetranychidae]	Yes (Cheng 1994)	No records found	No. Recorded causing damage to *P. persica* (Paschoal 1968). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Tetranychus neocaledonicus André, 1933 [Tetranychidae] Vegetable mite	Yes (Wang 1981)	Yes. NSW, NT, Qld, WA (Plant Health Australia 2001; Halliday 2013)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Tetranychus piercei McGregor, 1950 [Tetranychidae] Banana leaf mite	Yes (Wang 1981; Li *et al.*1997)	No records found	No. This mite is mainly a pest of banana, pawpaw and sweet potato (CABI 2014). It mainly attacks the leaves and stems (Zhang and Fu 2004). There is only a single record of peach as a host in Taiwan (Lo 1968). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Tetranychus turkestani Ugarov & Nikol'skii, 1937 Synonym: *Eotetranychus turkestani* Ugarov & Nikol'skii, 1937 [Tetranychidae] Strawberry spider mite	Yes (Chen *et al.*2007; CABI 2014)	No records found	Yes. *P. persica* is a host (Migeon and Dorkeld 2013). This mite feeds in colonies mainly on the lower surface of the leaf but the injury shows on the upper surface (Jeppson *et al.*1975). While fruit infestation appears to be uncommon, if population densities are high then mites may be associated with fruit. *Tetranychus turkestani* has been intercepted in South Africa on imported *Prunus* fruit from Spain (DAFF RSA 2014).	Yes. This species has a wide host range including willow, cucumber, melons, pumpkin, lucerne, cherry, peach, quince, grape and maize (Migeon and Dorkeld 2013). These host plants are widely distributed throughout Australia. This species is distributed throughout Europe, Africa, Asia, North America and New Zealand (Migeon and Dorkeld 2013). Many regions of Australia have similar climatic conditions to these areas suitable for its establishment.	Yes. A serious pest of many crops, with high populations able to cause leaf drop and plant death (Jeppson *et al.*1975).	Yes (EP)

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Tetranychus urticae Koch, 1836 Synonym: *Tetranychus bimaculatus* Harvey, 1892 [Tetranychidae] Two-spotted spider mite	Yes (CIQSA 2001b)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001; CSIRO 2005; Halliday 2013)	Assessment not required	Assessment not required	Assessment not required	No
Coleoptera						
Adoretus sinicus Burmeister, 1855 Synonym: *Adoretus tenuimaculatus* Waterhouse, 1875 [Scarabaeidae] Chinese rose beetle	Yes (Li *et al.*1997)	No records found	No. Adults feed on leaves of *P. persica* trees and larvae feed on roots (Hill 2008). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Anomala corpulenta Motschulsky, 1853 [Scarabaeidae]	Yes (AQSIQ 2006b)	No records found	No. Adults feed on the leaves and stems of *P. persica* trees (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Anomala cuprea (Hope, 1839) [Scarabaeidae] Cupreous chafer	Yes (Li *et al.*1997)	No records found	No. Adults feed on the leaves of *Prunus* spp. (Tayutivutikul and Kusigemati 1992). Larvae feed on roots and live in the soil (Hiromori and Nishigaki 1998). No reports of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Anthonomus pomorum (Linnaeus, 1758) [Curculionidae] Apple blossom weevil	Yes (Arakawa 1931)	No records found	No. Associated with *P. persica* (Arakawa 1931). Females deposit eggs in the tips of buds and larvae feed on the anthers, style and stigma (Schreiner 1914). Newly emerged adults feed on leaves (Arakawa 1931). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Anthonomus sp. [Curculionidae] Peach blossom weevil	Yes (Wu *et al.*1995)	No records found of this genus	No. Females deposit eggs singly on flower buds. The larvae feed on the flowers which fall to the ground, while adults feed on leaves (Wu *et al.*1995). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Gametis jucunda (Faldermann, 1835) [Scarabaeidae] Citrus flower chafer	Yes (AQSIQ 2006b)	No records found	No. Feeds on leaves and stems of *P. persica* (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Holotrichia diomphalia (Bates, 1888) [Scarabaeidae] Northeast larger black chafer	Yes (CAAS 1992; Tian and Hu 1992)	No records found	No. Associated with *P. persica* (CAAS 1992). Adults feed on the leaves, and larvae feed on roots (Chuno *et al.*1960). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Lamprodila limbata (Gebler, 1832) [Buprestidae] Golden jewel beetle	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves, stems and flowers of *P. persica* (AQSIQ 2006b; CABI 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Maladera orientalis (Motschulsky, 1857) [Scarabaeidae] Smaller velvety chafer	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* (AQSIQ 2006b). Generally, scarab beetle larvae feed on roots and adults feed on flowers and leaves (CABI 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Popillia japonica (Newman, 1841) [Scarabaeidae] Japanese beetle	Yes. *Popillia japonica* is reported as present in China (CAAS 1992; GSAGR 2010). However, MOA (2007) lists *P. japonica* as a quarantine pest for China. Some records may be a misidentification of *P. quadriguttata* (An 1990). Based on the available evidence, the Department considers *P. japonica* to be present in China.	No records found	No. Associated with *P. persica* (Fleming 1972). Larvae feed on plant roots, and eggs are preferentially laid in pasture and field crops (Fleming 1972). Adults can attack the fruit of early ripening varieties of peaches, but otherwise feed on leaves, flowers and externally on fruit (Fleming 1972). Adults are 8–10 millimetres long and brightly coloured (Fleming 1972). Likely to be disturbed during picking and would easily be detected during the packing process.	Assessment not required	Assessment not required	No
Proagopertha lucidula (Faldermann, 1835) [Scarabaeidae] Lucidula chafer	Yes (AQSIQ 2006b)	No records found	No. Feeds on leaves and stems of *P. persica* (AQSIQ 2006b). Generally, larvae feed on roots and adults feed on flowers and leaves (CABI 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Proagopertha pubicollis (Waterhouse, 1875) [Scarabaeidae] Apple hairy chafer	Yes (CIQSA 2001b)	No records found	No. Associated with *P. persica* (CIQSA 2001b). Generally, larval scarabs feed on roots and adults feed on flowers and leaves (CABI 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Protaetia brevitarsis Lewis, 1879 [Scarabaeidae] White-spotted flower chafer	Yes (CIQSA 2001b)	No records found	No. Associated with *P. persica* (CIQSA 2001b). Generally, larval scarabs feed on roots and adults feed on flowers and leaves (CABI 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Rhynchites auratus (Scopoli, 1763) [Rhynchitidae] Cherry weevil	Yes (CAAS 1992; Wang *et al.*1998)	No records found	Yes. Associated with *P. persica* (Dezianian 2005). Females oviposit deep into the fruit pulp where the larvae develop (Booth *et al.*1990).	Yes. Hosts of this species include apple and stonefruit (Booth *et al.*1990; Dezianian 2005). These hosts are distributed throughout Australia in domestic, commercial and wild environments where the weevils could establish. *Rhynchites auratus* is currently distributed from Europe to Siberia (Booth *et al.*1990). These regions span a range of climate types, many of which are similar to temperate areas throughout much of Australia.	Yes. Serious pest in Europe and Asia (Booth *et al.*1990; Wang *et al.*1998). A major pest of cherry and minor pest of apricot, peach, plum and almond in Iran (Dezianian 2005).	Yes (EP)
Rhynchites confragosicollis Voss, 1933 [Rhynchitidae] Peach curculio	Yes (Li *et al.*1997; CIQSA 2001b; CIQSA 2001c)	No records found	Yes. Associated with *P. persica* (Li *et al.*1997). Other weevils in this genus oviposit in the fruit where the larvae develop (Katsumata 1934; Hanson 1963; Booth *et al.*1990).	Yes. Pest of *P. persica* trees in China (Li *et al.*1997). These hosts are distributed throughout Australia. The climate in areas where *R. confragosicollis* occurs is similar to temperate areas in Australia.	Yes. Limited information is available on this species. However, other species within this genus have the potential for economic consequences.	Yes

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Rhynchites faldermanni Schoenherr, 1839 [Rhynchitidae] Peach weevil	Yes (CAAS 1992; China Plant Pests 2007)	No records found	Yes. Associated with *P. persica* (China Plant Pests 2007). Other weevils in this genus oviposit in the fruit where the larvae develop (Katsumata 1934; Hanson 1963; Booth *et al.*1990).	Yes. Pest of *P. persica* in China (China Plant Pests 2007). These hosts are distributed throughout Australia. Climatic conditions in the Russian Far East, China and Korea where *R. faldermanni* currently occurs are similar to some temperate areas of Australia.	Yes. This species causes significant fruit drop (China Plant Pests 2007).	Yes
Rhynchites heros Roelofs, 1874 [Rhynchitidae] Pear leaf weevil	Yes (CAAS 1992; Li *et al.*1997; CIQSA 2001a)	No records found	Yes. Associated with *P. persica* (Li *et al.*1997). Females deposit eggs in young fruit (Katsumata 1934; Hanson 1963).	Yes. Hosts of *R. heros* are fruit trees such as apple, pear, stonefruit, fig, quince and loquat (USDA 1958). Suitable hosts are distributed throughout Australia. *Rhynchites heros* is distributed in China, Japan and Korea (USDA 1958). These regions have similar climates to temperate regions of Australia.	Yes. Considered one of the most serious pests of fruit in China (Hanson 1963).	Yes (EP)
Urophorus humeralis (Fabricius, 1798) Synonym: *Carpophilus humeralis* (Fabricius, 1798) [Nitidulidae] Pineapple sap beetle	Yes (CABI 2014)	Yes. All states and territories (James *et al.*1995; James *et al.*2000; Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
Diptera						

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Bactrocera correcta (Bezzi, 1916) [Tephritidae] Guava fruit fly	Yes (Li *et al.*1997).	No records found	Yes. Associated with *P. persica* (Steck 2002; CABI 2014). Lays eggs on the skin of the fruit and the larvae bore into the fruit (CABI 2014). *Bactrocera correcta* is a quarantine pest of China. Limited distribution in south and southwest China (Li *et al.*1997).	Yes. Hosts of this pest include pawpaw, mango, cherry and peach and it is found across Asia (CABI 2014). Its hosts, and geographic, range suggest that it could establish and spread in Australia.	Yes. This pest has caused up to 80 per cent damage in guava crops (CABI 2014).	Yes (EP)
Bactrocera cucurbitae Coquillett, 1899 Synonym: *Dacus cucurbitae* Coquillett, 1899 [Tephritidae] Melon fly	Yes (Li *et al.*1997; Dhillon *et al.*2005; Huang 2006; CABI 2014)	No records found	No. Although *B. cucurbitae* was recorded on the dropped peach fruit on ground (Huang 2006), no records of *P. persica* on harvested commercial peach fruit was found. Limited distribution in south and southwest China (Li *et al.*1997; CABI 2014).	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Bactrocera dorsalis (Hendel, 1912) Synonym: *Dacus dorsalis* Hendel, 1912 [Tephritidae] Oriental fruit fly	Yes (Li *et al.*1997; Huang 2006; CABI 2014)	No records found	Yes. Associated with *P. persica*. Oviposits into the fruit of hosts. Eggs hatch inside the fruit and the larvae consume the fruit pulp (CABI 2014).	Yes. Found throughout Asia, with restricted distribution elsewhere. It has a wide host range, including capsicum, citrus, melon, apple, cherry and peach (CABI 2014). Its hosts and geographic range suggest that it could establish and spread in Australia.	Yes. The species is a very serious pest of a wide variety of fruit and vegetables, and damage levels can be anything up to 100 per cent of unprotected fruit (CABI 2014).	Yes (EP)

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Drosophila suzukii (Matsumura, 1931) [Drosophilidae] Spotted wing drosophila	Yes (Kaneshiro 1983; Toda 1991; Hu *et al.*1993; Damus 2009)	No records found	Yes. This species infests a range of fresh fruit including *P. persica* (Kanzawa 1939; Brewer *et al.*2012). Larvae and pupae develop internally in fruit (Dreves *et al.*2009; Lee *et al.*2011).	Yes. Attacks a broad range of ornamentals (Dreves *et al.*2009; NAPPO 2010) and commercially grown fruit, including apple, pear, grape, blueberry, raspberry, blackberry, cherry and stonefruit (CABI 2014). These hosts are widely available throughout Australia (AVH 2014). This species is considered native to Asia and has established and spread outside its native range to Europe, Canada, USA and South America (Hauser *et al.*2009). These regions have environments and climates similar to those found in various parts of Australia.	Yes. This species can cause significant economic damage to a range of commercial fruit crops (Bolda *et al.*2010; CABI 2014). It causes significant damage to commercial peaches, plums and apricots (Weydert 2011; Escudero Colomar *et al.*2011).	Yes (EP)
Hemiptera						

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Amrasca flavescens (Fabricius, 1794) [Cicadellidae] Green tea leafhopper	Yes (Li *et al.*1997)	No records found	No. Associated with *P. persica* (Li *et al.*1997). Little information is available on the biology of this pest. Members of this family (Cicadellidae) usually feed on leaves and stems, and secrete honeydew (Harvard Entomology 2006). Leafhoppers are highly mobile and would not remain on the fruit when disturbed during harvesting.	Assessment not required	Assessment not required	No
Aonidiella aurantii (Maskell, 1879) Synonym: *Aspidiotus aurantii* Maskell, 1879 [Diaspididae] Red scale	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Aonidiella citrina (Coquillett, 1891) [Diaspididae] Yellow scale	Yes. (CAAS 1992; CABI 2014)	Yes. NSW, Vic., SA, WA (Plant Health Australia 2001; Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Aphis craccivora Koch, 1854 [Aphididae] Cowpea aphid	Yes (Cao *et al.*2004; CABI 2014)	Yes. All states and territories (Plant Health Australia 2001). Because *A. craccivora* is a known vector of plum pox virus (which is absent from Australia) (Gildow 2004; CABI-EPPO 2007; Kaya *et al.*2014) the potential to be on the pathway needs to be assessed.	No. Young colonies concentrate on growing points of plants in spring. Feeds on young leaves, shoots and flowers (CABI 2014). No report of association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Aphis gossypii Glover, 1877 [Aphididae] Cotton aphid, Melon aphid	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001; Poole 2010). Because *A. gossypii* is a known vector of plum pox virus (which is absent from Australia) (Gildow 2004; CABI-EPPO 2007; Kaya *et al.*2014) the potential to be on the pathway needs to be assessed.	No. Prefers to feed on the undersides of young leaves causing infested leaves to curl downwards and appear wrinkled or reddened (CABI 2014). No report of association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Aphis spiraecola Patch, 1914 [Aphididae] Apple aphid	Yes (AQSIQ 2005)	Yes. ACT, NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001; Poole 2010). Because *A. spiraecola* is a known vector of plum pox virus (which is absent from Australia) (Gildow 2004; CABI-EPPO 2007; Kaya *et al.*2014) the potential to be on the pathway needs to be assessed.	No. Eggs are laid on smooth twigs and watersprouts. Adults prefer to feed on undersides of leaves, on growing shoot tips or the shoot stem although high populations can result in direct feeding on developing fruits (Beers *et al.*1993). No report of association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Apolygus lucorum (Meyer-Dür, 1843) Synonym: *Lygocoris lucorum* (Meyer-Dür, 1843) [Miridae] Green plant bug	Yes (Feng and Wang 2004; AQSIQ 2006b)	No records found	No. Feeds on fruit of *P. persica* (AQSIQ 2006b). Eggs laid in dead parts of tree branches (Pan *et al.*2014). Adults and nymphs will be disturbed during harvest and are not likely to remain with the fruit.	Assessment not required	Assessment not required	No
Aspidiotus destructor Signoret, 1869 [Diaspididae] Coconut scale	Yes (Watson 2005a; CABI 2014)	Yes. NSW, NT, Qld, Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Aspidiotus nerii Bouché, 1833 [Diaspididae] Oleander scale	Yes (Li *et al.*1997; CABI 2014)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
Bothrogonia ferruginea (Fabricius, 1787) [Cicadellidae] Black-tipped leafhopper	Yes (Li *et al.*1997)	No records found	No. Associated with *P. persica* (Li *et al.*1997). Little information is available on the biology of this pest. Members of this family (Cicadellidae) feed on various vascular plants, usually on the leaves and stems, and secrete honeydew (Harvard Entomology 2006). Leafhoppers are highly mobile and would not remain on the fruit when disturbed during harvesting.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Brachycaudus helichrysi (Kaltenbach, 1843) Synonym: *Anuraphis helichrysi* (Kaltenbach, 1843) [Aphididae] Leafcurl plum aphid	Yes (CAAS 1992; Feng and Wang 2004; Yang *et al.*2005)	Yes. ACT, NSW, Qld, SA, Tas., Vic., WA (APPD 2011). Because *B. helichrysi* is a known vector of plum pox virus (which is absent from Australia) (Gildow 2004; CABI-EPPO 2007; Kaya *et al.*2014) the potential to be on the pathway needs to be assessed.	No. Sucks sap from leaves, flower buds and newly formed fruit. Consequently the fruit either does not set or falls prematurely (CABI 2014).	Assessment not required	Assessment not required	No
Ceroplastes ceriferus Fabricius, 1798 [Coccidae] Indian wax scale	Yes (CABI 2014)	Yes. NSW, Qld, WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Ceroplastes floridensis Comstock, 1881 [Coccidae] Florida wax scale	Yes (CAAS 1992)	Yes. NSW, Qld (Plant Health Australia 2001). Listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	No. Primarily occurs on stems, leaves and branches (Miller *et al.*2007).	Assessment not required	Assessment not required	No
Ceroplastes japonicus Green, 1921 [Coccidae] Japanese wax scale	Yes (CAAS 1992)	No records found	No. Associated with *P. persica* (CAAS 1992; Sullivan and Molet 2011). Infestations occur on the foliage, stems and branches (Sullivan and Molet 2011). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Ceroplastes rubens Maskell, 1893 [Coccidae] Pink wax scale	Yes (Li *et al.*1997)	Yes. ACT, NSW, NT, Qld, SA, Vic., WA (Plant Health Australia 2001; CSIRO 2005).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Chrysomphalus aonidum (Linnaeus, 1758) [Diaspididae] Circular scale	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld, Tas., WA (Plant Health Australia 2001; Poole 2010; CABI 2014).	Assessment not required	Assessment not required	Assessment not required	No
Chrysomphalus dictyospermi (Morgan, 1889) [Diaspididae] Dictyospermum scale	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld, SA, WA (Plant Health Australia 2001; Poole 2010).	Assessment not required	Assessment not required	Assessment not required	No
Cicadella viridis (Linnaeus, 1758) Synonym: *Tettigella viridis* Linnaeus, 1758 [Cicadellidae] Green leafhopper	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Coccus hesperidum Linnaeus, 1758 [Coccidae] Brown soft scale	Yes (Li *et al.*1997; CABI 2014)	Yes. All states and territories (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
Cryptotympana atrata (Fabricius, 1775) Synonym: *Cryptotympana pustulata* (Fabricius, 1787) [Cicadidae] Oriental cicada	Yes (AQSIQ 2006b)	No records found	No. Associated with *P. persica* (AQSIQ 2006b). Adults feed on young branches and nymphs live in the soil and feed on roots (Feng and Wang 2004). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Diaspidiotus ostreaeformis (Curtis, 1843) Synonym: *Quadraspidiotus ostreaeformis* (Curtis, 1843) [Diaspididae] Oystershell scale	Yes (Ben-Dov *et al.*2014; CABI 2014)	Yes. NSW, SA, Tas., Vic. (Plant Health Australia 2001). This species is listed as a quarantine pest for WA (Poole *et al.*2011) and is listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Yes. Associated with *P. persica*. Mostly infests the bark on stems and branches of trees, but sometimes can be found on the fruit where it causes red spots (Beardsley Jr and Gonzalez 1975; CABI 2014).	Yes. This species has a wide host range, being reported from 41 genera in 18 families, mainly deciduous trees. Many of these host plants are widespread in Western Australia. It is widely distributed in Palaearctic and Nearctic regions and has been introduced into Australia, Argentina, Canada and New Zealand (CABI 2014). This species is already established in parts of Australia (Plant Health Australia 2001) suggesting that there are regions within Western Australia suitable for the establishment and spread of this pest.	No. The potential economic consequences would only apply to WA should this species enter, establish and spread. WA has assessed these consequences as 'very low' using similar methodology to the Australian Government Department of Agriculture(Poole *et al.*2011) which meets their ALOP.	No
Diaspidiotus perniciosus (Comstock, 1881) Synonym: *Quadraspidiotus perniciosus* (Comstock, 1881) [Diaspididae] California scale, San Jose Scale	Yes (Yang *et al.*2005; CABI 2014)	Yes. NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Didesmococcus koreanus Borchsenius, 1955 [Coccidae] Korean scale	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Drosicha corpulenta (Kuwana, 1902) [Monophlebidae] Giant mealybug	Yes (Xu *et al.*1999; CIQSA 2001b; Feng and Wang 2004)	No records found	No. Eggs overwinter in the soil, nymphs feed on young buds and pupate in cracks in the bark of the host (Xu *et al.*1999). Adult females and nymphs feed on stems and branches (Feng and Wang 2004). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Empoasca flavescens (Fabricius, 1794) Synonym: *Empoasca mali* (LeBaron, 1853) [Cicadellidae]	Yes (CIQSA 2001b; AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* (AQSIQ 2006b; CABI 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Eriosoma lanigerum (Hausmann, 1802) [Aphididae] Woolly aphid	Yes (CIQSA 2001a; CABI 2014)	Yes. NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001; CABI 2014).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Erthesina fullo (Thunberg, 1783) [Pentatomidae] Yellow spot stink bug	Yes (Feng and Wang 2004)	No records found	No. Pest of *P. persica* (Feng and Wang 2004). Eggs deposited in small masses on leaves (Hoffmann 1930). Adults and nymphs damage branches and fruit (Feng and Wang 2004). Adults and nymphs are highly mobile and would be likely to fall from the fruit during harvesting.	Assessment not required	Assessment not required	No
Erythroneura sudra (Distant, 1908) [Cicadellidae] Peach one spotted leafhopper	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* (CAAS 1992; AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Eulecanium excrescens (Ferris, 1920) Synonym: *Lecanium excrescens* Ferris, 1920 [Coccidae] Excrescent scale	Yes (Malumphy 2005)	No records found	No. Associated with *P. persica*, but only occurs on the bark or underside of leaves (Malumphy 2005). Females that overwinter on stems deposit their eggs underneath their protective scales (Malumphy 2005). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Eulecanium giganteum (Shinji, 1935) [Coccidae]	Yes (Yang *et al.*2008; Ben-Dov 2014a)	No records found	No. Associated with *P. persica*, but only feeds on twigs, branches and leaves (Yang *et al.*2008). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Eulecanium kunoense (Kuwana, 1907) [Coccidae] Globular peach scale	Yes (CIQSA 2001b; Feng and Wang 2004; AQSIQ 2006b)	No records found	No. Associated with *P. persica* (AQSIQ 2006b). Nymphs and adult females feed on branches and leaves (Feng and Wang 2004). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Geisha distinctissima (Walker, 1858) [Flatidae] Green broad-winged planthopper	Yes (Li *et al.*1997)	No records found	No. Associated with *P. persica* (Li *et al.*1997). On citrus, this planthopper feeds on young leaves (Clausen 1927) and it would be expected to behave similarly on nectarine trees. No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Halyomorpha halys Stål, 1855 [Pentatomidae] Yellow-brown stink bug	Yes (AQSIQ 2006b)	No records found	No. Associated with *P. persica* (CABI 2014). Eggs are attached, side-by-side, to the underside of leaves in masses of 20 to 30 (Jacobs 2014). Adults and nymphs feed on fruit, damaging the surface (Feng and Wang 2004) and the nymphs feed on leaves and stems (Hoebeke 2002). Adults and nymphs are highly mobile and would be likely to fall from the fruit during harvesting.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Hemiberlesia lataniae (Signoret, 1869) [Diaspididae] Latania scale	Yes (CABI 2014)	Yes. NSW, NT, Qld, Vic., WA (Plant Health Australia 2001; Watson 2005a; Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No
Homalogonia obtusa (Walker, 1868) [Pentatomidae] Four spotted stink bug	Yes (CAAS 1992; GAAS 2008b)	No records found	No. Associated with *P. persica* (Tayutivutikul and Kusigemati 1992; CAAS 1992; GAAS 2008b). Eggs laid in batches on leaves; nymphs feed on shoots, leaves and fruit (Funayama 2002). Adults and nymphs are highly mobile and would be likely to fall from the fruit during harvesting.	Assessment not required	Assessment not required	No
Hyalopterus amygdali Blanchard, 1840 [Aphididae] Mealy peach aphid	Yes (Feng and Wang 2004; AQSIQ 2006b)	No records found	No. Associated with *P. persica* (AQSIQ 2006b). Adults and nymphs feed on the underside of leaves (Feng and Wang 2004). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Hyalopterus pruni (Geoffroy, 1762) Synonym: *Hyalopterus arundinis* (Takahashi, 1924) [Aphididae] Mealy plum aphid	Yes (CAAS 1992; CIQSA 2001b; AQSIQ 2006b)	Yes. NSW, NT, Qld, SA, Tas., Vic. (Plant Health Australia 2001; CSIRO 2005). Because *H. pruni* is a known vector of plum pox virus (which is absent from Australia) (Gildow 2004; CABI-EPPO 2007; Kaya *et al.*2014) the potential to be on the pathway needs to be assessed.	No. Associated with *P. persica* (AQSIQ 2006b). Eggs are laid on the axils of lateral buds or into cracks in the bark. Adults and nymphs feed on flower buds, flowers and leaves (Smith 1936). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Icerya purchasi Maskell, 1878 [Monophlebidae] Cottony cushion scale	Yes (Li *et al.*1997)	Yes. All states and territories (Plant Health Australia 2001; CSIRO 2005).	Assessment not required	Assessment not required	Assessment not required	No
Icerya seychellarum (Westwood, 1855) [Monophlebidae] Seychelles mealybug	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld, WA (Plant Health Australia 2001; Poole 2010).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Lepidosaphes conchiformis (Gmelin, 1790) [Diaspididae] Pear oystershell scale	Yes (Ben-Dov *et al.*2014)	No records found	No. Associated with *P. persica* (Ben-Dov *et al.*2014). Feeds on leaves and branches (Kumral *et al.*2004; Watson 2005a; Ben-Dov *et al.*2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Lepidosaphes gloverii (Packard, 1869) Synonym: *Aspidiotus gloverii* Packard, 1869 [Diaspididae] Glover scale	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld and Vic. (Plant Health Australia 2001). This species is listed as a Permitted Organism (section 11) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Lepidosaphes pinnaeformis (Bouché, 1851) [Diaspididae] Purple scale	Yes (Ben-Dov *et al.*2014)	Yes. NSW, Qld, Tas., Vic., (Hudson 1967; Plant Health Australia 2001). This species is listed as a Permitted Organism (section 11) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Lepidosaphes tubulorum (Ferris, 1921) [Diaspididae] Dark oystershell scale	Yes (Ben-Dov *et al.*2014)	No records found	No. Associated with *P. persica* (Ben-Dov *et al.*2014). Feeds on stems (USDA-APHIS 2002). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Lepidosaphes ulmi (Linneaus, 1758) [Diaspididae] Oystershell scale	Yes (Ben-Dov *et al.*2014; CABI 2014)	Yes. NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001; CSIRO 2005).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Megacopta cribraria (Fabricius, 1798) [Plataspididae] Globular stink bug	Yes (Li *et al.*1997)	No records found	No. Associated with *P. persica* (Li *et al.*1997). On other hosts, females lay eggs on the underside of leaves (Ren 1984) and adults and nymphs feed on stems, leaves or legume pods (Wu *et al.*2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Myzus momonis (Matsumura, 1917) [Aphididae] Peach aphid	Yes (CIQSA 2001b)	No records found	No. Associated with *P. persica* (Li *et al.*1997). Attacks the lower surfaces of leaves; infested leaves become rolled (Takahashi 1923). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Myzus mumecola (Matsumura, 1917) [Aphididae] Plum aphid	Yes (CAAS 1992; Zhang 2009; Gansu Agricultural Academy 2012)	No records found	No. Associated with *P. persica* (MAFF 1989; CAAS 1992). Attacks the lower surfaces of leaves; infested leaves become rolled (Takahashi 1923). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Myzus persicae (Sulzer, 1776) Synonym: *Aphis persicae* Sulzer, 1776 [Aphididae] Green peach aphid	Yes (AQSIQ 2006b).	Yes. All states and territories (Plant Health Australia 2001; CSIRO 2005). Because *M. persicae* is a known vector of plum pox virus (which is absent from Australia) (Gildow 2004; CABI-EPPO 2007; Kaya *et al.*2014) the potential to be on the pathway needs to be assessed.	No. On summerfruit hosts, *M. persicae* feeds along the leaf veins of older leaves (Feng and Wang 2004; CABI 2014). Reproductive females usually lay their eggs, in crevices around and in axillary buds. Newly hatched nymphs feed on opened buds, flowers and soft shoots of peach trees (CABI 2014). No report of association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Naratettix zonatus (Matsumura, 1915) [Cicadellidae] Banded leafhopper	Yes (Yang 1965)	No records found	No. Leafhoppers usually feed on leaves (Yang 1965). Nymphs and adults are highly mobile and would be disturbed during harvest and are not likely to remain with the fruit.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Nezara antennata Scott, 1874 [Pentatomidae] Green stink bug	Yes (Li *et al.*2001; JNGPC 2008)	No records found	No. Associated with *P. persica* (Li *et al.*2001). Feeds on leaves and fruit. Nymphs and adults are highly mobile and would be disturbed during harvest and are not likely to remain with the fruit.	Assessment not required	Assessment not required	No
Nezara viridula (Linnaeus, 1758) [Pentatomidae] Green vegetable bug	Yes (Li *et al.*1997)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Nipaecoccus viridis (Newstead, 1894) [Pseudococcidae] Spherical mealybug	Yes (Li *et al.*1997)	Yes. NT, Qld, WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
Oncotympana maculaticollis (Motschulsky, 1866) [Cicadidae] Mingming cicada	Yes (Li *et al.*1997; CHNZX-Farming 2008b)	No records found	No. Associated with *P. persica*. Adults suck sap from and lay eggs in branches, and nymphs feed on sap of roots (CHNZX-Farming 2008b). No report of an association with mature nectarine or peach was found.	Assessment not required	Assessment not required	No
Parasaissetia nigra (Nietner,1861) Synonym: *Lecanium nigrum* Nietner, 1861 [Coccidae] Pomegranate scale	Yes (CABI 2014; Ben-Dov 2014a)	Yes. NSW, NT, Qld, SA, Vic., WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Parabemisia myricae (Kuwana, 1927) [Aleyrodidae] Bayberry whitefly	Yes (Li *et al.*1997)	Yes. Qld (CSIRO 2005). This species was not identified as a quarantine pest in WA's risk analysis for stonefruit from the eastern states (Poole *et al.*2011).	Assessment not required	Assessment not required	Assessment not required	No
Parlatoreopsis chinensis (Marlatt, 1908) Synonym: *Parlatoria chinensis* Sasscer, 1919 [Diaspididae] Chinese obscure scale	Yes (Miller and Davidson 2005; Ben-Dov *et al.*2014)	No records found	No. Associated with *P. persica* (Denning 1942; Baker *et al.*1943). It attacks stems, twigs and leaves (Baker *et al.*1943). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Parlatoria oleae (Clovée, 1880) [Diaspidae] Olive parlatoria scale, Olive scale	Yes (Li *et al.*1997; Chen 2003; Yang *et al.*2008)	Yes. NSW, Qld, WA (CSIRO 2005; Taylor and Burt 2007).	Assessment not required	Assessment not required	Assessment not required	No
Parlatoria pergandii Comstock, 1881 Synonym: *Parlatoria camelliae* Comstock, 1883 [Diaspididae] Black parlatoria scale, Chaff scale	Yes (Li *et al.*1997; Ben-Dov *et al.*2014)	Yes. NSW, Qld (CSIRO 2005). This species was not identified as a quarantine pest in WA's risk analysis for stonefruit from the eastern states (Poole *et al.*2011).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Parlatoria proteus (Curtis, 1843) [Diaspididae] Common parlatoria scale	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld, SA, WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
Parthenolecanium corni (Beuché, 1844) [Coccidae] Plum scale, European fruit lecanium	Yes (Feng and Wang 2004; Yang *et al.*2008)	Yes. NSW, Vic., Tas. (CSIRO 2005). This species was not identified as a quarantine pest for WA and on the fresh summerfruit pathway in its pest risk analysis for fresh summerfruit from the eastern states (Poole *et al.*2011).	Assessment not required	Assessment not required	Assessment not required	No
Parthenolecanium orientalis Borchsenius, 1957 [Coccidae] Oriental scale	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Parthenolecanium persicae (Fabricius, 1776) [Coccidae] European peach scale	Yes (Li *et al.*1997)	Yes. ACT, NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
Pinnaspis strachani (Cooley, 1898) [Diaspididae] Hibiscus snow scale	Yes (Ben-Dov *et al.*2014; CABI 2014)	Yes. NSW, NT, Qld, WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Planococcus citri (Risso, 1813) [Pseudococcidae] Citrus mealybug	Yes (Li *et al.*1997)	Yes. All states and territories (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
Plautia stali Scott, 1874 [Pentatomidae] Brown winged green stinkbug	Yes (Liu and Zheng 1994; Schaefer and Panazzi 2000; CABI 2014)	No records found	No. Associated with *P. persica* (Schaefer and Panazzi 2000). Nymphs and adults are highly mobile and would be disturbed during harvest and are not likely to remain with the fruit.	Assessment not required	Assessment not required	No
Pseudaonidia duplex (Cockerell, 1899) [Diaspididae] Camphor scale	Yes (Li *et al.*1997; Watson 2005a)	No records found	Yes. Associated with *P. persica* (Hodges 2005). Mainly feeds on the bark of stems and branches (Shiao 1977), but it also attacks leaves and fruit (Watson 2005a).	Yes. This species has hosts in 57 genera in 10 plant families (Davidson and Miller 1990) including *Prunus*, *Pyrus* and *Citrus* species (Watson 2005a), which are widely cultivated in Australia. Climatic conditions in many parts of Australia will be suitable for its establishment and spread.	Yes. A serious pest of tea in Taiwan. Male [nymphs] attack leaves while the females attack branches, eventually leading to plant death (Shiao 1977).	Yes

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Pseudaulacaspis pentagona (Targioni-Tozzetti, 1886) [Diaspididae] White peach scale	Yes (AQSIQ 2006b);	Yes. NSW, Qld (Plant Health Australia 2001). This species is listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Yes. This pest is mainly associated with leaves, branches and stems of *P. persica* (Feng and Wang 2004; Yang *et al.*2005; AQSIQ 2006b), but can infest fruit (Watson 2005a).	Yes. Has been recorded on hosts from 108 genera in 55 plant families (Ben-Dov *et al.*2014). Many of these hosts are present in Australia. This species is found across Asia and Europe as well as eastern Australia (CABI 2014). Its geographic distribution indicates that this species has the potential to establish and spread in Western Australia.	No. The potential economic consequences would only apply to WA should this species enter, establish and spread. WA has assessed the consequences as 'very low' using similar methodology to the Australian Government Department of Agriculture(Poole *et al.*2011) which meets their ALOP.	No
Pseudaulacaspis prunicola (Maskell, 1895) [Diaspididae]	Yes (Davidson and Miller 1990; Ben-Dov *et al.*2014)	No records found	Yes. A pest of *P. persica* (Miller and Davidson 1990). It feeds on the bark, fruit and occasionally on leaves (Davidson and Miller 1990).	Yes. Crawlers are the primary dispersal stage and are dispersed by wind or animal contact (Davidson and Miller 1990). This species is recorded on host plants belonging to 21 genera in 16 families (Davidson and Miller 1990). Climatic conditions in many parts of Australia will be suitable for its establishment and spread.	Yes. In the USA and Japan this scale is a serious pest of *Prunus* spp. (Davidson and Miller 1990; MAFF 2008). Despite control measures this pest sometimes kills its host plants (Davidson and Miller 1990).	Yes (EP)

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Pseudococcus calceolariae (Maskell, 1879) Synonym: *Pseudococcus gahani* Green, 1915 [Pseudococcidae] Citrophilus mealybug	Yes (Li *et al.*1997; Ben-Dov 2014b)	Yes. NSW, Qld, SA, Tas., Vic. (Smith *et al.*1997; Plant Health Australia 2001; CABI 2014). This species is listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Yes. This pest occurs on a wide variety of plants including *Prunus* spp. (Ben-Dov 2014b). Nymphs and adults seek shelter under the fruit calyx, between touching fruit and on leaves. Adult females may reproduce in these protected sites (Smith *et al.*1997).	Yes. A highly polyphagous species that has been recorded on plants in 40 families, including many commercial and nursery plants such as apple, pear, grape, stonefruit, potato, hibiscus and rose (Smith *et al.*1997; Ben-Dov 2014b). These hosts are widespread in Western Australia. This species is considered to be native to eastern Australia and now also occurs in the USA, South America, New Zealand, South Africa and Europe as well as China. Conditions in Western Australia will be suitable for its establishment and spread.	No. Reported as the main pest of stonefruit, citrus and grape (Smith *et al.*1997; CABI 2014). The potential economic consequences would only be applicable to WA should this species enter, establish and spread. WA has assessed these consequences as 'very low' using similar methodology to the Australian Government Department of Agriculture(Poole *et al.*2011) which meets their ALOP.	No

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Pseudococcus comstocki (Kuwana, 1902) Synonym: *Dactylopius comstocki* Kuwana, 1902 [Pseudococcidae] Comstock mealybug	Yes (CABI 2014; Ben-Dov 2014b)	No records found	Yes. Associated with *P. persica* (Ben-Dov 2014b). Females and third instar nymphs infest fruits localising in the stem end of nectarines and peaches (Pellizzari *et al.*2012).	Yes. This species feeds on many host plants and is known to damage several horticultural crops such as banana, peach, pear, lemon, apricot, cherry and mulberry (Ben-Dov 2014b). These hosts are widespread throughout Australia. This species is believed to be of Asian origin, possibly indigenous to Japan, (Kuwana 1902) and has been recorded from numerous countries throughout the world (CABI 2014). This indicates that this species has the ability to adapt to new environments and would be able to establish and spread in Australia.	Yes. Occasionally a serious pest in apple, pear and peach orchards in eastern USA (Bartlett *et al.*1978). A common pest on mulberry, apple and pear in Japan (Murakami *et al.*1967). It damages several agricultural crops including banana, pear, lemon, apricot, cherry peach, and mulberry as well as several ornamental and shade trees (CABI 2014). Weires (1984) recorded extensive losses from this mealybug in apple orchards.	Yes (EP)
Pseudococcus longispinus (Targioni Tozzetti, 1867) [Pseudococcidae] Longtail mealybug	Yes (CABI 2014)	Yes. All states and territories (Plant Health Australia 2001; CSIRO 2005)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Pulvinaria vitis (Linnaeus, 1758) Synonym: *Coccus betulae* Linnaeus, 1758 [Coccidae] Cottony grape scale	Yes (Zhang and Wu 2007; Yang *et al.*2008; Ben-Dov 2014a)	No records found	No. Associated with *P. persica* (Phillips 1963). Found on the stems and underside of leaves; immature females overwinter on twigs of host (Landcare Research 2014).	Assessment not required	Assessment not required	No
Rhodococcus turanicus (Archangelskaya, 1937) Synonym: *Lecanium coryli turanicum* Archangelskaya, 1937 [Coccidae]	Yes (Yang *et al.*2008)	No records found	No. Yang (2008) reported that this pest only attacks the twigs, branches and leaves of *P. persica*. No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Rhopalosiphum padi (Linnaeus 1758) [Aphididae] Oat aphid	Yes (Li *et al.*1997)	Yes. NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Saissetia coffeae (Walker, 1852) [Coccidae] Hemispherical scale	Yes (Li *et al.*1997)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Saissetia oleae (Bernard, 1782) [Coccidae] Olive scale	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Sphaerolecanium prunastri (Boyer de Fonscolombe, 1834) [Coccidae] Plum scale	Yes (Yang *et al.*2005; CABI 2014)	No records found	No. Associated with *P. persica*. It completes its whole lifecycle on the trunk, branches or twigs of its host plant (CABI 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Stephanitis nashi Esaki & Takeya, 1931 [Tingidae] Pear lace bug	Yes (AQSIQ 2006b).	No records found	No. Causes damage to many fruit trees including *P. persica* (Li *et al.*1997; Shanghai Insects Online 2014). Eggs are laid on the underside of leaves. Nymphs feed in groups on the underside of leaves on both sides of main veins. Adults overwinter on the ground in fallen leaves and branches, crevices, grasses and gaps in soil (Shanghai Insects Online 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Takahashia japonica (Cockerell, 1896) [Coccidae] String cottony scale	Yes (Li *et al.*1997; Ben-Dov 2014a)	No records found	No. This species only attacks the leaves and stems of *P. persica* (MAFF 1989; MAFF 1990). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Toxoptera citricidus (Kirkaldy, 1907) [Aphididae] Brown citrus aphid	Yes (Li *et al.*1997)	Yes. ACT, NSW, Qld, SA, Vic. and WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
Tuberocephalus momonis (Matsumura, 1917) Synonym: *Myzus spinulosa* Matsumura, 1917 [Aphididae] Peach aphid	Yes (CAAS 1992; CIQSA 2001b; Feng and Wang 2004)	No records found	No. Associated with *P. persica* (Li *et al.*1997). Adults and nymphs feed on buds and leaves (CAAS 1992; Feng and Wang 2004). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Urochela luteovaria Distant, 1881 [Urostylidae] Pear stink bug	Yes (Feng and Wang 2004)	No records found	No. Adults and nymphs feed on branches and fruit of *P. persica* (Feng and Wang 2004). However, adults and nymphs are highly mobile and will not stay on the fruit during harvesting when they are disturbed.	Assessment not required	Assessment not required	No
Hymenoptera						

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Pristiphora sinensis Wong, 1977 [Tenthredinidae]	Yes (Wu *et al.*2006a)	No records found	No. Causes damage to the leaves of *P. persica* (Wu *et al.*2006a). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Lepidoptera						
Acleris fimbriana (Thunberg, 1791) [Tortricidae]	Yes (Han and Ma 1996; Liu and Meng 2003; AQSIQ 2006b)	No records found	No. Feeds on leaves and stems of *P. persica* in China (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Acrobasis pirivorella (Matsumura, 1900) [Pyralidae] Pear pyralid	Yes (Li *et al.*1997; Gao *et al.*2004)	No records found	No. A pest of *P. persica* in China (Li *et al.*1997). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Acronicta intermedia Warren, 1909 Synonym: *Acronycta incretata* Hampson, 1909 [Noctuidae] Apple dagger moth	Yes (Sun and Wang 1999)	No records found	No. A pest of *P. persica* (Sun and Wang 1999). Eggs laid on leaves and larvae feed on leaves (Bailey and Caon 1986; CABI 2014). Larvae also chew on fruit skin causing scarring (Feng and Wang 2004); such fruit would be removed during packing shed operations. It overwinters as pupae in the soil (Feng and Wang 2004).	Assessment not required	Assessment not required	No
Acronicta rumicis (Linnaeus, 1758) [Noctuidae] Knotgrass moth	Yes (Fu *et al.*2009; CABI 2014)	No records found	No. Associated with *P. persica* (Feng and Wang 2004). Eggs laid on bark and the underside of leaves (Feng and Wang 2004). Larvae feed on young leaves in colonies and overwinter in the soil as pupae (Feng and Wang 2004).	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Acronicta strigosa (Denis & Schiffermüller, 1775) [Noctuidae] Cherry dagger moth	Yes (Cao and Wang 1986)	No records found	No. A pest of *P. persica* and other fruit trees (Cao and Wang 1986). Larvae feed on leaves (Bailey and Caon 1986; Cao and Wang 1986). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Actias selene ningpoana Felder & Felder, 1862 [Saturniidae] Chinese moon moth	Yes (He 1991)	No records found	No. Associated with *P. persica* (Feng and Wang 2004). Larvae feed on leaves (Feng and Wang 2004). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Adoxophyes orana (Fischer von Roeslerstamm, 1834) Synonym: *Adoxophyes fasciata* Walsingham, 1900 [Tortricidae]	Yes (CIQSA 2001b; AQSIQ 2006b)	No records found	Yes. Associated with *P. persica* (Milonas and Savopoulou-Soultani 2000). The larvae feed on leaves, shoots and fruit. Eggs are also sometimes deposited on fruit (Davis *et al.*2005).	Yes. Feeds on a wide range of plant families (Davis *et al.*2005; Zhou and Deng 2005). Fruit trees and other hosts occur commonly throughout Australia. This species has established and spread outside its native range in areas where it has been introduced, for example, Greece (Savopoulou-Soultani *et al.*1985). Its host range and demonstrated ability to establish and spread in new environments suggests that it could establish and spread in Australia.	Yes. A major pest of fruit tree crops in China and elsewhere in the world and has been reported to cause up to 50 per cent crop loss (Davis *et al.*2005). The polyphagous nature of *A. orana* indicates the potential for consequences across a wide range of fruit growing industries, as well as for wild plants.	Yes (EP)
Agrotis ipsilon (Hufnagel, 1766) [Noctuidae] Black cutworm	Yes (Li *et al.*1997)	Yes. ACT, NSW, NT, Qld, SA, Tas., WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Amphipyra pyramidea Linnaeus, 1758 [Noctuidae] Copper underwing	Yes (Zhang 2005; CHNZX-Farming 2008a)	No records found	No. Larvae have been found on *P. persica* trees (Chapman and Lienk 1974). Larvae feed on leaves and occasionally chew on the skin of fruit (CHNZX-Farming 2008a). Larvae feed externally on fruit and would be dislodged during harvesting and packing operations.	Assessment not required	Assessment not required	No
Anarsia lineatella Zeller, 1839 Synonym: *Anarsia pruniella* (Clerck, 1759) [Gelechiidae] Peach twig borer	Yes (Yang *et al.*2005)	No records found	Yes. Associated with *P. persica* (CABI 2014). Larvae feed on shoots and bore into fruit. Females lay eggs on shoots, the underside of the leaves and on developing fruit (Reding and Alston 2003).	Yes. Feeds on *Prunus* spp. (CABI 2014). Prunus species are common as residential and amenity plantings and are also commercially grown in many areas of Australia. It is widespread in North America, Europe, Asia and North Africa (CABI 2014), which have regions with similar climates to parts of Australia. The pest's host range and current distribution suggest that it could establish and spread in Australia.	Yes. Feeds on fruit reducing marketability; a major pest of stonefruit across North America, Europe, Asia and North Africa (CABI 2014). In California, it has previously been reported to cause damage to 71 per cent of almond kernels in susceptible cultivars and may still cause extensive losses in the absence of adequate control measures (Rice *et al.*1996).	Yes (EP)

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Anomis mesogona (Walker, 1858) [Noctuidae] Anomis fruit moth	Yes (Li *et al.*1997)	No records found	No. Associated with *P. persica* (CABI 2014). *Anomis mesogona* is a nocturnal fruit piercing moth whose adults pierce and suck the juice from fleshy fruit. This large, wary moth shelters in foliage away from fruit during daylight hours (USDA 2002) therefore it would not be present on fruit during harvesting.	Assessment not required	Assessment not required	No
Aporia crataegi adherbal Fruhstorfer, 1910 [Pieridae] Blackveined white butterfly	Yes (Grichanov and Ovsyannikova 2009)	No records found	No. Larvae damage leaves and buds of *P. persica* (Grichanov and Ovsyannikova 2009). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Archips breviplicanus Walsingham, 1900 [Tortricidae] Asiatic leafroller	Yes (Byun *et al.*2003)	No records found	No. Associated with *P. persica* (Meijerman and Ulenberg 2000a). Larvae feed on leaves (Jung *et al.*2001) and buds (Meijerman and Ulenberg 2000a). Eggs are laid in batches on the underside of fully expanded leaves (Meijerman and Ulenberg 2000a). The older larvae attack young fruit and make shallow feeding scars on fruit that are in contact with leaves (Meijerman and Ulenberg 2000a). Surface feeding of the fruit will result in blemishes. These fruit will be removed during harvesting and packing house procedures.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Archips xylosteana (Linnaeus, 1758) [Tortricidae] Apple leafroller, Variegated golden tortrix	Yes (Hwang 1974; Byun *et al.*2003; CABI 2014)	No records found	No. Present on *P. persica* (Byun *et al.*2003; CABI 2014). Eggs are laid in batches on trunks or branches (Meijerman and Ulenberg 2000a). Larvae feed on buds, fully expanded leaves and sometimes on fruitlets resulting in corky blemishes on the fruits (Alford 2007; Hoebeke *et al.*2008). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Argyrotaenia ljungiana (Thunberg, 1797) Synonym: *Argyrotaenia pulchellana* (Haworth, 1811) [Tortricidae] Grape tortrix, Grey-barred twist	Yes (Byun *et al.*2003; Afonin *et al.*2008)	No records found	Yes. Larvae attack fruit of *P. persica* (Briolini and Giunchi 1966; Kharizanov 1976; Castellari 1988). Larvae feed on both foliage and fruit (Kharizanov 1976; Carter 1984).	Yes. Attacks a large number of ornamental and cultivated host plants as well as forest trees (Baggiolini 1961; Tremblay 1966; Briolini and Giunchi 1966; Carter 1984; INRA 1997; Meijerman and Ulenberg 2000a; Pollini 2008; Afonin *et al.*2008). The species has a broad host range and its current distribution in China suggests that it could establish and spread in many parts of Australia.	Yes. This species is one of the most important insect pests of apricot, peach and plum in Europe (Baggiolini 1961; Briolini and Giunchi 1966; Kharizanov 1976; Castellari 1988; Afonin *et al.*2008). It is a significant pest of fruit production, industrial, ornamental, and field cultures in the southern regions of Russia (Afonin *et al.*2008).	Yes

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Artena dotata (Fabricius, 1794) [Noctuidae]	Yes (Li *et al.*1997)	No records found	No. Fruit-piercer of *P. persica* (Bänziger 1982). Both larvae and adult moths are inactive during the day and hide amongst foliage or leaf litter. During the night, adults usually feed on overripe or fermenting fruit (Common 1990) and will fly away when disturbed.	Assessment not required	Assessment not required	No
Bhima undulosa Walker, 1855 [Lasiocampidae]	Yes (Wu and Huang 1986)	No records found	No. Found on *P. persica* (Wu and Huang 1986). Larvae feed on leaves and overwinter on bark close to the ground. Eggs are laid in the fork of branches (Wu and Huang 1986). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Biston panterinaria (Bremer & Grey, 1853) Synonym: *Culcula panterinaria* (Bremer & Grey, 1853) [Geometridae] Chinese pistacia looper	Yes (Zhu *et al.*1985; Li *et al.*1997; Ding *et al.*2006; FSLY 2010)	No records found	No. *P. persica* is a host tree (Yu 2001). Larvae feed on leaves (Ding *et al.*2006; FSLY 2010). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Calyptra gruesa (Draudt, 1950) Synonym: *Calpe gruesa* (Draudt, 1950) [Noctuidae]	Yes (ZDCBIC 2005; Savela 2009)	No records found	No. Attacks *P. persica* (Hattori 1969). Both larvae and adult moths are inactive during the day and hide amongst the foliage or leaf litter. At night adults usually feed on overripe or fermenting fruit (Common 1990) and will fly away when disturbed.	Assessment not required	Assessment not required	No
Calyptra lata (Butler, 1881) Synonyms: *Calpe lata* (Butler, 1881) [Noctuidae]	Yes (Savela 2009)	No record found	No. Attacks *P. persica* (Hattori 1969). Both larvae and adult noctuid moths are inactive during the day and hide amongst the foliage or leaf litter. At night adults suck sap of fruit (GAAS 2008a) and will fly away when disturbed.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Calyptra thalictri (Borkhausen, 1790) [Noctuidae] Fruit piercing moth	Yes (Li *et al.*1997; Savela 2009)	No records found	No. This pest attacks *P. persica* (Hattori 1969). Both larvae and adults of fruit piercing moths are inactive during the day and hide in foliage or leaf litter (Common 1990). Larvae feed on leaves at night and usually fall to the ground when disturbed (Hattori 1969). Adults usually feed on overripe or fermenting fruit (Common 1990) and will fly away when disturbed.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Carposina sasakii Matsumura, 1900 Synonym: *Carposina niponensis* Walsingham, 1900 [Carposinidae] Peach fruit borer	Yes (AQSIQ 2006c)	No records found	Yes. Feeds on fruit of *P. persica* (Zhang *et al.*1995; AQSIQ 2006b). Females lay eggs on the fruit near the calyx. Larvae may tunnel into fruit and feed on the flesh and seed (CABI 2014).	Yes. This species feeds on a wide range of cultivated fruit trees, such as apple, pear and stonefruit, especially the Rosaceae but also other families. This pest is capable of spreading independently as the adult moths can fly long distances (CABI 2014). *Carposina sasakii* is known to have established and spread outside its native range in areas where it has been introduced. In Russia, internal quarantine measures are employed in an attempt to control the spread of *C. sasakii* (CABI 2014). *C sasakii* is found throughout many areas of China as well as Japan, Korea and Russia (CABI 2014). The pest's host range, current distribution and demonstrated ability to spread in new areas suggest that it could establish and spread in Australia.	Yes. *Carposina sasakii* is a very serious pest of fruit crops, causing up to 100 per cent crop loss in apple and pear orchards (Sytenko 1960; Gibanov and Sanin 1971; CABI 2014). It causes significant economic consequences in its current range and would potentially do so in Australia. Consequences would include crop losses as well as quarantine restrictions on trade, both within Australia and internationally to areas where *C. sasakii* is not present.	Yes (EP)

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Choreutis pariana (Clerck, 1759) [Choreutidae] Apple-and-thorn skeletonizer	Yes (Yin *et al.*1987)	No records found	No. Larvae feed on leaves of *P. persica* (Yin *et al.*1987). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Choristoneura longicellana (Walsingham, 1900) [Tortricidae] Common apple leaf roller	Yes (Feng and Wang 2004)	No records found	No. Associated with *P. persica* (Robinson *et al.*2010). Larvae mainly damage leaves and branches and the females lay eggs on the surface of the leaves (Byun *et al.*2003; Feng and Wang 2004). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Clania variegata (Snellen, 1879) [Psychidae] Cotton bag worm	Yes (AQSIQ 2006c)	Yes. NT, WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Conogethes punctiferalis (Guenée 1854) [Pyralidae] Yellow Peach moth	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld, SA, Vic., WA (Plant Health Australia 2001; Poole 2010). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Cydia pomonella Linnaeus, 1758 Synonym: *Laspeyresia pomonella* (Linnaeus, 1758) [Tortricidae] Codling moth	Yes (Yang *et al.*2005; Men *et al.*2013)	Yes. ACT, NSW, NT, Qld, SA, Tas., Vic. (Plant Health Australia 2001). Eradicated from WA (Poole 2010; CABI 2014). This species is listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Yes. Pest *of P. persica* (Yang *et al.*2005; Alford 2007; Men *et al.*2013). There is a marked tendency for young fruit of peach and nectarine to exude gum at the site of attempted entry resulting in larval mortality (Smith 1929). Codling moth infestations associated with secondary hosts are usually in close proximity to apple orchards (Barnes 1991).	Yes. Main hosts are apple and pear. Larvae are known to be polyphagous feeding on apple, pear, peach, nectarine, Japanese plum, prune, quince, walnut and maize (Alford 2007; CABI 2014). These hosts are widespread in Western Australia. *Cydia pomonella* has been reported from all Australian states and territories except Western Australia. However, several outbreaks have occurred in Western Australia and have been successfully eradicated, indicating that climatic conditions are suitable for its establishment in Western Australia.	Yes. Codling moth is a serious pest of apples and pears (Alford 2007; CABI 2014). In the Czech republic, codling moth has been reported to cause 80 per cent damage to apples in untreated plots and up to 30 per cent damage in chemically treated plots (Stará and Kocourek 2007). The potential economic consequences would only apply to WA should this species enter, establish and spread.	Yes (EP, WA)
Cystidia couaggaria (Guenee, 1858) [Geometridae] Canker worm	Yes (Zhang *et al.*1995)	No records found	No. Associated with *P. persica* (Robinson *et al.*2010). Larvae feed on flower buds, young leaves and shoots (AQSIQ 2006c). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Endoclyta excrescens (Butler, 1877) Synonym: *Phassus excrescens* (Butler, 1877) [Hepialidae] Japanese swift moth	Yes (Zhang 2005)	No records found	No. A pest of *P. persica* (MAFF 1989). Larvae of this species feed internally on the woody parts (trunk, branches, stems, roots)of their host plants (Grehan 1989; Zhang 2005).	Assessment not required	Assessment not required	No
Eudocima fullonia (Clerck, 1764) Synonym: *Othreis fullonia* (Clerck, 1764) [Noctuidae]	Yes (ZDCBIC 2005)	NSW, NT, Qld, WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Eudocima tyrannus (Guenée, 1852) [Noctuidae]	Yes (AQSIQ 2006a)	No records found	No. *P. persica* is a host of this species (Robinson *et al.*2010) which is a primary fruit-piercer of peach (Bänziger 1982). Both larvae and adult noctuid moths are inactive during the day and hide amongst foliage or leaf litter. During the night, adults usually feed on overripe or fermenting fruit (Common 1990) and will fly away when disturbed.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Gastropacha quercifolia (Linneaus, 1758) [Lasiocampidae] Lappet moth	Yes (Sun and Wang 1999)	No records found	No. Associated with *P. persica* (Panait and Ciortan 1972). Larvae feed on flower buds and leaves (Panait and Ciortan 1972). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Grapholita funebrana Treitschke, 1835 Synonym: *Cydia funebrana* (Treitschke, 1835) [Tortricidae] Plum fruit moth	Yes (Kang *et al.*1989; AQSIQ 2006b)	No records found	Yes. Damages *P. persica* fruit (AQSIQ 2006b; CABI 2014). Females lay eggs on fruitlets. Newly hatched larvae bore into the fruitlets. Larval feeding continues for several weeks until they reach the fifth instar (Meijerman and Ulenberg 2000a). Second generation females lay eggs near the base of developing fruit (Gilligan and Epstein 2012).	Yes. Main hosts are species of the genus *Prunus* (including plum, apricot, cherry, peach) and also apple (Meijerman and Ulenberg 2000a). Other hosts include chestnut and almond (CABI 2014). Present in north east China and across central Asia to Turkey, also present in Algeria and throughout Europe (CABI 2014). Host plants of this pest are grown across Australia. Australia also has similar climatic conditions to areas where the pest currently occurs. It is likely that this pest could establish and spread in Australia.	Yes. This species is one of the most important lepidopteran pests of fruit in Europe. Larvae can cause significant damage to apricot, cherry, peach, plum and other *Prunus* species (Gilligan and Epstein 2012; CABI 2014). In plum orchards, first generation larvae are reported to cause 8–12 per cent damage, but second and third generation larvae caused up to 33 per cent damage (Andreev and Kutinkova 2010).	Yes

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Grapholita molesta (Busck, 1916) Synonym: *Cydia molesta* (Busck, 1916) [Tortricidae] Oriental fruit moth	Yes (CIQSA 2001a; CIQSA 2001b; AQSIQ 2006b)	Yes. ACT, NSW, Qld, SA, Tas., Vic. (Plant Health Australia 2001; CABI 2014). This species is listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Yes. A pest of *P. persica* in China (Li *et al.*1997; CIQSA 2001b; AQSIQ 2006b). Early instar larvae may penetrate fruit through the side of the stem. Such fruit has no obvious signs of the presence of the larva inside the fruit. The larvae remain inside the fruit, feeding until ready to pupate (Howitt 1993).	Yes. The principal economic hosts are peach, apricot, nectarine, almond, apple, quince, pear, plum and cherry (Howitt 1993). Many woody ornamental plants are also hosts (Howitt 1993). Late ripening peach cultivars are particularly vulnerable to this pest. Some of these host species are widespread in Western Australia. *Grapholita molesta* is already reported from all other Australian states and territories (Plant Health Australia 2001) except the Northern Territory (Poole *et al.*2011). The previously eradicated incursion of *G. molesta* in Western Australia indicates that areas with a suitable environment for the establishment of *G. molesta* occur in Western Australia.	Yes. A major pest of stonefruit throughout the world and a principal economic pest of apple, pear and quince (Rothschild and Vickers 1991; Gilligan and Epstein 2012; CABI 2014). In severe attacks, young trees can suffer distortion of growing shoots and stems leading to economic losses (CABI 2014). The potential economic consequences would only be applicable to WA should this species enter, establish and spread.	Yes (EP, WA)

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Helicoverpa armigera (Hubner, 1805) [Noctuidae] Cotton bollworm	Yes (AQSIQ 2006b)	Yes. All states and territories (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
Homona magnanima Diakonoff, 1948 [Tortricidae] Oriental tea tortrix	Yes (Li *et al.*1997)	No records found	No. Feeds on *P. persica* (Meijerman and Ulenberg 2000a). Eggs are laid on the upper surface of leaves. Larvae web mature leaves together to form a nest from which to feed on leaves and young shoots (Meijerman and Ulenberg 2000a). Fruits are not affected (CABI 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Hyphantria cunea (Drury, 1773) [Arctiidae] Fall webworm	Yes (Feng and Wang 2004)	No records found	No. Larvae feed on leaves of *P. persica* (Feng and Wang 2004; Robinson *et al.*2010). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Latoia consocia (Walker, 1863) [Limacodidae] Green urticating caterpillar	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* in China (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Leucoptera malifoliella (Costa, 1836) Synonym: *Leucoptera scitella* (Zeller, 1839) [Lyonetiidae] Pear leaf miner	Yes (CIQSA 2001b; CABI 2014)	No records found	No. Associated with *P. persica* (Robinson *et al.*2010). It is generally a leaf-eating pest, but overwinters on twigs, branches, trunks and on the soil surface (Maciesiak 1999). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Lymantria dispar (Linnaeus, 1759) [Lymantriidae] Asian gypsy moth	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* in China (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Lyonetia clerkella (Linneaus, 1758) [Lyonetiidae] Peach leaf miner	Yes (AQSIQ 2006c)	No records found	No. Common leaf and stem feeder on *P. persica* in China (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Malacosoma neustria testacea Motschulsky, 1861 [Lasiocampidae] Tent caterpillar	Yes (Feng and Wang 2004)	No records found	No. Associated with *P. persica* in China (Feng and Wang 2004). Eggs are laid on twigs and are the overwintering stage. Larvae feed on leaves in spring (Feng and Wang 2004). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Malacosoma parallela (Staudinger, 1887) [Lasiocampidae] Mountain ring silk moth	Yes (Yang *et al.*2005)	No records found	No. Associated with *P. persica* (CABI 2014). Larvae feed on leaves (Yang *et al.*2005). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Mamestra brassicae (Linnaeus, 1758) [Noctuidae] Cabbage armyworm	Yes (CABI-EPPO 1984; CABI 2014)	No records found	No. Larvae are primarily associated with *Brassica* crops (CABI 2014), but also feed on *P. persica* (Molinari *et al.*1995). Eggs are laid on the underside of leaves; larvae feed on leaves (CABI 2014). This pest only has an incidental association with peach and nectarine in orchards where understorey grass is high and other preferred host plants are present. Damage is only to the outside of ripening fruit (Molinari *et al.*1995) Larvae feed externally on fruit and would be dislodged during harvesting and packing operations.	Assessment not required	Assessment not required	No
Marumba goschkewitshi (Bremer & Grey, 1852) [Sphingidae] Peach horn worm	Yes (Sun and Wang 1999; CIQSA 2001b; Feng and Wang 2004)	No records found	No. Associated with leaves and stems of *P. persica* in China (Feng and Wang 2004; AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Monema flavescens (Walker, 1855) [Limacodidae] Oriental moth	Yes (CIQSA 2001b; Lammers and Stigter 2004)	No records found	No. Associated with leaves and stems of *P. persica* in China (AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Oraesia emarginata (Fabricius, 1794) [Noctuidae]	Yes (Liu and Kuang 2001)	Yes. Qld (Plant Health Australia 2001). This species is listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013). Not a regulated pest for Tas. (DPIPWE 2013).	No. A pest of *P. persica* (Liu and Kuang 2001). Both larvae and adult noctuid moths are inactive during the day and hide amongst foliage or leaf litter. During the night, adults usually feed on overripe or fermenting fruit (Common 1990). Adults fly off from the fruit, once disturbed.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Oraesia excavata (Butler, 1878) [Noctuidae]	Yes (Liu 2002)	No records found	No. Associated with *P. persica* (Robinson *et al.*2010). Both larval and adult noctuid moths are inactive during the day and hide amongst foliage or leaf litter. During the night, adults usually feed on overripe or fermenting fruit (Common 1990). Adults fly off fruit, once disturbed.	Assessment not required	Assessment not required	No
Pandemis cerasana (Hübner, 1786) Synonym: *Pandemis ribeana* Hübner, 1797 [Tortricidae] Common twist moth	Yes (Hwang 1974; CABI 2014)	No records found	No. Associated with *P. persica* (CABI 2014). Egg masses are laid on leaves. Larvae feed on leaves and can also nibble at the skin of fruit near foliage (INRA 1997). Larvae overwinter as young larvae protected in a silken shelter under a dry leaf fixed by a silken thread to the branches (CABI 2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Pandemis heparana Denis & Schiffermüller, 1775 [Tortricidae] Apple brown tortrix	Yes (AQSIQ 2006b; AQSIQ 2006c)	No records found	No. Feeds on *P. persica* (Ma 2006; Gilligan and Epstein 2012). Eggs laid in masses on upper surface of leaves. Larvae feed on leaves and construct a hibernaculum under bark in the second or third instar in which to overwinter (INRA 1997; Gilligan and Epstein 2012). Larvae only feed superficially on fruit (Ma 2006) and it is rarely reported from summerfruit (CABI 2014). If present, this pest would be removed during harvest and post-harvest packing procedures (Feng and Wang 2004).	Assessment not required	Assessment not required	No
Peridroma saucia (Hübner, 1808) [Noctuidae] Pearly underwing moth	Yes (Kuang 1985; CABI 2014)	No records found	No. Present on *P. persica* (CABI 2014). Adult females oviposit on the ground or on the leaves of weeds. Upon hatching, larvae feed on the leaves of hosts and fully grown larvae overwinter in the soil (Kuang 1985). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Phalera flavescens (Bremer & Grey, 1852) [Noctuidae] Cherry caterpillar	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* in China (CIQSA 2001b; AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Phyllonorycter ringoniella (Matsumura, 1931) [Gracillariidae] Apple leafminer	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* in China (CIQSA 2001b; AQSIQ 2006b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Recurvaria syrictis Meyrick, 1925 [Gelechiidae]	Yes (Cao and Guo 1987)	No records found	No. A pest of *P. persica*. Larvae feed on mesophyll tissue in leaves (Cao and Guo 1987). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Serrodes campana Guenée, 1852 [Noctuidae]	Yes (Li *et al.*1997)	Yes. NSW, Qld (Plant Health Australia 2001). This species is listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013). Not a regulated pest for Tas. (DPIPWE 2013).	No. Adults pierce *P. persica* fruit and the larvae feed on leaves (Hattori 1969). Both larvae and adult noctuid moths are inactive during the day and hide amongst foliage or leaf litter. During the night, adults usually feed on overripe or fermenting fruit (Common 1990). Adults fly off from the fruit, once disturbed.	Assessment not required	Assessment not required	No
Setora postornata (Hampson, 1900) [Limacodidae] Brown cochild	Yes (Fang *et al.*2001)	No records found	No. *P. persica* listed as a host; larvae feed on the leaves (Ruiting *et al.*2014). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Spilonota albicana (Motschulsky, 1866) Synonym: *Spilonota prognathana* (Sneller, 1883) [Tortricidae] White fruit moth	Yes (AQSIQ 2006c)	No records found	Yes. Feeds on *P. persica* (Kondo and Miyahara 1930; Zhang and Qi 2013). Eggs are usually laid on underside of leaves but can be laid directly into plum fruit (Zhang and Qi 2013). The larvae bore directly into the fruit (Kondo and Miyahara 1930), most often at the calyx (Afonin *et al.*2008).	Yes. This species has a wide range of hosts including apple, pear, apricot, peach, plum (Kondo and Miyahara 1930; Zhang and Li 2005). It is widespread across China, and is also present in Japan, Korea and Russia (Ma 2006; Afonin *et al.*2008). Its host range and current distribution suggest that it could establish and spread in Australia.	Yes. A pest of apple, pear, hawthorn, peach, plum, apricot and cherry (Afonin *et al.*2008). Up to 85 per cent of an apple crop can be damaged by this pest (Afonin *et al.*2008).	Yes (EP)

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Spilosoma subcarnea (Walker, 1855) [Arctiidae]	Yes (Feng and Wang 2004)	No records found	No. Associated with *P. persica* (Feng and Wang 2004). Larvae feed on leaves, in some cases only leaving the stem and veins of the leaf. Later instar larvae feed on the surface of fruit in addition to feeding on leaves (Feng and Wang 2004). Later instar larvae are easily detectable because they are large (approximately 46–55 millimetres), colourful and hairy, and would be removed during harvest or post-harvest packing procedures (Feng and Wang 2004).	Assessment not required	Assessment not required	No
Stathmopoda auriferella (Walker, 1864) Synonym: *Stathmopoda crocophanes* Meyrick, 1897 [Oecophoridae] Apple heliodinid	Yes (Shanghai Insects Online 2014)	Yes. SA, Tas., Vic., WA (Plant Health Australia 2001; CSIRO 2005) (as *Stathmopoda crocophanes*).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Synanthedon hector (Butler, 1878) Synonym: *Conopia hector* Butler, 1878 [Sesiidae] Cherry tree borer, Apple borer	Yes (AQSIQ 2006c)	No records found	No. Serious pest of *P. persica* (Matsumoto *et al.*2007). Larval sesiids are stem borers of fruit trees and shrubs and do not feed on the fruit (CABI 2014). The larvae of this species bore into the lower trunk of trees and feed on the cambium layer (Naka *et al.*2008). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Telphusa chloroderces Meyrick, 1929 [Gelechiidae] Black star-spotted gelechid moth	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* (CIQSA 2001b). No report of association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Thosea sinensis (Walker, 1855) [Limacodidae] Coconut cup moth	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves and stems of *P. persica* (CIQSA 2001b). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Thyas juno (Dalman, 1823) [Noctuidae]	Yes (Li *et al.*1997; CABI 2014)	No records found	No. Associated with *P. persica* (CABI 2014). Both larvae and adult noctuid moths are inactive during the day and hide amongst foliage or leaf litter. During the night, adults usually feed on overripe or fermenting fruit (Common 1990). Adults fly off fruit, once disturbed.	Assessment not required	Assessment not required	No
Trifurcula sinica (Yang, 1989) [Nepticulidae]	Yes (Yang 1989; Wang *et al.*2007)	No records found	No. Associated with *P. persica* (Yang 1989; Wang *et al.*2007). Larvae form galls on young branch tips of apricot (Wang *et al.*2007). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Xestia c-nigrum (Linnaeus, 1758) [Noctuidae] Spotted cutworm	Yes (CABI 2014)	No records found	No. This insect is a pest of *P. persica* (CABI 2014). The larvae prefer to feed on foliage. Any damage by larval feeding on fruit results in deep external erosions (Molinari *et al.*1995). Larvae feed at night, and then descend to the ground to hide during the day (CABI 2014) and would not be present at harvest.	Assessment not required	Assessment not required	No
Orthoptera						
Gryllus bimaculatus DeGeer, 1773 [Gryllidae] Field cricket	Yes (Li *et al.*1997)	No records found	No. Associated with *P. persica* (Li *et al.*1997). Usually feeds on seeds, seedlings, leaves and also sometimes on grasshoppers and caterpillars (Saeed *et al.*2000). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Holochlora japonica Brunner von Wattenwyl, 1878 [Tettigoniidae] Japanese broad winged katydid	Yes (Li *et al.*1997)	No records found	No. Associated with *P. persica* (Li *et al.*1997). May feed on the surface of fruit but would jump away when disturbed during harvesting.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Tarbinskiellus portentosus (Lichtenstein, 1796) [Gryllidae] Rice field cricket	Yes (Li *et al.*1997)	No records found	No. Associated with *P. persica* (Li *et al.*1997). Adults and nymphs live in the soil and emerge at night. Feeds on seedlings and tender shoots of agricultural crops and nursery stock (Li *et al.*1997). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Thysanoptera						
Frankliniella intonsa (Trybom, 1895) [Thripidae] Eurasian flower thrips	Yes (Li *et al.*1997; CABI 2014)	No records found	Yes. Principally a pest of flowers and strawberries, but is reported to cause damage to developing *P. persica* fruit (CABI 2014). It feeds and lays eggs in fruit (CABI 2014).	Yes. Wide host range including cotton, peanuts, leafy vegetables, rice, sugarcane, sweet potato, capsicum, asparagus, strawberry, bean, pea, rose and tomato (Li *et al.*1997; CABI 2014). Distributed over a range of environments across Asia including China, the Middle East, North America, Europe and New Zealand. Its host range and geographic range suggests potential for establishment and spread.	Yes. Feeds on fruit and lays eggs in fruit reducing marketability. Can be a vector of economically important tospoviruses such as Tomato spotted wilt tospovirus (TSWV) (Wijkamp *et al.*1995; Jones 2005; CABI 2014).	Yes (EP)

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Frankliniella occidentalis (Pergande, 1895) [Thripidae] Western flower thrips	Yes (Lu *et al.*2007)	Yes. All states and ACT (Plant Health Australia 2001) but is absent from NT. Regulated for the NT (Northern Territory Government 2011).	Yes. Pest of *P. persica* (CABI 2014). Affects the fruiting stages of its hosts feeding on, and laying eggs in the fruit (CABI 2014). It has been collected on nectarine fruit during harvest (Tommasini and Ceredi 2007).	Yes. Wide host range and distributed worldwide. It has a limited distribution in Australia, indicating that suitable environments exist in Australia for this thrips to establish (Jones 2005; Davidson *et al.*2006; CABI 2014). The high fecundity, short generation time, and capacity to reproduce by parthenogenesis suggests that minimal numbers are required for establishment of founding populations (Morse and Hoddle 2006). Under optimal conditions, thrips populations could potentially establish from a single female (Morse and Hoddle 2006).	Yes. Direct damage through feeding and oviposition may scar leaf, flower, or fruit surfaces and/or deform plant growth (Dreistadt and Phillips 2007b). Leaves may become mottled, dwarfed and distorted with browned or wilted margins and may drop prematurely (Smith and Van Driesche 2003; Dreistadt and Phillips 2007b). This species is one of the most important greenhouse pests in the world and is also a major pest of some outdoor crops in warmer climates (CABI 2014). It is also an important vector of plant diseases (CABI 2014).	Yes (EP, NT)
Heliothrips haemorrhoidalis (Bouché, 1833) [Thripidae] Greenhouse thrips	Yes (Li *et al.*1997)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Scirtothrips dorsalis Hood, 1919 [Thripidae] Yellow tea thrips, Chilli thrips, Strawberry thrips	Yes (CABI-EPPO 2010)	Yes. NSW, NT, Qld (Plant Health Australia 2001) and WA (Poole 2010).	Assessment not required	Assessment not required	Assessment not required	No
Thrips flavus Schrank, 1776 [Thripidae] Eurasian yellow flower thrips, Honeysuckle thrips	Yes (Li *et al.*1997; Liang *et al.*2007; CABI 2014)	Yes. NSW (Plant Health Australia 2001)	No. Pest of *P. persica* (Veer 1985). This thrips feeds on the lower surface of leaves and on floral parts and lays eggs in petals, the walls of the ovary in young fruit or on the lower surface of the leaves (Veer 1985). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Thrips tabaci Lindeman, 1888 [Thripidae] Onion thrips	Yes (Li *et al.*1997; AQSIQ 2006a)	Yes. All states and territories (Plant Health Australia 2001; Poole 2010).	Assessment not required	Assessment not required	Assessment not required	No
BACTERIA						
Pseudomonas syringae pv. *syringae* van Hall 1902 Synonym: *Pseudomonas syringae* f.sp.*prunicola* (Wormald) Dowson 1949 [Pseudomonadales: Pseudomonadaceae] Bacterial canker	Yes (AQSIQ 2006b)	Yes. All states and territories (Bradbury 1986; Plant Health Australia 2001).	Assessment not required	Assessment not required	Assessment not required	No
CHROMALVEOLATA						

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Phytophthora cactorum (Lebert & Cohn) Schröt. [Peronosporales: Peronosporaceae]	Yes (CIQSA 2001a)	Yes. ACT, NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Phytophthora cambivora (Petri) Buisman [Peronosporales: Peronosporaceae]	Yes (Bounous and Liu 1996)	Yes. NSW, Qld, SA, Vic., WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
FUNGI						
Alternaria alternata (Fr.) Keissl. [Pleosporales: Pleosporaceae] Alternaria leaf blight	Yes (Zhuang 2005)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Alternaria tenuissima (Kunze) Wiltshire [Pleosporales:Pleosporaceae]	Yes (Zhuang 2005)	Yes. All states (Plant Health Australia 2001; DAWA 2006)	Assessment not required	Assessment not required	Assessment not required	No
Armillaria tabescens (Scop.) Emel [Agaricales: Physalacriaceae] Armillaria root rot	Yes (AQSIQ 2006b)	No records found	No. Infects roots (Drake 1990). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Ascochyta pruni Kabát & Bubák [Pleosporales: Incertae sedis]	Yes (Bai 2003)	No records found	No. Affects leaves (Bai 2003). No report of association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Ascochyta prunicola P.K. Chi [Pleosporales: Incertae sedis]	Yes (Bai 2003)	No records found	No. Affects leaves (Bai 2003). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Aspergillus awamori Nakaz. [Eurotiales: Trichocomaceae]	Yes (Zhuang 2005)	No records found	Yes. Most *Aspergillus* spp. are saprotrophs, but can also affect stored fruit, acting as opportunistic pathogens that grow on living tissues (Huber 1930; CABI 2014).	Yes. *Aspergillus* spp. are rapidly growing filamentous fungi or moulds that are ubiquitous in the environment and are found worldwide. *Aspergillus* disperse easily and grow almost anywhere when food and water are available (Bennett 2010). They commonly grow in soil and moist locations and are among the most common moulds encountered on spoiled food and decaying vegetation, in compost piles and in stored hay and grain. Many other species of this genus are present in Australia (Plant Health Australia 2001).	No. *Aspergillus* spp. are secondary invaders of fruits that have been damaged by insects, pathogens, environmental factors such as rain and wind (Somma *et al.*2012). Many other species of this genus are present in Australia (Plant Health Australia 2001). Introduction of this species is unlikely to have significant economic effects.	No
Aspergillus japonicus Saito [Eurotiales: Trichocomaceae]	Yes (Tai 1979)	Yes. NSW (Burrows 1976), Qld (Upsher and Upsher 1995)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Aspergillus niger Tiegh. [Eurotiales: Trichocomaceae]	Yes (Tai 1979)	Yes. ACT, NSW, NT, Qld, SA, Vic., WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Aspergillus versicolor (Vuill.) Tirab. [Eurotiales: Trichocomaceae]	Yes (Tai 1979)	Yes. All states and territories (Global Biodiversity Information Facility 2013)	Assessment not required	Assessment not required	Assessment not required	No
Botryosphaeria dothidea (Moug.) Ces. & De Not. Synonym: *Fusicoccum aesculi* Corda Grossenb. & Duggar [Botyosphaeriales: Botryosphaeriaceae]	Yes (AQSIQ 2006b)	Yes. NSW, Qld, Vic., WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Botryosphaeria ribis Grossenb. & Duggar Synonym: *Neofusicoccum ribis* (Slippers, Crous & M. J. Wingf.) Crous, Slippers & A. J. L. Phillips [Botryosphaeriales: Botryosphaeriaceae]	Yes (AQSIQ 2006b)	Yes. ACT, NSW, Qld, Vic, WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Botryosphaeria obtusa (Schwein.) Shoemaker Synonym: *Physalospora obtusa* (Schwein.) Cooke [Botyosphaeriales: Botryosphaeriaceae]	Yes (Tai 1979)	Yes. All states and territories (Sampson and Walker 1982; Plant Health Australia 2001; Cunnington *et al.*2007).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Botrytis cinerea Pers. Synonym: *Botryotinia fuckeliana* (de Bary) Whetzel [Heliotiales: Sclerotiniaceae]	Yes (AQSIQ 2006b)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Camarosporium persicae Maubl. [Botryosphaeriales: Incertae sedis] Camarosporium canker	Yes (Zhuang 2005)	No records found	No. Attacks trunks, branches and young shoots of *P. persica* (Homma 1927). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Caryospora putaminum (Schwein.) De Not. [Pleosporales: Zopfiaceae]	Yes (Jeffers 1940)	No records found	No. Grows on dead woody tissues and is found on *P. persica* stones that are left on the ground after the fruit has decomposed (Jeffers 1940). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Ceratocystis fimbriata Ellis & Halst. [Microascales: Ceratocystidaceae] Mallet wound fungus	Yes (Huang *et al.*2007)	No. There are several apparently host-specialized strains that are sometimes called 'types', 'races', or 'forms' (Vogelzang and Scott 1990; Harrington 2000; Baker *et al.*2003). *Ceratocystis fimbriata* records reported in Australia are all from *Syngonium* and is not pathogenic to *Prunus* spp. (Vogelzang and Scott 1990).	No. Unlikely to be on the pathway as *C. fimbriata* does not infect the fruit (CABI 2015).	Assessment not required	Assessment not required	No
Cercospora rubrotincta Ellis & Everh. [Capnodiales: Mycosphaerellaceae]	Yes (Tai 1979)	No records found	No. Causes leaf spots on *P. persica* (Farr and Rossman 2014). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Chondrostereum purpureum (Pers.) Pouzar [Russulales: Stereaceae] Silver leaf	Yes (Zhuang 2005)	Yes. NSW, SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Cladosporium cladosporioides (Fresen.) G.A. De Vries [Capnodiales: Davidiellaceae]	Yes (AQSIQ 2006b)	Yes. All states and territories (Plant Health Australia 2001; DAWA 2006)	Assessment not required	Assessment not required	Assessment not required	No
Colletotrichum acutatum J.H. Simmonds [Incertae sedis: Glomerellaceae] Anthracnose	Yes (Farr and Rossman 2014)	Yes. ACT, NSW, Qld., SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Colletotrichum gloeosporioides (Penz.) Penz. & Sacc. Synonym: *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk [Incertae sedis: Glomerellaceae] Anthracnose, bitter rot	Yes (AQSIQ 2006b)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Coniothyrium nakatae Hara [Pleosporales: Leptosphaeriaceae]	Yes (Tai 1979)	No records found	No. *Coniothyrium* spp. are common wood and soil inhabiting fungi (Damm *et al.*2008). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Coryneum foliicola Fuckel [Diaporthales: Pseudovalsaceae]	Yes (Tai 1979)	No records found	No. On branches, twigs and leaves (Farr *et al.*1995). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Davidiella tassiana (De Not.) Crous & U. Braun Synonym: *Cladosporium herbarum* (Pers.) Link. [Capnodiales: Mycosphaerellaceae]	Yes (Zhuang 2005)	Yes. NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Dermea cerasi (Pers.) Fr. Synonym: *Foveostroma drupacearum* (Lév.) DiCosmo [Helotiales: Dermateaceae]	Yes (Teng 1996).	Yes. NSW, Vic. (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Diaporthe amygdali (Delacr.) Udayanga, Crous & K.D. Hyde Synonyms: *Phomopsis amygdali* (Del.) Tuset & Portilla [Botryosphaeriales: Botryosphaeriaceae] Fusicoccum canker, Constriction canker	Yes (Tai 1979)	No records found	No. Affects *P. persica* shoots and fruit causing withering of infected fruit (MAFF 2008). Leaves and twigs are the most affected tissues and fruit infections are rare (Zehr 1995a). Young peach fruit can become infected via the shoots that eventually wilt and drop off (Lalancette and Robison 2002; MAFF 2008).	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Diaporthe eres Nitschke Synonym: *Phomopsis oblonga* (Desm.) Traverso [Diaporthales: Diaporthaceae] Constriction canker	Yes (Tai 1979)	Yes. NSW (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Fomes fasciatus (Sw.) Cooke [Polyporales: Polyporaceae]	Yes (Reinking 1919)	No records found	No. Parasitic on woody parts of trees (Reinking 1919; Zhao and Zhang 1992). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Fomes fomentarius (L.) J.J. Kickx [Polyporales: Polyporaceae]	Yes (Zhuang 2005)	Yes. Vic. (Plant Health Australia 2001). An unwanted quarantine pest for Tas. (revoked list A pest) (DPIPWE 2013). Listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	No. Saprophytic or parasitic on dead, rotten or living wood of trees (Zhuang 2005). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Fomes fulvus (Scop.) Gillet [Polyporales: Polyporaceae]	Yes (AQSIQ 2006b)	Yes. Qld (Plant Health Australia 2001). An unwanted quarantine pest for Tas. (revoked list A pest) (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	No. Associated with branches of *P. persica* (Farr and Rossman 2014). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Fomitopsis pinicola (Sw.) P. Karst. [Polyporales: Fomitopsidaceae] Brown cubical rot	Yes (Zhuang 2005)	Yes. Vic. (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	No. Wood decay pathogen that affects *P. persica* (CABI 2014). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Fusarium avenaceum (Fr.) Sacc. Synonym: *Gibberella avenacea* R.J. Cook [Hypocreales: Nectriaceae]	Yes (Tai 1979)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Fusarium lateritium Nees Synonym: *Gibberella baccata* (Wallr.) Sacc. [Hypocreales: Nectriaceae]	Yes (Tai 1979)	Yes. NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Fusarium oxysporum Schltdl. [Hypocreales: Nectriaceae]	Yes (AQSIQ 2006b)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Fusarium solani (Mart.) Sacc. Synonym: *Nectria haematococca* Berk. & Broome [Hypocreales: Nectriaceae]	Yes (AQSIQ 2006a)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Geotrichum candidum Link [Saccharomycetales: Dipodascaceae] Citrus sour rot	Yes (Tai 1979)	Yes. NSW, NT, Qld, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Gloeodes pomigena (Schwein.) Colby [Phyllachorales: Phyllachoraceae]	Yes (AQSIQ 2006b)	Yes. NSW, Qld, Tas., WA (Simmonds 1966; Sampson and Walker 1982; Shivas 1989; Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Inonotus hispidus (Bull.) P. Karst. [Hymenochaetales: Hymenochaetaceae]	Yes (Tai 1979)	No records found	No. Parasitic on wood (Grand and Vernia 2005; CABI 2014). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Irpex lacteus (Fr.) Fr. [Polyporales: Meruliaceae]	Yes (Zhuang 2005)	Yes. NSW (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Laetiporus sulphureus (Bull.) Murrill [Polyporales: Fomitopsidaceae] Sulphur fungus	Yes (Zhuang 2005)	Yes. NSW, Qld (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Lasiodiplodia theobromae (Pat.) Griffon & Maubl. Synonym: *Botryosphaeria rhodina* (Berk. & M.A. Curtis) Arx (1970) [Botryosphaeriales: Botryosphaeriaceae] Blister canker, Peach gummosis	Yes (Farr and Rossman 2014)	Yes. NSW, NT, Qld, SA, WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Leptosphaeria yulan Sacc. [Pleosporales: Leptosphaeriaceae]	Yes (Yu 1940)	No records found	No. Leaf spot disease affecting *P. persica* (NIAS 2009) and not associated with fruit (MAFF 2010).	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Leptoxyphium fumago (Woron.) R.C. Srivast. Synonym: *Caldariomyces fumago* Woron.; Fumago vagans Pers. [Capnodiales: Capnodiaceae]	Yes (Tai 1979)	Yes. NSW, Qld, SA, (Phillips 1994; Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Leucotelium pruni-persicae (Hori) Tranzschel. [Pucciniales: Uropyxidaceae] White rust of peach	Yes (Teng 1996)	No records found	No. Disease only occurs on leaves and is heteroecious with *Semiaquilegia adoxoides* plants being the alternate host (Kitajima and Sawamura 1995). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Monilia mumecola Y. Harada, Y. Sasaki & Sano [Helotiales; Sclerotiniaceae] Brown rot	Yes (Hu *et al.*2011)	No records found	Yes. This fungus causes brown rot of *P. persica* in China (Hu *et al.*2011; Yin *et al.*2013).	Yes. *Monilia mumecola* causes brown rot of apricot, peach and nectarine (Hu *et al.*2011; Yin *et al.*2013). These hosts are widespread in Australia. It has been reported from Hubei in southern China and Japan. The climatic conditions in many parts of Australia are similar to these countries.	Yes. *Monilia mumecola* causes brown rot of apricot, peach and nectarine which is an economically important disease (Hu *et al.*2011; Yin *et al.*2013).	Yes

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Monilia polystroma G. Leeuwen [Heliotales: Sclerotiniaceae] Brown rot	Yes (Zhu *et al.*2011)	No records found	Yes. This fungus causes brown rot of fruit (Farr and Rossman 2014).	Yes. Affects, amongst other hosts, *Prunus* spp. (Farr and Rossman 2014). *Monilia polystroma* produces specialised structures during infection which protect the infected fruit against degradation and decomposition. This inhibition in degradation of infected fruit may enhance survival and subsequently increase the amount of primary inoculum (van Leeuwen *et al.*2002). This fungus disperses easily over long distances by wind or attached to vectors. Suitable climatic conditions for spore germination occur in many parts of Australia, specifically in southern temperate Australia (Farr and Rossman 2014).	Yes. Causes significant yield losses and loss of vigour of apple, pear and *Prunus* species (van Leeuwen *et al.*2002).	Yes
Monilinia fructicola (G. Winter) Honey [Helotiales: Sclerotiniaceae]	Yes (AQSIQ 2006b)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Monilinia fructigena Honey [Helotiales; Sclerotiniaceae] Brown rot	Yes (AQSIQ 2006b; AQSIQ 2007)	No records found	Yes. Causes brown rot of pome and stonefruits (Ogawa *et al.*1995; Farr and Rossman 2014).	Yes. *Monilinia fructigena* can infect many fruit crops including apple, pear, plum, quince, peach, apricot, nectarine and hazel (Byrde and Willets 1977). These host plants are widely available in Australia. The spores of this fungus can be spread from one orchard to another through air (Byrde and Willets 1977; Jones 1990).	Yes. *Monilinia fructigena* causes significant yield losses both before and after harvest. In Europe, losses of 7–36 per cent were reported in individual orchards (Jones 1990).	Yes (EP)
Monilinia laxa (Aderh. & Ruhland) Honey [Helotiales: Sclerotiniaceae] Blossom and twig rot, Gummosis, Brown rot, Fruit rot	Yes (Feng and Wang 2004)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Monilinia yunnanensis M. J. Hu & C. X. Luo [Helotiales; Sclerotiniaceae] Brown rot	Yes (Hu *et al.*2011)	No records found	Yes. Causes brown rot of peach fruit and survives in mummified fruit (Hu *et al.*2011).	Yes. *Monilinia yunnanensis* has recently been reported from Yunnan and Liaoning in China (Hu *et al.*2011). Suitable climatic conditions for spore germination would occur in many parts of Australia.	Yes. *Monilinia yunnanensis* which causes brown rot of *Prunus persica* in China, is most closely related to *M. fructigena,* a species widely prevalent in Europe (Hu *et al.*2011). *Monilinia fructigena* causes significant yield losses both before and after harvest with losses of 7–36 per cent being reported (Jones 1990). It is considered that *M. yunnanensis* will produce similar economic consequences.	Yes
Mucor circinelloides Tiegh. [Mucorales: Mucoraceae] Mucor fruit rot	Yes (Zhuang 2005)	Yes. Qld, Vic. (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and listed as a permitted organism (section 11) in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Mucor racemosus Fresen. [Mucorales: Mucoraceae] Spongy storage rot	Yes (Zhuang 2005)	Yes. ACT, NSW, Vic. (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and listed as a permitted organism (section 11) in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Mycosphaerella cerasella Aderh. Synonyms: *Cercospora cerasella* Sacc.; *Cercospora circumscissa* Sacc. [Capnodiales: Mycosphaerellaceae] Shot hole	Yes (AQSIQ 2006b)	Yes. NSW, NT, Qld, SA, Vic. (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013). Listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	No. Causes necrotic spots on leaves of *P. persica* that coalesce and drop out leaving shot-hole symptoms (Sztejnberg 1995). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Mycosphaerella pruni-persicae Deighton Synonym: *Mycosphaerella persicae* B.B. Higgins & F.A. Wolf [Capnodiales: Mycosphaerellaceae] Frosty mildew of peach	Yes (Tai 1979)	No records found	No. Affects leaves of *P. persica* (Zehr 1995b). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Nectria cinnabarina (Tode) Fr. Synonym: *Tubercularia vulgaris* Tode [Hypocreales: Nectriaceae]	Yes (Zhuang 2005)	Yes. NSW, Qld, Tas., Vic. (Plant Health Australia 2001). Listed as a regulated pest (prohibited (section 12)) in the Western Australian organism list (Government of Western Australia 2013).	No. Occurs as a saprophyte on dead wood but can be a weak opportunistic wound parasite on various hosts including *Prunus* spp. (Hirooka *et al.*2005; MBG Integrated Pest Management 2011). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Oxyporus populinus (Schumach.) Donk [Incertae sedis: Incertae sedis]	Yes (Teng 1996; Farr and Rossman 2014)	Yes. Qld (Plant Health Australia 2001; May *et al.*2003). Not a regulated pest for Tas. (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Penicillium corylophilum Dierckx [Eurotiales: Trichocomaceae]	Yes (Tai 1979; Farr and Rossman 2014)	Yes. All states and territories (Sampson and Walker 1982; Cook and Dubé 1989; Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Penicillium expansum Link [Eurotiales: Trichocomaceae] Blue mould	Yes (Tai 1979)	Yes. NSW, Qld, Vic., WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Phellinus baumii Pilát [Hymenochaetales: Hymenochaetaceae]	Yes (Dai and Xu 1998)	No records found	No. Found on wood of broadleaf trees (Zhuang 2005). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Phellinus conchatus (Pers.) Quél. [Hymenochaetales: Hymenochaetaceae]	Yes (Zhuang 2005)	Yes. NSW, WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Phellinus pomaceus (Pers.) Maire Synonym: *Phellinus tuberculosus* Niemelä [Hymenochaetales: Hymenochaetaceae]	Yes (Teng 1996)	Yes. Vic. (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Phoma persicae Schulzer & Sacc. [Pleosporales, Incertae sedis]	Yes (Tai 1979; Farr and Rossman 2014)	Yes. Qld (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Phoma pomorum Thüm. Synonyms: *Phyllosticta persicae* Sacc.; *Phyllosticta prunicola* Opiz ex Sacc. [Pleosporales:Incertae sedis]	Yes (Tai 1979; AQSIQ 2006b)	Yes. NSW, Qld, SA, Vic., WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Phyllactinia guttata (Wallr.) Lév. Synonym: *Ovulariopsis moricola* Delarc. [Erisyphales: Erysiphaceae] Powdery mildew	Yes (Zhuang 2005)	No records found	No. Affects leaves and stems of *P. persica* (Farr and Rossman 2014). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Podosphaera leucotricha (Ellis & Everh.) E.S. Salmon Synonym: *Oidium mespili* Cooke [Erysiphales: Erysiphaceae]	Yes (Zhuang 2005)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Podosphaera pannosa (Wallr.) de Bary Synonym: *Oidium leucoconium* Desm. [Erysiphales: Erysiphaceae]	Yes (Zhuang 2005)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Podosphaera tridactyla (Wallr.) de Bary [Erysiphales: Erysiphaceae] Plum powdery mildew	Yes (AQSIQ 2006b)	Yes. ACT, NSW, Qld, SA, Tas., Vic. (Plant Health Australia 2001). Listed as a regulated pest (prohibited (section 12)) in the Western Australian organism list (Government of Western Australia 2013).	Yes. Fruit and leaves of *P. persica* can both be infected (Grove 1995).	Yes. Hosts include almond, cherry, peach and plum (Farr *et al.*1989). These plants are widely distributed in Western Australia. Powdery mildews generally grow and spread well in warmer climates. The fungus overwinters as cleistothecia on the surface of shoots, on dead leaves on the ground in orchards and on bark. Ascospores are produced from these structures during spring rains and infect the developing foliage (Grove 1995). Climatic conditions in Western Australia are favourable for the establishment of *P. tridactyla*, given that other closely related powdery mildews are already established in Western Australia.	No. The fungus infects a variety of *Prunus* species, including apricot, plum, cherry and peach. Infections can result in crop loss and defoliation (Grove 1995). It was assessed as not a quarantine pest in the PRA for summerfruit from eastern Australia into WA (Poole *et al.*2011).	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Polystigma deformans Syd. [Phyllachorales: Phyllachoraceae]	Yes (AQSIQ 2006b)	No records found	No. Associated with leaves of *Prunus* (Cannon 1996), including apricot and peach (Tai 1979). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Polystigma rubrum subsp. *rubrum* (Pers.) DC. [Phyllachorales: Phyllachoraceae] Apricot red spot	Yes (AQSIQ 2006b)	No records found	No. Associated with living leaves of *Prunus* species (Cannon 1996). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Rhizopus stolonifer (Ehrenb. Fr.) Vuill [Mucorales: Incertae sedis] Rhizopus rot, Plum black mould	Yes (AQSIQ 2006b)	Yes. All states and territories (Sampson and Walker 1982; Cook and Dubé 1989; Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Rosellinia necatrix Berl. ex Prill. Synonym: *Dematophora necatrix* R. Hartig [Xylariales: Xylariaceae] Dematophora root rot	Yes (AQSIQ 2006b)	Yes. NSW, Qld, WA (Washington and Nancarrow 1983; Shivas 1989; Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Schizophyllum commune Fr. [Agaricales: Schizophyllaceae]	Yes (Dai 2005)	Yes. NSW, NT, Qld, SA, Vic., WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Schizothyrium pomi (Mont. & Fr.) Arx Synonym: *Leptothyrium pomi* (Mont. & Fr.) Sacc. [Capnodiales: Schizothyriaceae] Fly speck	Yes (Tai 1979)	Yes. NSW, Qld, WA (Simmonds 1966; Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Sclerotinia sclerotiorum (Lib.) de Bary [Helotiales: Sclerotiniaceae]	Yes (Zhuang 2005)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Sclerotium rolfsii Sacc. [Atheliales: Atheliaceae] Sclerotium stem rot	Yes (AQSIQ 2006b)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Septobasidium bogoriense Pat. [Septobasidiales: Septobasidiaceae] Velvet blight	Yes (Tai 1979)	Yes. NT, Qld (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013) and not listed as a regulated pest in the Western Australian organism list (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Septobasidium tanakae Miyabe, Boedijn & B.A. Steinm. [Septobasidiales: Septobasidiaceae] Felty fungus	Yes (Tai 1979)	No records found	No. *Septobasidium* spp. are epiphytic on trees, usually on stems and branches, and associated with scale insects which they parasitise (McRitchie 1991; Lepp 2006). No report of association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Skeletocutis nivea (Jungh.) Jean Keller [Polyporales: Polyporaceae]	Yes (Farr and Rossman 2014)	No records found	No. On dead hardwoods causing white rots (Farr and Rossman 2014).	Assessment not required	Assessment not required	No
Stigmina carpophila (Lév.) M.B. Ellis [Capnodiales: Mycosphaerellaceae]	Yes (AQSIQ 2006b)	Yes. ACT, NSW, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Taphrina deformans (Berk.) Tul. [Taphrinales: Taphrinaceae] Peach leaf curl	Yes (Zhuang 2005)	Yes. ACT, NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No
Thanatephorus cucumeris (A. B. Frank) Donk Synonym: *Rhizoctonia solani* J. G. Kühn [Cantharellales: Ceratobasidiaceae] Thread blight	Yes (Zhuang 2005)	Yes. All states and territories (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Trametes gallica var. *trogii* Berk Pilát [Polyporales: Polyporaceae]	Yes (Tai 1979)	No records found	No. On deciduous trees, especially stumps of *Salix* and *Populus* (Zhao and Zhang 1992). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Trametes hirsuta (Wulfen) Lloyd [Polyporales: Polyporaceae]	Yes (Teng 1996)	Yes. NSW, Qld, Tas., Vic., WA (Plant Health Australia 2001; ALA 2014)	Assessment not required	Assessment not required	Assessment not required	No
Trametes versicolor (L.) Lloyd [Polyporales: Polyporaceae]	Yes (Zhuang 2005)	Yes. ACT, NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001; ALA 2014)	Assessment not required	Assessment not required	Assessment not required	No
Tranzschelia discolor Fuckel Tranzschel & Litv. [Pucciniales: Uropyxidaceae]	Yes (Zhuang 2005)	Yes. All states and territories (Plant Health Australia 2001)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Tranzschelia pruni-spinosae (Pers.) Dietel (1922) Synonym: *Puccinia pruni-spinosae* Pers.: Pers. [Pucciniales: Uropyxidaceae]	Yes (Tai 1979)	Yes. SA, Tas., Vic. (Plant Health Australia 2001), (Sampson and Walker 1982). Listed as a Permitted Organism (section 11) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Trichothecium roseum (Pers.) Link [Hyphocreales: Incertae sedis] Pink mould rot	Yes (Tai 1979)	Yes. ACT, NSW, Qld, SA, Vic., WA (Plant Health Australia 2001). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Valsa ambiens (Pers.) Fr. Synonym: *Cytospora leucosperma* (Pers.) Fr. [Diaporthales: Valsaceae] Valsa canker	Yes (Zhuang 2005)	Yes. NSW, SA, Tas., Vic. (Plant Health Australia 2001). Not listed under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Valsa ceratosperma (Tode) Maire Synonym: *Cytospora sacculus* (Schwein. : Fr.) Gvrit [Diaporthales: Valsaceae]	Yes (Zhuang 2005)	Yes. ACT, NSW, Tas. (Plant Health Australia 2001).	No. Causes cankers on trunk, branches and twigs (EPPO 2004; Zhuang 2005). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Valsa persoonii Nitschke 1870 Synonyms: *Cytospora leucostoma* (Pers.) Sacc.; *Leucostoma persoonii* (Nitschke) Höhn. [Diaporthales: Valsaceae]	Yes (AQSIQ 2006b)	Yes. NSW, SA, Vic. (Plant Health Australia 2001). Listed as a Declared Organism (Prohibited (section 12)) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	No. Associated with branches of *P. persica* (AQSIQ 2006b). No report of an association with nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Venturia carpophila E.E.Fisher Synonyms: *Fusicladium carpophilum* (Thüm.) Oudem.; *Cladosporium carpophilum* Thüm [Pleosporales: Venturiaceae]	Yes (AQSIQ 2006b)	Yes. ACT, NSW, Qld, SA, Tas., Vic. (Plant Health Australia 2001). Listed as a Permitted Organism (section 11) under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
VIRUSES						

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Apple chlorotic leaf spot trichovirus [Flexiviridae: Trichovirus] ACLSV	Yes (Zhou *et al.*1996; Brunt *et al.*1996).	Yes. NSW, Qld, SA, Tas., Vic., WA (Washington and Nancarrow 1983; Letham 1995; Constable *et al.*2007).	Assessment not required	Assessment not required	Assessment not required	No
Apple mosaic ilarvirus Synonyms: *Dutch plum line pattern virus*; *European plum line pattern virus*, *Hop A virus* [Bromoviridae: Ilarvirus] Apple mosaic (ApMV)	Yes (Diekmann and Putter eds 1996; Zhou *et al.*1996)	Yes. Qld, SA, Vic., WA (Constable *et al.*2007). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Apple stem pitting virus [Flexiviridae: Foveavirus] ASPV	Yes (Brunt *et al.*1996).	Yes. NSW, Qld, SA, Tas., Vic., WA (Constable *et al.*2007).	Assessment not required	Assessment not required	Assessment not required	No
Apricot pseudo-chlorotic leaf spot virus [Betaflexiviridae: Trichovirus] APCLSV	Yes (Niu *et al.*2012)	Yes. Vic. (Liberti *et al.*2005). Not a regulated pest for Tas. (DPIPWE 2013) and not listed under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Cherry green ring mottle virus [Flexiviridae: Foveavirus] CGRMV	Yes (Zhou *et al.*2011)	Yes. NSW (Diekmann and Putter eds 1996; Davis 2011). Not a regulated pest for Tas. (DPIPWE 2013) and not listed under the Western Australian Biosecurity and Agriculture Management Act 2007 (Government of Western Australia 2013).	Assessment not required	Assessment not required	Assessment not required	No
Cherry leaf roll virus [Comoviridae: Nepovirus] CLRV	Yes (Brunt *et al.*1996).	No records found	No. The virus is transmitted through the seed of most natural hosts including *Prunus* spp. (Schimanski *et al.*1976) and has been associated with peach (Delbos *et al.*1982). However, it is not recorded on *P. persica* or other summerfruit in China. Strains of the virus are distinct and defined by host (Rebenstorf *et al.*2006) and no evidence of infection of *P. persica* in China can be found.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Cherry mottle leaf virus [Betaflexiviridae: Trichovirus]	Yes (Ma *et al.*2014)	No records found	No. Transmitted by budding and grafting, or by the bud mite *Eriophyes inaequalis*, which does not feed on fruit (Adaskaveg and Caprile 2014).	Assessment not required	Assessment not required	No
Cherry necrotic rusty mottle virus [Betaflexiviridae: Not assigned] CNRM	Yes (Zhou *et al.*2013)	No records found	No. Affects *P. persica* (Zhou *et al.*2013). Spread by grafting and budding (Rott and Jelkmann 2011).	Assessment not required	Assessment not required	No
Cherry rasp leaf virus [Comoviridae: Nepovirus] CRLV	Yes (ICTVdB Management 2014)	No. It was listed as present in Australia (Büchen-Osmond 2002). However these specimens are believed to be based on symptoms that may have been caused by other viruses (Büchen-Osmond *et al.*1988; Priest 2009). There is doubt that this virus is correctly reported from Australia and the department considers it absent.	No. Associated with *P. persica* (CABI 2014). While it can be isolated from the sap of trees, there is no report that it has been isolated from fruit. Transmitted only by its nematode vector or by mechanical inoculation (CABI-EPPO 1997c).	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Cherry virus A [Flexiviridae: Capillovirus] CVA	Yes (Rao *et al.*2009)	No records found	No. Affects *P. persica* (Svanella-Dumas *et al.*2005; Barone and Alioto 2006) and is graft-transmissible (Brunt *et al.*1996; Svanella-Dumas *et al.*2005). No report of an association with mature nectarine or peach fruit was found.	Assessment not required	Assessment not required	No
Cucumber mosaic virus [Bromoviridae: Fabavirus]	Yes (CABI-EPPO 2002; Tan *et al.*2010)	Yes. NSW, Qld, SA, Tas., Vic., WA (CABI-EPPO 2002)	Assessment not required	Assessment not required	Assessment not required	No
Little cherry virus [Closteroviridae: Closterovirus] LChV1, LChV2	Yes (AQSIQ 2006c; AQSIQ 2006d)	No. *Little cherry virus 2* is present in NSW, Tas., Vic. (IPPC 2015). However, *little cherry virus 1* has not been reported in Australia.	No. Associated with *P. persica* (CABI 2014). *Little cherry virus* is transmitted by budding and grafting (Diekmann and Putter eds 1996; CABI 2014) and is also spread from tree to tree by the apple mealy bug *Phenacoccus aceris* (Raine *et al.*1986; Ministry of Agriculture and Lands 2006). There are no reports that *little cherry viruses* have been isolated from nectarine or peach fruit.	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Plum bark necrosis stem pitting-associated virus [Closteroviridae: Ampelovirus] PBNSP	Yes (Cui *et al.*2011)	No records found	No. PBNSP causes trunk gummosis and/or stem pitting in *P. persica* (Cui *et al.*2011). It is not known to be transmitted by seeds. Infected propagated material is considered the primary source of infection (Boscia *et al.*2011).	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Plum pox virus [Potyviridae: Virus] PPV	Yes (Navratil *et al.*2005)	No records found	Yes. Infects *P. persica* (Adams 1995). PPV can be isolated from fruit and seed. There have been reports of aphids being able to transmit the virus from infected fruit (Gildow *et al.*2004). Important method of spread is via diseased plant material (Adams 1995).	Yes. Considerable spread can occur from new disease foci before infections are recognised (Adams 1995). *Plum pox virus* is extremely difficult to eradicate once established. Affects all *Prunus* spp. in a variety of environments similar to Australia. The virus is transmitted by grafting. It is also transmitted non-persistently by two main aphid vectors *Aphis spiraecola* and *Myzus persicae*. Other aphids able to transmit the virus are: *Aphis craccivora*, *A. fabae*, *Brachycaudus cardui*, *B. helychrysi*, *B. persicae*, *Hyalopterus pruni*, *Myzus varians*, *Phorodon humuli* (Gildow *et al.*2004; CABI-EPPO 2007), *A. gossypii*, *Rhopalosiphum padi* and *A. hederae* (Labonne *et al.*1995).	Yes. Plum pox arrival in Australia would see the loss of overseas and potentially new markets. PPV reduces the value and marketability of many apricot and some other *Prunus* spp. cultivars that have been naturally infected. Some are latently infected and act as a reservoir for continued infection cycles. There is a high cost in living with PPV through testing, eradication, and breeding resistant cultivars such as in Europe and USA.	Yes (EP)

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Prune dwarf virus Synonyms: *Prune dwarf ilarvirus*, *cherry chlorotic ringspot virus*, *peach stunt virus*, *sour cherry yellows virus* [Bromoviridae: Ilarvirus] Prune dwarf	Yes (Zhou *et al.*1996)	Yes. NSW, SA, Tas., Vic., WA (Smith *et al.*1977; McLean and Price 1984; Johnstone *et al.*1995; Büchen-Osmond 2002)	Assessment not required	Assessment not required	Assessment not required	No
Prunus necrotic ringspot virus Synonyms: *European plum line pattern virus*, *Hop B virus*, *Hop C virus*, *Peach ringspot virus*, *Plum line pattern virus*, *Prunus ringspot virus* [Bromoviridae: Ilarvirus] PNRSV	Yes (Zhou *et al.*1996; Kulshrestha *et al.*2005)	Yes. NSW, Qld, SA, Tas., Vic., WA (Smith *et al.*1977; McLean and Price 1984; Munro 1987; Cook and Dubé 1989; CABI 2014)	Assessment not required	Assessment not required	Assessment not required	No
Tobacco necrosis viruses (*Tobacco necrosis virus A*, *Tobacco necrosis virus D*) [Tombusviridae: Necrovirus] TNV	Yes (Huang *et al.*1984; Xi *et al.*2008)	Yes. Vic., Qld (Finlay and Teakle 1969; Teakle 1988). Not a regulated pest for Tas. (DPIPWE 2013). Tobacco necrosis viruses were not identified as quarantine pests in the IRA for summerfruit from eastern Australian states to WA (Poole *et al.*2011).	Yes. Rarely associated with peach and symptomless in fruit trees (NCPN-FT 2014). Virus particles released from plant debris and acquired in soil by zoospores of chytrid fungi (*Olpidium* spp.) may be transmitted to suitable hosts (Uyemoto 1981; Spence 2001; CABI 2014). Necroviruses may also be transmitted in soil water without a vector (Lommel *et al.*2005).	Yes. Tobacco necrosis virus strains are established in Australia (Teakle 1988). TNVs infect common vegetable crop plants, ornamental plants and tree species (Brunt *et al.*1996; Zitikaite and Staniulis 2009; CABI 2014). TNVs are transmitted by *Olpidium* spp. (Rochon *et al.*2004; Sasaya and Koganezawa 2006) and these vectors occur in Australia (McDougall 2006; Maccarone *et al.*2008).	Yes. Tobacco necrosis viruses cause rusty root disease of carrot, Augusta disease of tulip, stipple streak disease of common bean, necrosis diseases of cabbage, cucumber, soybean and zucchini and ABC disease of potato (Uyemoto 1981; Smith *et al.*1988; Xi *et al.*2008; Zitikaite and Staniulis 2009).	Yes (EP)

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Tobacco ringspot virus [Comoviridae: Nepovirus] TRSV	Yes (CABI 2014)	Yes. Qld, SA, WA (Randles and Francki 1965; Reynolds and Teakle 1976; McLean and Price 1984; Brunt *et al.*1996). Not a regulated pest for Tas. (DPIPWE 2013).	Assessment not required	Assessment not required	Assessment not required	No
Tomato ringspot virus Synonyms: *Peach yellow bud mosaic virus, Prune brown line, Prunus stem pitting* [Comoviridae: Nepovirus] ToRSV	Yes (Zhang and Huang 1990)	No. Eradicated (IPPC 2013; CABI 2014)	No. This virus is seed-borne in several weed hosts (Gonsalves 1995). However, no report of seed transmission in *Prunus* spp. or evidence of infection of *P. persica* or other summerfruit in China can be found. Therefore, it is not considered to be associated with the summerfruit pathway from China.	Assessment not required	Assessment not required	No
VIROIDS						

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Apple scar skin viroid [Pospiviroidae: Apscaviroid] ASSVd	Yes (Han *et al.*2003; Zhao and Niu 2008a; Kaponi *et al.*2010).	No records found	Yes. Recorded from *P. persica* trees in China (Zhao and Niu 2008a; Zhao and Niu 2008b; Kaponi *et al.*2010). A recent study suggested *Apple scar skin viroid* can be transmitted from infected apple seeds to the seedlings germinated from these seeds, with a 7.7 percent transmission rate (Kim *et al.*2006). No seed tramsmition of ASSVd on stoneftruit was reported.	Yes. *Apple scar skin viroid* has spread in a number of Asian countries, Europe and North America. This viroid can be found in the fruit pulp of apples and pears including apple seeds (Hadidi *et al.*1991; Hurtt and Podleckis 1995; Han *et al.*2003; Koganezawa *et al.*2003). Transmission of *Apple scar skin viroid* is by grafting and contaminated pruning equipment (Grove *et al.*2003; Kim *et al.*2006).	Yes. Apple scar skin disease has been a very destructive disease in Korea (Kim *et al.*2006). In China, in the 1950's, some counties of Shanxi, Hebei and Shenxi provinces, more than 50 per cent of the apple trees were affected with this viroid (Han *et al.*2003).	Yes (EP)
Hop stunt viroid Synonym: *Peach dapple viroid* [Pospiviroidae: Hostuviroid] HSVd	Yes (Yang *et al.*2006; Zhou *et al.*2006b; Zhou *et al.*2006c; Guo *et al.*2008).	Yes. SA, Vic. (Koltunow *et al.*1988). Not a regulated pest for Tas. (DPIPWE 2013). It was not identified as a quarantine pest in the IRA for summerfruit from eastern Australian states to WA (Poole *et al.*2011).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in China	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Peach latent mosaic viroid [Avsunviroidae: Pelamoviroid] PLMVd	Yes (Hadidi *et al.*1997; Turturo *et al.*1998)	Yes. SA (di Serio *et al.*1999). Not a regulated pest for Tas. (DPIPWE 2013). It was not identified as a quarantine pest in the IRA for summerfruit from eastern Australian states to WA (Poole *et al.*2011).	Assessment not required	Assessment not required	Assessment not required	No

Appendix B Biosecurity framework

Australia's biosecurity policies

The objective of Australia's biosecurity policies and risk management measures is the prevention or control of the entry, establishment or spread of pests and diseases that could cause significant harm to people, animals, plants and other aspects of the environment.

Australia has diverse native flora and fauna and a large agricultural sector, and is relatively free from the more significant pests and diseases present in other countries. Therefore, successive Australian Governments have maintained a conservative, but not a zero-risk, approach to the management of biosecurity risks. This approach is consistent with the World Trade Organization's (WTO's) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement).

The SPS Agreement defines the concept of an 'appropriate level of protection' (ALOP) as the level of protection deemed appropriate by a WTO Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory. Among a number of obligations, a WTO Member should take into account the objective of minimising negative trade effects in setting its ALOP.

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

Consistent with the SPS Agreement, in conducting risk analyses Australia takes into account as relevant economic factors:

- the potential damage in terms of loss of production or sales in the event of the entry, establishment or spread of a pest or disease in the territory of Australia
- the costs of control or eradication of a pest or disease
- and the relative cost-effectiveness of alternative approaches to limiting risks.

Roles and responsibilities within Australia's quarantine system

Australia protects its human, animal and plant life or health through a comprehensive quarantine system that covers the quarantine continuum, from pre-border to border and post-border activities. The Australian Government Department of Health is responsible for human health aspects of quarantine. The Australian Government Department of Agriculture is responsible for animal and plant life or health.

Pre-border, Australia participates in international standard-setting bodies, undertakes risk analyses, develops offshore quarantine arrangements where appropriate, and engages with our neighbours to counter the spread of exotic pests and diseases.

At the border, Australia screens vessels (including aircraft), people and goods entering the country to detect potential threats to Australian human, animal and plant health.

The Australian Government also undertakes targeted measures at the immediate post-border level within Australia. This includes national co-ordination of emergency responses to pest and disease incursions. The movement of goods of quarantine concern within Australia's border is the responsibility of relevant state and territory authorities, which undertake inter– and intra–state quarantine operations that reflect regional differences in pest and disease status, as a part of their wider plant and animal health responsibilities.

Roles and responsibilities within the Department

The Australian Government Department of Agriculture is responsible for the Australian Government's animal and plant biosecurity policy development and the establishment of risk management measures. The Secretary of the Department is appointed as the Director of Animal and Plant Quarantine under the *Quarantine Act 1908* (the Act).

The Department takes the lead in biosecurity and quarantine policy development and the establishment and implementation of risk management measures across the biosecurity continuum, and:

- **Pre-border** conducts risk analyses, including IRAs, and develops recommendations for biosecurity policy as well as providing quarantine policy advice to the Director of Animal and Plant Quarantine
- **At the border** develops operational procedures, makes a range of quarantine decisions under the Act (including import permit decisions under delegation from the Director of Animal and Plant Quarantine) and delivers quarantine services
- **Post-border** coordinates pest and disease preparedness, emergency responses and liaison on inter– and intra–state quarantine arrangements for the Australian Government, in conjunction with Australia's state and territory governments.

Roles and responsibilities of other government agencies

State and territory governments play a vital role in the quarantine continuum. The department works in partnership with state and territory governments to address regional differences in pest and disease status and risk within Australia, and develops appropriate sanitary and phytosanitary measures to account for those differences. Australia's partnership approach to quarantine is supported by a formal Memorandum of Understanding that provides for consultation between the Australian Government and the state and territory governments.

Depending on the nature of the good being imported or proposed for importation, the Australian Government Department of Agriculturemay consult other Australian Government authorities or agencies in developing its recommendations and providing advice.

As well as a Director of Animal and Plant Quarantine, the Act provides for a Director of Human Quarantine. The Australian Government Department of Health is responsible for human health aspects of quarantine and Australia's Chief Medical Officer within that Department holds the position of Director of Human Quarantine. The Australian Government Department of Agriculturemay, where appropriate, consult with that Department on relevant matters that may have implications for human health.

The Act also requires the Director of Animal and Plant Quarantine, before making certain decisions, to request advice from the Environment Minister and to take the advice into account when making those decisions. The Australian Government Department of the Environment is responsible under the *Environment Protection and Biodiversity Conservation Act 1999* for assessing the environmental impact associated with proposals to import live species. Anyone proposing to import such material should contact the Department of the Environment directly for further information.

When undertaking risk analyses, the Australian Government Department of Agricultureconsults with the Department of the Environment about environmental issues and may use or refer to the Department of the Environment's assessment.

Australian quarantine legislation

The Australian quarantine system is supported by Commonwealth, state and territory quarantine laws. Under the Australian Constitution, the Commonwealth Government does not have exclusive power to make laws in relation to quarantine, and as a result, Commonwealth and state quarantine laws can co-exist.

Commonwealth quarantine laws are contained in the *Quarantine Act 1908* and subordinate legislation including the Quarantine Regulations 2000, the Quarantine Proclamation 1998, the Quarantine (Cocos Islands) Proclamation 2004 and the Quarantine (Christmas Island) Proclamation 2004.

The quarantine proclamations identify goods, which cannot be imported, into Australia, the Cocos Islands and or Christmas Island unless the Director of Animal and Plant Quarantine or delegate grants an import permit or unless they comply with other conditions specified in the proclamations. Section 70 of the Quarantine Proclamation 1998, section 34 of the Quarantine (Cocos Islands) Proclamation 2004 and section 34 of the Quarantine (Christmas Island) Proclamation 2004 specify the things a Director of Animal and Plant Quarantine must take into account when deciding whether to grant a permit.

In particular, a Director of Animal and Plant Quarantine (or delegate):

- must consider the level of quarantine risk if the permit were granted, and
- must consider whether, if the permit were granted, the imposition of conditions would be necessary to limit the level of quarantine risk to one that is acceptably low, and
- for a permit to import a seed of a plant that was produced by genetic manipulation—must take into account any risk assessment prepared, and any decision made, in relation to the seed under the *Gene Technology Act*, and
- may take into account anything else that he or she knows is relevant.

The level of quarantine risk is defined in section 5D of the *Quarantine Act 1908*. The definition is as follows:

reference in this Act to a *level of quarantine risk* is a reference to:

a) the likelihood of:

   i) a disease or pest being introduced, established or spread in Australia, the Cocos Islands or Christmas Island; and
   ii) the disease or pest causing harm to human beings, animals, plants, other aspects of the environment, or economic activities; and

b) the probable extent of the harm.

The Quarantine Regulations 2000 were amended in 2007 to regulate keys steps of the import risk analysis process. The Regulations:

- define both a standard and an expanded IRA;
- identify certain steps, which must be included in each type of IRA;
- specify time limits for certain steps and overall timeframes for the completion of IRAs (up to 24 months for a standard IRA and up to 30 months for an expanded IRA);
- specify publication requirements;
- make provision for termination of an IRA; and
- allow for a partially completed risk analysis to be completed as an IRA under the Regulations.

The Regulations are available on the ComLaw website.

International agreements and standards

The process set out in the *Import Risk Analysis Handbook 2011* is consistent with Australia's international obligations under the SPS Agreement. It also takes into account relevant international standards on risk assessment developed under the International Plant Protection Convention (IPPC) and by the World Organisation for Animal Health (OIE).

Australia bases its national risk management measures on international standards where they exist and when they achieve Australia's ALOP. Otherwise, Australia exercises its right under the SPS Agreement to apply science-based sanitary and phytosanitary measures that are not more trade restrictive than required to achieve Australia's ALOP.

Notification obligations

Under the transparency provisions of the SPS Agreement, WTO Members are required, among other things, to notify other members of proposed sanitary or phytosanitary regulations, or changes to existing regulations, that are not substantially the same as the content of an international standard and that may have a significant effect on trade of other WTO Members.

Risk analysis

Within Australia's quarantine framework, the Australian Government uses risk analyses to assist it in considering the level of quarantine risk that may be associated with the importation or proposed importation of animals, plants or other goods.

In conducting a risk analysis, the Department of Agriculture:

- identifies the pests and diseases of quarantine concern that may be carried by the good

- assesses the likelihood that an identified pest or disease would enter, establish or spread
- assesses the probable extent of the harm that would result.

If the assessed level of quarantine risk exceeds Australia's ALOP, the Australian Government Department of Agriculturewill consider whether there are any risk management measures that will reduce quarantine risk to achieve the ALOP. If there are no risk management measures that reduce the risk to that level, trade will not be allowed.

Risk analyses may be carried out by the Department of Agriculture's specialists, but may also involve relevant experts from state and territory agencies, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), universities and industry to access the technical expertise needed for a particular analysis.

Risk analyses are conducted across a spectrum of scientific complexity and available scientific information. An IRA is a type of risk analysis with key steps regulated under the Quarantine Regulations 2000. The Department of Agriculture's assessment of risk may also take the form of a non-regulated analysis of existing policy or technical advice. Further information on the types of risk analysis is provided in the *Import Risk Analysis Handbook 2011.*

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 2012).
Anamorph	An asexual stage in the life cycle of a fungus, also known as the imperfect state of a fungus.
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 2012).
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 2012).
Arthropod	The largest phylum of animals, including the insects, arachnids and crustaceans.
Asexual reproduction	The development of new individual from a single cell or group of cells in the absence of meiosis.
Biosecurity Australia	The previous name for the unit, within the Department of Agriculture, responsible for recommendations for the development of Australia's biosecurity policy. These functions are undertaken within the Plant Division of the Department.
Certificate	An official document which attests to the phytosanitary status of any consignment affected by phytosanitary regulations (FAO 2012).
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 2012).
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO 2012).
Diapause	Period of suspended development/growth occurring in some insects, in which metabolism is decreased.
Disease	A condition of part or all of an organism that may result from various causes such as infection, genetic defect or environmental stress.
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 2012).
Endemic	Belonging to, native to, or prevalent in a particular geography, area or environment.
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 2012).
Establishment	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO 2012).
Fecundity	The fertility of an organism.
Fresh	Living; not dried, deep-frozen or otherwise conserved (FAO 2012).
Fumigation	A method of pest control that completely fills an area with gaseous pesticides to suffocate or poison the pests within.
Genus	A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature the genus name is used, either alone or followed by a Latin adjective or epithet, to form the name of a species.

Term or abbreviation	Definition
Host	An organism that harbours a parasite, mutual partner, or commensal partner, typically providing nourishment and shelter.
Host range	Species capable, under natural conditions, of sustaining a specific pest or other organism (FAO 2012).
Import permit	Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2012).
Import risk analysis	An administrative process through which quarantine policy is developed or reviewed, incorporating risk assessment, risk management and risk communication.
Infection	The internal 'endophytic' colonisation of a plant, or plant organ, and is generally associated with the development of disease symptoms as the integrity of cells and/or biological processes are disrupted.
Infestation (of a commodity)	Presence in a commodity of a living pest of the plant or plant product concerned. Infestation includes infection (FAO 2012).
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 2012).
Intended use	Declared purpose for which plants, plant products, or other regulated articles are imported, produced, or used (FAO 2012).
Interception (of a pest)	The detection of a pest during inspection or testing of an imported consignment (FAO 2012).
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 IPCC (FAO 2012).
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO 2012).
Lot	A number of units of a single commodity, identifiable by its homogeneity of composition, origin, forming part of a consignment (FAO 2012). Within this report a 'lot' refers to a quantity of fruit of a single variety, harvested from a single production site during a single pick and packed at one time.
Mature fruit	Commercial maturity is the start of the ripening process. The ripening process will then continue for climeartic fruit and provide a product that is consumer-acceptable. Maturity assessments include colour, starch, index, soluble solids content, flesh firmness, acidity, and ethylene production rate.
Mortality	The total number of organisms killed by a particular disease.
National Plant Protection Organization (NPPO)	Official service established by a government to discharge the functions specified by the IPPC (FAO 2012).
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 2012).
Orchard	A contiguous area of nectarine trees operated as a single entity. Within this report a single orchard is covered under one registration and is issued a unique indentifying number.
Parthenogenesis	Production of an embryo from unfertilised egg.
Pathogen	A biological agent that can cause disease to its host.
Pathway	Any means that allows the entry or spread of a pest (FAO 2012).
Pest	Any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products (FAO 2012).
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 2012).
Pest free area (PFA)	An area in which a specific pest does not occur as demonstrated by scientific

Term or abbreviation	Definition
	evidence and in which, where appropriate, this condition is being officially maintained (FAO 2012).
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 2012).
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 2012).
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 2012).
Pest risk assessment (for quarantine pests)	Evaluation of the likelihood of the introduction and spread of a pest and of the associated potential economic consequences (FAO 2012).
Pest risk management (for quarantine pests)	Evaluation and selection of options to reduce the risk of introduction and spread of a pest (FAO 2012).
Pest status (in an area)	Presence or absence, at the present time, of a pest in an area, including where appropriate its distribution, as officially determined using expert judgement on the basis of current and historical pest records and other information (FAO 2012).
Phytosanitary certificate	An official paper document or its official electronic equivalent, consistent with the model of certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (FAO 2012).
Phytosanitary certification	Use of phytosanitary procedures leading to the issue of a phytosanitary certificate (FAO 2012).
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 2012).
Phytosanitary procedure	An official method for implementing phytosanitary measures including the performance of inspections, tests, surveillance or treatments in connection with regulated pests (FAO 2012).
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 2012).
Polyphagous	Feeding on a relatively large number of hosts from different plant family and/or genera.
PRA area	Area in relation to which a pest risk analysis is conducted (FAO 2012).
Practically free	Of a consignment, field or place of production, without pests (or a specific pest) in numbers or quantities in excess of those that can be expected to result from, and be consistent with good cultural and handling practices employed in the production and marketing of the commodity (FAO 2012).
Production site	In this report, a production site is a continuous planting of nectarine trees treated as a single unit for pest management purposes. If an orchard is subdivided into one or more units for pest management purposes, then each unit is a production site. If the orchard is not subdivided, then the orchard is also the production site.
Quarantine	Official confinement of regulated articles for observation and research or for further inspection, testing or treatment (FAO 2012).
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 2012).
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 2012).

Term or abbreviation	Definition
Regulated pest	A quarantine pest or a regulated non-quarantine pest (FAO 2012).
Restricted risk	Risk estimate with phytosanitary measure(s) applied.
Saprophyte	An organism deriving its nourishment from dead organic matter.
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO 2012).
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures.
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.
Stonefruit	Fleshy indehiscent fruit with a single seed: for example, apricot, peach, nectarine, plum.
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.
Teleomorph	The sexual stage of the life cycle of a fungus. Also called the perfect stage.
Trash	Soil, splinters, twigs, leaves, and other plant material, other than fruit stalks.
Treatment	Official procedure for the killing, inactivation or removal of pests, or for rendering pests infertile or for devitalisation (FAO 2012).
Unrestricted risk	Unrestricted risk estimates apply in the absence of risk mitigation measures.
Vector	An organism that does not cause disease itself, but which causes infection by conveying pathogens from one host to another.
Viable	Alive, able to germinate or capable of growth.

Reference List

Adams AN (1995) *Plum pox virus*. In Ogawa JM, Zehr EI, Bird GW, Ritchie DF, Uiru K, Uyemoto JK (eds) *Compendium of stone fruit diseases* 69–69. The American Phytopathological Society Press, St. Paul, Minnesota.

Adaskaveg JE, Caprile JL (2014) Diseases. In UC IPM Pest management guidelines: cherry. UC IPM Online: Statewide Integrated Pest Management Program. http://www.ipm.ucdavis.edu/PDF/PMG/pmgcherry.pdf Accessed 2014.

Afonin AN, Greene SL, Dzyubenko NI, Frolov AN (2008) Interactive agricultural ecological atlas of Russia and neighboring countries. Economic plants and their diseases, pests and weeds [online]. http://www.agroatlas.ru Accessed 2014.

ALA (2014) Atlas of Living Australia. www.ala.org.au Accessed 2014.

Alford DV (2007) *Pest of fruits crops: a colour handbook.* Manson Publishing, London, UK.

Alston D, Murray M (2007) Utah pests fact sheet ENT-36-07: Peach twig borer (*Anarsia lineatella*). Utah State University Extension. http://utahpests.usu.edu/ipm/htm/fruits/fruit-insect-disease/peach-twig-borer07 Accessed 25 October 2013.

An ZG (1990) Diagnostics of *Popillia japonica*. *Zhiwu Jianyi (Plant Quarantine)* 4: 29–31.

Andreev R, Kutinkova H (2010) Possibility of reducing chemical treatments aimed at control of plum insect pests. *Acta Horticulturae (ISHS)* 874: 215–220.

APPD (2011) Australian Plant Pest Database. Plant Health Australia. http://www.planthealthaustralia.com.au/APPD/queryForm.asp Accessed May 2011.

AQSIQ (2005) *Export technical reference information for Chinese apple, received on 14 March 2005*. General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, Beijing.

AQSIQ (2006a) *Export technical reference information for Chinese grape received on 20 July 2006*. General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, Beijing.

AQSIQ (2006b) *Export technical reference information for Chinese stone fruit: pests and diseases associated with summerfruit (apricot, plum) in China*. The General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, Beijing.

AQSIQ (2006c) *Pest list of Chinese cherries (electronic pest list received 13 September 2006)*. The General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, Beijing.

AQSIQ (2006d) *Technical information of export of Chinese cherry (hard copy received at bilateral discussions 20 July 2006, Beijing)*. The General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, Beijing.

AQSIQ (2007) *Reply on supplementary information on pests in table grapes exported from China to Australia received on 19 March 2007*. General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, Beijing.

Arakawa HY (1931) The pear flower bud weevil in S. Manchuria. *Research Bulletin.Agricultural Experiment Station, South Manchuria Railway Co.* 5: 13–39.

Asjes CJ, Blom-Barnhoorn GJ (2002) Control of spread of Augusta disease caused by *Tobacco necrosis virus* in tulip by composting residual waste of small bulbs, tunics, roots and soil debris. *Acta Horticulturae (ISHS)* 570: 283–286 (abstract only).

AVH (2014) *Australia's Virtual Herbarium*, Council of Heads of Australasian Herbaria. http://avh.chah.org.au Accessed 28 April 2014.

Baggiolini M (1961) A new Tortricid injurious to fruit trees and vines: *Eulia (Argyrotaenia pulchllana* Hw.). *Revue romande d'Agriculture, de Viticulture et d'Arboriculture* 17: 68–71.

Bai JK (2003) *Flora Fungorum Sinicorum Vol. 17 Sphaeropsidales, Ascochyta, Septoria.* Science Press, Beijing.

Bailey P, Caon G (1986) Predation on two-spotted mite, *Tetranychus urticae* Koch (Acarina: Teteranychidae) by *Haplothrips victoriensis* Bagnall (Thysanoptera: Phlaeothripidae) and *Stethorus nigripes* Kapur (Coleoptera: Coccinellidae) on seed lucerne crops in South Australia. *Australian Journal of Zoology* 34: 515–525.

Baker CJ, Harrington TC, Krauss U, Alfenas AC (2003) Genetic variability and host specialization in the Latin Amerian Clade of *Ceratocystic fimbriata*. *Phytopathology* 93: 1274–1284.

Baker H, Stahler N, Johnson AC, Adams L, Froesciner RO (1943) *Parlatoria chinensis* Marlatt. *United States Department of Agriculture Circular* E-595: 1–17.

Bänziger H (1982) Fruit-piercing moths (Lep.: Noctuidae) in Thailand: a general survey and some new perspectives. *Bulletin de la Société Entomologique Suisse* 55: 213–240.

Baozhen H, Aijuan Z, Xiangzhou L, Lei H (1998) Seasonal history of *Carposina sasakii* Matsumura on apricot orchard in Qinling Mountain region, Shaanxi. *Acta Agriculturae Borealroccidentalis Sinica* 7: 32–35.

Barnes MM (1991) Codling moth occurrence, host race formulation, and damage. In Van der Geest LPS, Evenhuis HH (eds) *Tortricid pests: their biology, natural enemies and control* 313–327. Elsevier Science Publishers B.V., Amsterdam.

Barone M, Alioto D (2006) Disease Notes: First report and high prevalence in noncherry host of *Cherry virus A* in Italy. *Plant Disease* 90: 1459–1459.

Bartlett BR, Clausen CP, DeBach P, Goeden RD, Legner EF, McMurtry JA, Oatman ER, Bay EC, Rosen D (1978) *Introduced parasites and predators of arthropod pests and weeds: a world review. Agriculture Handbook No. 480.* Clausen CP (ed) United States Department of Agriculture, Washington, D.C.

Batra LR (1991) *World species of Monilinia (fungi): their ecology, biosystematics and control.* J. Cramer, Berlin.

Beardsley JW Jr, Gonzalez RH (1975) The biology and ecology of armored scales. *Annual Review of Entomology* 20: 47–73.

Beers EH, Hoyt SC, Willett MJ (1993) Apple aphid and spirea aphid. Orchard Pest Management Online, Washington State University. http://jenny.trec.wsu.edu/opm/displaySpecies.php?pn=380 Accessed 12 June 2008.

Beljaev EA, Ponomarenko MG (2005) New lepidopterological finds (Lepidoptera: Gelechidae, Tortricidae, Geometridae) in south of Russian Far East. *Far Eastern Entomologist* 155: 1–11.

Ben-Dov Y (2014a) Coccidae. ScaleNet, Catalogue Query Results. http://www.sel.barc.usda.gov/scalenet/scalenet.htm Accessed 2014a.

Ben-Dov Y (2014b) Pseudococcidae. ScaleNet, Catalogue Query Results. http://www.sel.barc.usda.gov/scalenet/scalenet.htm Accessed 2014b.

Ben-Dov Y, Miller DR, Denno BD, Gimpel ME (2014) Diaspididae. ScaleNet, Catalogue Query Results. http://www.sel.barc.usda.gov/scalenet/scalenet.htm Accessed 2014.

Bennett JW (2010) An overview of the genus *Aspergillus*. In Machida M, Gomi K (eds) *Aspergillus: molecular biology and genomics* 1–17. Caister Academic Press, Norfolk.

Bentley WJ, Day KR (2012) Insects and mites. In: UC IPM pest management program: nectarine. http://www.ipm.ucdavis.edu/PMG/selectnewpest.nectarine.html Accessed 2014.

Bentley WJ, Hasey JK, Day KR (2012) Insects and mites. In UC IPM Pest management guidelines: peach. UC IPM Online: Statewide Integrated Pest Management Program. http://www.ipm.ucdavis.edu/PDF/PMG/pmgpeach.pdf Accessed 2014.

Berry RE (1998) Spider mites Acari: Tetranychidae Twospotted *Tetranychis urticae,* McDaniel T. *mcdanieli*, European red *Panonychus ulmi*, Yellow *Eotetranychus carpini borealis*. *Insects and mites of economic importance in the Pacific Northwest* 2nd edn, 66–66. Agricultural Experiment Station, Oregon State University, Corvallis.

Biosecurity Australia (2005a) *Draft extension of existing policy for pears from The People's Republic of China*. Biosecurity Australia, Department of Agriculture, Fisheries and Forestry, Canberra.

Biosecurity Australia (2005b) *Final extension of policy for the importation of pears from the People's Republic of China*. Department of Agriculture, Fisheries and Forestry, Canberra.

Biosecurity Australia (2006a) *Final import risk analysis report for apples from New Zealand: part a, b and c*. Biosecurity Australia, Department of Agriculture, Fisheries and Forestry, Canberra.

Biosecurity Australia (2006b) *Final pest risk analysis for stone fruit from New Zealand into Western Australia*. Biosecurity Australia, Department of Agriculture, Fisheries and Forestry, Canberra.

Biosecurity Australia (2006c) *Policy for the importation of fresh mangoes (Mangifera indica L.) from Taiwan*. Biosecurity Australia, Department of Agriculture, Fisheries and Forestry, Canberra.

Biosecurity Australia (2008) *Final import risk analysis report for fresh mango fruit from India*. Biosecurity Australia, Department of Agriculture, Fisheries and Forestry, Canberra.

Biosecurity Australia (2009) *Final import risk analysis report for fresh unshu mandarin fruit from Shizuoka prefecture in Japan*. Department of Agriculture, Fisheries and Forestry, Canberra.

Biosecurity Australia (2010a) *Final import risk analysis report for fresh apple fruit from the People's Republic of China*. Biosecurity Australia, Department of Agriculture, Fisheries and Forestry, Canberra.

Biosecurity Australia (2010b) *Final import risk analysis report for fresh stone fruit from California, Idaho, Oregon and Washington*. Biosecurity Australia, Department of Agriculture, Fisheries and Forestry, Canberra.

Biosecurity Australia (2011) *Final import risk analysis report for table grapes from the People's Republic of China*. Department of Agriculture, Fisheries and Forestry, Canberra.

Blomefield TL, Giliomee JH (2012) Fecundity and mortality of codling moth, *Cydia pomonella* (L.) (Lepidoptera: Tortricidae), under field conditions in South Africa. *African Entomology* 20: 316–324.

Bolda MP, Goodhue RE, Zalom FG (2010) Spotted wing drosophila: potential economic impact of a newly established pest. *Agricultural and Resource Economics Update* 13: 5–8.

Booth RG, Cox ML, Madge RB (1990) *Coleoptera.* CAB International, Wallingford.

Bos L (1999) Symptoms of virus diseases. *Plant viruses, unique and intriguing pathogens: a textbook of plant virology* 27–29. Backhuys Publishers, Leiden.

Boscia D, Myrta A, Uyemoto JK (2011) Plum bark necrosis stem pitting-associated virus. In Hadidi A, Barba M, Candresse T, Jelkman W (eds) *Virus and virus-like diseases of pome and stone fruits* 177–179. The American Phytopathological Society, St. Paul, Minnesota.

Botha J, Learmonth S (2005) *Management of European red mite in Western Australia*. Farmnote no. 40/2005, Department of Agriculture, Western Australia.

Bounous G, Liu L (1996) Castanicoltura in China. *Rivista di Frutticoltura e di Ortofloricoltura* 1: 41–48.

Bradbury JF (1986) *Guide to plant pathogenic bacteria.* CAB International, Slough.

Brewer LJ, Walton V, Dreves A, Shearer P, Zalom F, Walsh D (2012) Biology and management of spotted wing *Drosophila* on small and stone fruits: Year 2 reporting cycle. http://horticulture.oregonstate.edu/system/files/SWD_ResearchReviewYear%202_7.16.12.pdf Accessed July 2012.

Briolini G, Giunchi P (1966) Brief notes on the ecology and ethology of some injurious insects. *Bollettino dell'Osservatorio per le malattie delle piante di Bologna* 1: 83–89.

Brunner JF, Rice RE (1998) Oriental fruit moth: *Grapholita molesta* (Busck) (Lepidoptera: Tortricidae). Washington State University. http://jenny.tfrec.wsu.edu/ Accessed 2 November 2009.

Brunt AA, Crabtree K, Dallwitz MJ, Gibbs AJ, Watson L, Zurcher EJ (1996) Plant viruses online: descriptions and lists from the VIDE database. http://biology.anu.edu.au/Groups/MES/vide/ Accessed 2014.

Brunt AA, Teakle DS (1996) *Tobacco necrosis necrovirus*. In Brunt AA, Crabtree K, Dallwitz MJ, Gibbs A, Watson L (eds) *Viruses of plants: descriptions and lists from the VIDE database* 1256–1259. CAB International, Wallingford.

Büchen-Osmond C (2002) Viruses of plants in Australia. ICTVdB: The Universal Virus Database, version 4. http://ictvdb.bio-mirror.cn/Aussi/aussi.htm Accessed September 2013.

Büchen-Osmond C, Crabtree K, Gibbs A, McLean G eds (1988) *Viruses of plants in Australia. Descriptions and lists from the VIDE database.* The Australian National University Research School of Biological Sciences, Canberra.

Burrows WE (1976) *Aspects of nutrient cycling in semi arid Mallee and Mulga communities.* PhD thesis, Australian National University, Canberra, Australia.

Byrde RJW, Willets HJ (1977) *The brown rot fungi of fruit: their biology and control.* A. Wheaton & Co., Exeter.

Byun BK, Yan SC, Li CD (2003) Revision of tribe archipini (Tortricidae: Tortricinae) in northeast China. *Journal of Forestry Research* 14: 93–102.

CAAS (1992) *Disease and pest fauna of fruit trees in China.* Fruit Tree Research Institute and Citrus Research Institute (ed)Chinese Academy of Agricultural Sciences, China Agriculture Publishing House, Beijing, China.

CABI (2012) Crop Protection Compendium. CAB International, Wallingford, UK. http://www.cabi.org/cpc Accessed 2012.

CABI (2013) Crop Protection Compendium. CAB International, Wallingford, UK. http://www.cabi.org/cpc Accessed 2013.

CABI (2014) Crop Protection Compendium. CAB International, Wallingford, UK. http://www.cabi.org/cpc Accessed 2014.

CABI (2015) Crop Protection Compendium. CAB International, Wallingford, UK. http://www.cabi.org/cpc Accessed 2015.

CABI-EPPO (1984) Commonwealth Institute of Entomology, distribution maps of plant pests, map no. 467: *Mamestra brassicae* (Linnaeus). CAB Abstracts plus. http://www.cababstractsplus.org/DMPP/Index.asp Accessed 17 February 2010.

CABI-EPPO (1997a) Data sheets on quarantine pests: *Cydia packardi*. European and Mediterranean Plant Protection Organization. http://www.eppo.org/ Accessed 20 May 2009a.

CABI-EPPO (1997b) Datasheets on quarantine pests: *Anarsia lineatella*. European and Mediterranean Plant Protection Organization. http://eppo.org/ Accessed 7 February 2011b.

CABI-EPPO (1997c) Datasheets on quarantine pests: *Cherry rasp leaf 'nepovirus'*. In Smith IM, McNamara DG, Scott PR, Holderness M (eds) *Quarantine pests for Europe* 2nd edn, 1–3. CAB International, Wallingford.

CABI-EPPO (1997d) Datasheets on quarantine pests: *Frankliniella occidentalis*. European and Mediterranean Plant Protection Organization. http://eppo.org/ Accessed 7 February 2011d.

CABI-EPPO (2002) Cucumber mosaic virus. Distribution maps of Plant Diseases No.866. European and Mediterranean Plant Protection Organization. http://www.cabi.org/dmpd/?loadmodule=review&page=4050&reviewid=16250&site=165 Accessed 5 August 2011.

CABI-EPPO (2004) Datasheets on quarantine pests: *Plum pox potyvirus*. European and Mediterranean Plant Protection Organization. http://www.eppo.org/ Accessed 27 March 2009.

CABI-EPPO (2007) Datasheets on quarantine pests: *Plum pox potyvirus*. In Smith IM, McNamara DG, Scott PR, Holderness M (eds) *Quarantine pests for Europe* 1287–1293. CAB International, Wallingford.

CABI-EPPO (2010) Datasheets on quarantine pests: *Scirtothrips dorsalis*. European and Mediterranean Plant Protection Organization. http://www.eppo.org/ Accessed 29 March 2010.

Cannon PF (1996) Systematics and diversity of the Phyllachoraceae associated with Rosaceae, with a monograph of *Polystigma*. *Mycological Research* 100: 1409–1427.

Cao KC, Guo SF (1987) Preliminary observations on the bionomics of *Recurvaria syrictis* Meyrick. *Insect Knowledge [Kunchong Zhishi]* 24: 279–281.

Cao KC, Wang CX (1986) A preliminary report on bionomics of *Acronycta strigosa*. *Plant Protection* 12: 29–31.

Cao Y, Zeng L, Cui ZX, Wang YB, Chen WS (2004) Study of the effect of host plants on peach aphid on lily (in Chinese). *Journal of Southwest Agricultural University (Natural Science)* 26: 165–168.

Cardoso JM, Felix MR, Clara MI, Oliveira S (2005) The complete genome sequence of a new necrovirus isolated from *Olea europaea* L. *Archives of Virology* 150: 815–823.

Carter DJ (1984) *Pest Lepidoptera of Europe: with special reference to the British Isles.* Dr W. Junk Publishers, Dordrecht.

Carver M, Gross GF, Woodward TE (1991) Hemiptera (bugs, leafhoppers, cicadas, aphids, scale insects etc.). In Naumann ID, Carne PB, Lawrence JF, Nielsen ES, Spradbery JP, Taylor RW, Whitten MJ, Littlejohn MJ (eds) *The insects of Australia: a textbook for students and research workers* 429–509. Melbourne University Press, Carlton.

Castellari PL (1988) Studies on *Pandemis cerasana* Hb. (=ribeana Hb.), *Archips podanus* Scob., *A. rosanus* L., *Argyrotaenia pulchellana* Haw. (Lep. Tortricidae) and a method for their control. *Bollettino dell'Istituto di Entomologia della Universita degli Studi di Bologna* 42: 139–174.

Chapman PJ, Lienk SE (1974) Green Fruitworms. *New York's Food and Life Sciences Bulletin* 50: 1–15.

Chapman PJ, Lienk SJ (1971) *Tortricid fauna of apple in New York (Lepidoptera: Tortricidae): including an account of apples' occurrence in the State, especially as a naturalized plant.* New York State Agricultural Experiment Station, Cornell University, New York.

Chen P, Ye H (2007) Population dynamics of *Bactrocera dorsalis* (Diptera: Tephritidae) in Lujiangba, Yunnan. *Journal of Zhejiang University (Agriculture and Life Sciences)* 33: 633–640.

Chen P, Ye H, Liu J (2006) Population dynamics of *Bactrocera dorsalis* (Diptera: Tephritidae) and analysis of the factors influencing the population in Ruili, Yunnan Province, China. *Acta Ecologica Sinica* 26: 2801–2809.

Chen PC, Zhang JH, Li MM, Lei YH (2007) Physiological change and hyperspectral character analysis of cotton leaves infested by *Tetranychus turkestani* (in Chinese). *Chinese Bulletin of Entomology* 44: 61–65.

Chen S (2003) Bionomics of *Parlatoria oleae* and its control. http://www.ilib2.com/A-QCode~kczs200303020.html Accessed 23 February 2010.

Cheng LS (1994) A new record of Chinese Tetranychidae. *Journal Zoological Research* 15: 20–20 (abstract only).

China Plant Pests (2007) Peach weevil *(Rhynchites faldermanni* Schoenherr). www.zwbc.net Accessed 23 February 2010.

China Shipping Australia (2014) 2013 CSAA North bound transit times - AUS1 Mandarin service AUS2 East Orient service. http://www.chinashippingaustralia.com/pdf/transit.pdf Accessed 29 January 2014.

CHNZX-Farming (2008a) *Amphipyra pyramidea* Linneaus. http://www.chnzx.com/book/Farming/index3/guoshu/pinguo/chonghai/10.htm Accessed 20 October 2008a.

CHNZX-Farming (2008b) *Oncotympana maculiocllis* Motschulsky. www.chnzx.com/book/Farming/index3/guoshu/pinguo/chonghai/22.htm Accessed 20 October 2008b.

Chuno CC, Chyi EL, Wai HC (1960) Biology and ecology of the Korean black Scarabaeid *(Holotrichia diomphalia* Bates) and some other Scatabaeids in North China. *Acta Entomologica Sinica (China)* 10: 201–213.

CIQSA (2001a) *Report on exportation of apple from P.R. China to Australia (Shandong province) received between 5-9 March 2001*. State Administration for Entry-Exit Inspection and Quarantine of People's Republic of China, Beijing.

CIQSA (2001b) *Report on exportation of China peach to Australia (Shandong province)*. State Administration for Entry-Exit Inspection and Quarantine of People's Republic of China, Beijing.

CIQSA (2001c) *The document concerning exports of apples of Shaanxi China to Australia received between 5-9 March 2009*. State Administration for Entry-Exit Inspection and Quarantine of People's Republic of China, Beijing.

Clausen CP (1927) The citrus insects of Japan. *Technical Bulletin United States Department of Agriculture* 15: 15–15.

Common IFB (1990) *Moths of Australia.* Melbourne University Press, Carlton.

Constable FE, Joyce PA, Rodoni BC (2007) A survey of key Australian pome fruit growing districts for exotic and endemic pathogens. *Australasian Plant Pathology* 36: 165–172.

Cook RP, Dubé AJ (1989) *Host-pathogen index of plant diseases in South Australia.* Field Crops Pathology Group, South Australian Department of Agriculture, Adelaide.

Coutts RHA, Rigden JE, Slabas AR, Lomonossoff GP, Wise PJ (1991) The complete nucleotide sequence of *Tobacco necrosis virus* strain D. *Journal of General Virology* 72: 1521–1529.

CSIRO (2005) Australian insect common names version 1.53. http://www.ces.csiro.au/aicn/name_s/b_1.htm Accessed 2014.

Cui HG, Hong N, Xu WX, Zhou JF, Wang GP (2011) First report of *Plum bark necrosis stem pitting-associated virus* in stone fruit trees in China. *Plant Disease* 95: 1483–1483 (abstract only).

Cunnington JH, Priest MJ, Powney RA, Cother NJ (2007) Diversity of *Botryosphaeria* species on horticultural plants in Victoria and New South Wales. *Australasian Plant Pathology* 36: 157–159.

Curtis CE, Clark JD, Tebbets JS, Mackey BE (1992) Incidence of arthropods found in packed nectarine fruit in central California. *Southwestern Entomologist* 17: 29–39.

DAFF (2004) *Longan and lychee fruit from the People's Republic of China and Thailand: Final import risk analysis report - Part A and Part B*. Department of Agriculture, Fisheries and Forestry, Canberra.

DAFF (2013) *Final report for the non-regulated analysis of existing policy for fresh lychee fruit from Taiwan and Vietnam*. Department of Agriculture, Fisheries and Forestry, Canberra.

DAFF Biosecurity (2013) *Final pest risk analysis report for Drosophila suzukii*. Department of Agriculture, Fisheries and Forestry, Canberra.

DAFF RSA (2014) 140124 Database 2014 Import Interceptions. Department of Agriculture, Forestry & Fisheries Republic of South Africa. http://www.daff.gov.za/daffweb3/Branches/Agricultural-Production-Health-Food-Safety/Plant-Health Accessed 21 February 2014.

Dai KR, Shi SY (2013) Occurrence regularity and integrated control technology of *Drosophila suzukii* in Chang'an district. *Shaanxi Forest Science and Technology* 5: 88–90.

Dai YC (2005) First report of sapwood rot of peach caused by *Schizophyllum commune* in China. *Plant Disease* 89: 778–778 (abstract only).

Dai YC, Xu M (1998) Studies on the medicinal polypore, *Phellinus baumii,* and its kin, *P. linteus*. *Mycotaxon* 67: 191–200.

Damm U, Verkley GJM, Crous PW, Fourie PH, Haegi A, Riccioni L (2008) Novel *Paraconiothyrium* species on stone fruit trees and other woody hosts. *Persoonia* 20: 9–17.

Damos P, Savopoulou-Soultani M (2010) Population dynamics of *Anarsia lineatella* in relation to crop damage and the development of economic injury levels. *Journal of Applied Entomology* 134: 105–115.

Damus M (2009) Some preliminary results from Climex and Maxent distribution modelling of *Drosophila suzukii.*: version 2. http://entomology.oregonstate.edu/sites/default/files/DrosophilaSuzukiiInfestationModel.pdf Accessed 30 November 2009.

David'yan GE (2009) *Eotetranychus pruni* (Oudemans): garden spider mite. Interactive Agricultural Ecological Atlas of Russia and Neighbouring Countries: Economic Plants and their Diseases, Pests and Weeds. http://www.agroatlas.ru/ Accessed 10 August 2010.

Davidson JA, Miller DR (1990) Ornamental plants. In Rosen D (ed) *Armoured scale insects: their biology, natural enemies and control. Vol. 4B* 603–632. Elsevier Science Publishers B.V., Amsterdam.

Davidson MM, Butler RC, Teulon DAJ (2006) Starvation period and age affect the response of female *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae) to odor and visual cues. *Journal of Insect Physiology* 52: 729–736.

Davis EE, French S, Venette RC (2005) *Mini risk assessment: summer fruit tortrix moth, Adoxophyes orana (Fischer von Roslerstamm, 1834) [Lepidoptera: Tortricidae]*. University of Minnesota, St. Paul, Minnesota.

Davis K (2011) *Presence of Cherry ring mottle virus in Australia (personal communication)*. Department of Agriculture, Fisheries and Forestry, Canberra.

DAWA (2006) *Draft plant pathology lists of pathogen species: table one: pathogens (fungi, bacteria, viruses, viroids and nematodes) recorded from Western Australia*. Department of Agriculture, Perth.

Delbos R, Kerlan C, Dunez J, Lansac M, Dosba F, Germain E (1982) Virus infection of walnuts in France. *Acta Horticulturae (ISHS)* 130: 1–1 (abstract only).

Denning JA (1942) The present status of *Parlatoria chinensis* Marlatt in St. Louis. *Journal of Economic Entomology* 35: 784–785.

Desvignes JC, Grasseau BR, Cornaggia D (1999) Biological properties of apple scar skin viroid: isolates, host range, different sensitivity of apple cultivars, elimination and natural transmission. *Plant Disease* 83: 768–772.

Dezianian A (2005) Investigation on biology of cherry weevil *Rhynchites auratus* (Scop.) in Shahrood region. *Applied Entomology and Phytopathology* 73: 105–117.

Dhillon MK, Singh R, Naresh JS, Sharma HC (2005) The melon fruit fly, *Bactrocera cucurbitae*: a review of its biology and management. *Journal of Insect Science* 5: 1–16.

di Serio F, Malfitano M, Flores R, Randles JW (1999) Detection of *Peach latent mosaic viroid* in Australia. *Australasian Plant Pathology* 28: 80–81.

Diekmann M, Putter CAJ eds (1996) *Stone fruits*. FAO/IPGRI Technical Guidelines for the Safe Movement of Germplasm No. 16, Food and Agriculture Organization of the United Nations, Rome.

Ding DR, Gai JY (2000) Pollinating insects and degree of natural outcrossing of male sterile soyabean materials in Southern China. *Soyabean Science* 19: 74–79.

Ding J, Wu Y, Zheng H, Fu W, Reardon R, Liu M (2006) Assessing potential biological control of the invasive plant, tree-of-heaven, *Ailanthus altissima*. *Biocontrol Science and Technology* 16: 547–566.

DPIPWE (2013) *Plant Quarantine Manual Tasmania - 2014 Edition*. Department of Primary Industries, Parks, Water and Environment, Hobart, Tasmania.

Drake CR (1990) *Armillaria* and *Clitocybe* root rot. In Jones AL, Aldwinckle HS (eds) *Compendium of apple and pear diseases* 49–50. The American Phytopathological Society Press, St. Paul, Minnesota.

Dreistadt SH, Phillips PA (2007a) Thrips. UC IPM Online: Statewide integrated pest management program, University of California, Agriculture and Natural Resources. http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7429.html Accessed 9 February 2009a.

Dreistadt SH, Phillips PA (2007b) Thrips: integrated pest management for landscape professional and home gardeners. *Pest Notes* 7429: 1–8.

Dreves AJ, Walton V, Fisher G (2009) A new pest attacking healthy ripening fruit in Oregon: spotted wing Drosophila, *Drosophila suzukii* (Matsumura). Oregon State University Extension. http://plant-disease.ippc.orst.edu Accessed 23 February 2010.

Ehara S (1969) Three spider mites of the genus *Eotetranychus* infesting fruit trees in Japan (Acarina: Tetranychidae). *Applied Entomology and Zoology* 4: 16–22.

EPPO (2004) *Valsa ceratosperma:* a new canker disease of pear. European and Mediterranean Plant Protection Organization. http://eppo.org/QUARANTINE/Alert_List/fungi/VALSCE.htm Accessed 23 June 2008.

Escudero Colomar LAGLA, Peñarrubia María E, Alcalá Castellblanque F, Vilajiliu Serra M, Batllori Obiols L (2011) *Drosophila suzukii*: new threat for European fruit production. Fondazione Edmund Mach, Research and Innovation Centre (Istituto Agrario di San Michele all'Adige). http://cri.fmach.eu/publications/report/Drosophila-talks Accessed 13 February 2014.

Fang ZG, Wang YP, Zhou K, Zhou ZL (2001) Biological characteristics of *Setora postornata* and its chemical control. *Journal of Zhejiang Forestry College* 18: 173–176.

FAO (1995) *International Standards for Phytosanitary Measures (ISPM) no. 4: Requirements for the establishment of pest free areas*. Food and Agriculture Organization of the United Nations, Rome.

FAO (1999) *International Standards for Phytosanitary Measures (ISPM) no. 10: Requirements for the establishment of pest free places of production and pest free production sites*. Food and Agriculture Organization of the United Nations, Rome.

FAO (2005) *International Standards for Phytosanitary Measures (ISPM) no. 22: Requirements for the establishment of areas of low pest prevalence*. Food and Agriculture Organization of the United Nations, Rome.

FAO (2006) *International Standards for Phytosanitary Measures (ISPM) no. 26: Establishment of pest free areas for fruit flies (Tephritidae)*. Food and Agriculture Organization of the United Nations, Rome.

FAO (2007a) *International Standards for Phytosanitary Measures (ISPM) no 29: Recognition of pest free areas and areas of low pest prevalence*. Food and Agriculture Organization of the United Nations, Rome.

FAO (2007b) *International Standards for Phytosanitary Measures (ISPM) no. 2: Framework for pest risk analysis*. Food and Agriculture Organization of the United Nations, Rome.

FAO (2009) *International Standards for Phytosanitary Measures (ISPM) no. 28: phytosanitary treatments pt 7: irradiation treatment for fruit flies of the family Tephritidae (generic)*. Food and Agriculture Organization of the United Nations, Rome.

FAO (2012) *International Standards for Phytosanitary Measures (ISPM) no. 5: Glossary of phytosanitary terms*. Food and Agriculture Organization of the United Nations, Rome.

FAO (2013) *International Standards for Phytosanitary Measures (ISPM) no. 11: Pest risk analysis for quarantine pests*. Food and Agriculture Organization of the United Nations, Rome.

Farr DF, Bills GF, Chamuris GP, Rossman AY (1989) *Fungi on plants and plant products in the United States.* The American Phytopathological Society Press, St. Paul, Minnesota.

Farr DF, Bills GF, Chamuris GP, Rossman AY (1995) *Nectria*. In Farr DF, Bills GF, Chamuris GP, Rossman AY (eds) *Fungi on plants and plant products in the United States* 1020–1020. The American Phytopathological Society Press, St. Paul, Minnesota.

Farr DF, Rossman AY (2014) Fungal Databases, Systematic Mycology and Microbiology Laboratory, ARS, USDA. http://nt.ars-grin.gov/fungaldatabases/index.cfm Accessed 2014.

Feng MX, Jiang RD, Wang JQ, Li Q, Wang PS, Li RG (2004) Study on the choice of chemicals for use in green apple production. *China Fruits* 4: 8–10.

Feng MX, Wang GP (2004) *Diagnostics and control of pests and diseases of peach, apricot, plum and cherry.* Jindun, Beijing.

Finlay JR, Teakle DS (1969) The effect of pH on the particle stability of a phosphotungstate-stained *Tobacco necrosis virus*. *Journal of General Virology* 5: 93–96.

Fisher DS, Learmonth S (2006) *Six-spotted mite*. Farmnote no. 146, Department of Agriculture, Western Australia.

Fleming WE (1972) *Biology of the Japanese beetle*. Technical Bulletin No. 1449, United States Department of Agriculture, Washington, D.C.

Follett PA, Swedman A, Price DK (2014) Postharvest irradiation treatment for quarantine control of *Drosophila suzukii* (Diptera: Drosophilidae) in fresh commodities. *Journal of Economic Entomology* 107: 964–969.

FSLY (2010) *Culcula panterinaria*. http://www.fsly.gov.cn/newsgl/show.asp?id=1282 Accessed 15 February 2012.

Fu JF, Fu C, Yan XR (2009) Preliminary report of pests and diseases on raspberry in Liaoning province. *Journal of Jilin Agricultural University* 31: 661–665.

Funayama K (2002) Oviposition and development of *Halyomorpha halys* (Stål) and *Homalogonia obtusa* (Walker) (Heteroptera: Pentatomidae) on apple trees. *Japanese Journal of Applied Entomology and Zoology* 46: 1–6.

GAAS (2008a) *Calyptra lata* (Butler). Gansu Academy of Agricultural Science. http://gsagr.ac.cn/zypt/kongchong/showsoft.asp?id=1671 Accessed 20 October 2008a.

GAAS (2008b) *Homalogonia obtusa* (Walker). Gansu Academy of Agricultural Science. http://www.gsagr.ac.cn/zypt/kongchong/showsoft.asp?id=83 Accessed 22 October 2008b.

Gansu Agricultural Academy (2012) *Myzus mumecola* Matsumura. http://www.gsagr.ac.cn/zypt/kunchong/showsoft.asp?id=4219 Accessed 1 May 2012.

Gao HQ, Zhou BQ, Xie X (2004) Control of pear fruit moth by 25% Lidajing emulsion. *China Fruits* 1: 53–53.

Gell I, de Cal A, Torres R, Usall J, Melgarejo P (2009) Conidial density of *Monilinia* spp. on peach fruit surfaces in relation to the incidences of latent infections and brown rot. *European Journal of Plant Pathology* 123: 415–424.

Gencsoylu I, Aksit T, Ozer G, Cacamer A, Baspinar N (2006) Population dynamics and damages on shoots and fruits caused by *Grapholita molesta* Busck (Lep.: Tortricidae), *Anarsia lineatella* Zell (Lep. : Gelechiidae) and *Ceratitis capitata* (Weid.) (Dip. : Tephritidae) in some peach varieties. *Asian Journal of Plant Sciences* 5: 487–491.

Gibanov PK, Sanin YV (1971) Lepidopteran pests of fruits in Primor'ye Province. *Zashchita Rastenii* 16: 41–43.

Gibbs A, Harrison B (1976) Effects of viruses in plants. *Plant virology: the principles* 19–32. Edward Arnold, London.

Gildow F, Damsteegt VD, Stone AL, Schneider W, Luster D, Levy L (2004) *Plum pox* in North America: identification of aphid vectors and a potential role for fruit in virus spread. *Phytopathology* 94: 868–874.

Gildow FE (2004) Transmission of three North American isolates of *Plum pox virus:* identification of aphid vectors and species-specific transmission from infected stone fruits. *Acta Horticulturae (ISHS)* 657: 207–211.

Gilligan TM, Epstein ME (2012) TortAI: Tortricids of agricultural importance. http://idtools.org/id/leps/tortai/index.html Accessed September 2013.

Gilligan TM, Epstein ME (2014) *Adozophyes orana*. TortAI - Tortricids of agricultural importance. http://idtools.org/id/leps/tortai/Adoxophyes_orana.htm Accessed 2015.

Global Biodiversity Information Facility (2013) GBIF Backbone Taxonomy. http://www.gbif.org/species# Accessed 2013.

Gonsalves D (1995) *Tomato ringspot virus*. In Ogawa JM, Zehr EI, Bird GW, Ritchie DF, Uriu K, Uyemoto JK (eds) *Compendium of stone fruit disease* 1st edn, 70–71. The American Phytopathological Society Press, St Paul, Minnesota.

Government of Western Australia (2013) Western Australia Organism List (WAOL). Biosecurity and Agriculture Management Act 2007. http://www.biosecurity.wa.gov.au/western-australian-organism-list-waol Accessed 2013.

Grand LF, Vernia CS (2005) Biogeography and hosts of poroid wood decay fungi in North Carolina: species of *Coltricia*, *Coltriciella* and *Inonotus*. *Mycotaxon* 91: 35–38 (abstract only).

Grehan JR (1989) Larval feeding habits of the Hepialidae. *Journal of Natural History* 23: 803–824.

Grichanov IY, Ovsyannikova EI (2009) *Aporia crataegi* Linnaeus: black-veined White. Interactive Agricultural Ecological Atlas of Russia and Neighbouring Countries: Economic Plants and their Diseases, Pests and Weeds. http://www.agroatlas.ru/en/content/pests/Aporia_crataegi/ Accessed 24 December 2009.

Grove GG (1995) *Podosphaera tridactyla*. The American Phytopathological Society Press, St. Paul, Minnesota.

Grove GG, Eastwell KC, Jones AL, Sutton TB (2003) Diseases of apple. In Ferree DC, Warringtong IJ (eds) *Apples: botany, production and uses* 459–488. CAB International, Wallingford.

GSAGR (2010) *Popillia japonica* (Newman). Gansu Academy of Agricultural Sciences. http://www.gsagr.ac.cn/zypt/kongchong/showsoft.asp?id=2693 Accessed 12 January 2010.

Gu QY, Chen WB, Wang LJ, Shen J, Zhang JP (2010) Effects of sublethal dosage of abamectin and pyridaben on life table of laboratory populations of *Tetranychus turkestani* (Acari: Tetranychidae). *Acta Entomologica Sinica (China)* 53: 876–883.

Guo L, Liu S, Wu Z, Mu L, Xiang B, Li S (2008) *Hop stunt viroid* (HSVd) newly reported from hop in Xinjiang, China. *Plant Pathology* 57: 764–764.

Hadidi A, Giunchedi L, Shamloul AM, Poggi-Pollini C, Amer MA (1997) Occurrence of peach latent mosaic viroid in stone fruits and its transmission with contaminated blades. *Plant Disease* 81: 154–158.

Hadidi A, Hansen AJ, Parish CL, Yang X (1991) Scar skin and dapple apple viroids are seed-borne and persistent in infected apple trees. *Research Virology* 142: 289–296.

HAL (2012) The Australian Horticulture Statistics Handbook 2012. http://cms2live.horticulture.com.au/librarymanager/libs/200/HAL%20Stat%20Handbook.pdf Accessed 1 January 2014.

Halliday RB (2000) Additions and corrections to *Mites of Australia:* a checklist and bibliography. *Australian Journal of Entomology* 39: 233–235.

Halliday RB (2013) Acari. Australian Faunal Directory.Australian Biological Resources Study. http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/Acari Accessed 2014.

Han G, Ma R (1996) Scanning electron microscopy of antennal sensilla of *Acleris fimbriana*. *Forest Research Bulletin* 9: 300–304.

Han L, Wang G, Yang X, Zhu SF, Hadidi A (2003) Viroids in China. In Hadidi A, Flores R, Randles JW, Semancik JS (eds) *Viroids* 283–285. Commonwealth Scientific and Industrial Research Organisation, Collingwood.

Hanson HC (1963) *Diseases and pests of economic plants of Central and South China, Hong Kong and Taiwan (Formosa): a study based on field survey data and on pertinent records, material, and reports*. American Institute of Crop Ecology, Washington, D.C.

Harrington C (2000) Host specialization and speciation in the American wilt pathogen *Ceratocystis fimbriata*. *Fitopatologia Brasileira* 25: 262–263.

Harvard Entomology (2006) Field guides: Hemiptera. http://insects.oeb.harvard.edu/caribbean/ Accessed 12 October 2006.

Hattori I (1969) Fruit-piercing moths in Japan. pp. 32–36.

Hauser M, Gaimari S, Damus M (2009) *Drosophila suzukii* new to North America. *Fly times* 43: 12–15.

He B (1991) Bionomics of *Actias selene ningpoana* Felder and its control. *Entomological Knowledge* 28: 353–354.

Hely PC, Pasfield G, Gellatley JG (1982) *Insect pests of fruit and vegetables in NSW.* Department of Agriculture, Sydney.

Hibben CR, Bozarth RF, Reese J (1979) Identification of *Tobacco necrosis virus* in deteriorating clones of aspen. *Forest Science* 25: 557–567.

Hill DS (2008) *Pests of crops in warmer climates and their control.* Springer-Verlag, Skegness.

Hiromori H, Nishigaki J (1998) Joint action of an entomopathogenic fungus (*Metarhizium anisopliae*) with synthetic insecticides against the scarab beetle, *Anomala cuprea* (Coleoptera: Scarabaeidae) larvae. *Applied Entomology and Zoology* 33: 77–84.

Hirooka Y, Kobayashi T, Natsuaki KT (2005) *Neonectria castaneicola* and *Neo. rugulosa* in Japan. *Mycologia* 97: 1058–1066.

Hodges G (2005) *Scale insects*. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Florida, USA.

Hoebeke ER (2002) Brown marmorated stink bug, *Halyomorpha halys* (Stal) Heteroptera: Pentatomidae. *Regulatory Horticulture* 28: 35–37.

Hoebeke ER, Wheeler AG Jr, Brown JW (2008) *Archips xylosteana* (L.) (Lepidoptera: Tortricidae): a Palearctic leafroller new to North America. *Proceedings of the Entomological Society of Washington* 110: 789–795.

Hoffmann WE (1930) The food habits of *Erthesina fullo* (Thunb.). *Lingnan Science Journal* 9: 139–142.

Homma Y (1927) A canker disease of *Prunus mume* and *P. persica* caused by a species of *Camarosporium*. *The Botanical Magazine* 41: 541–547.

Hou BH, Zhang RJ (2005) Potential distribution of the fruit fly *Bactrocera dorsalis* (Diptera: Tephritidae) in China as predicted by CLIMEX. *Acta Ecologica Sinica* 25: 1570–1574.

Howitt AH (1993) Oriental fruit moth: *Grapholita molesta* (Busck). Fruit IPM Online, Michigan State University. http://www.msu.edu/ Accessed 30 September 2010.

Hoy LE, Whiting DC (1997) Low-temperature storage as a postharvest treatment to control (*Pseudococcus affinis*) (Homoptera: Pseudococcidae) on royal gala apples. *Entomological Society of America: Annual Meeting* 90: 1377–1381.

Hu K, Zhang WX, Carson HL (1993) The Drosophilidae (Diptera) of Hainan Island (China). *Pacific Science* 47: 319–327.

Hu MJ, Cox KD, Schnabel G, Luo CX (2011) *Monilinia* species causing brown rot of peach in China. *PloS ONE* 6(9): e24990–doi:10.1371/journal.pone.0024990.

Hua L, Wang S (2006) Apple pest and disease control system. College of Plant Protection, Northwest Agriculture and Forestry University. http://www.appleonline.com.cn/apple2000 Accessed 24 November 2006.

Huang C, Qin B, Xi Z, Mang K (1984) On the *Tobacco necrosis virus* isolated from hamimelon in Xinjiang and its chemicophysical properties. *Acta Phytopathologica Sinica* 14: 153–158.

Huang Q, Wang YY, Zhao YY, Jiao YX, Li XF, Chen HR, Zhu YY (2007) First report of taro black rot caused by *Ceratocystis fimbriata* in China. *New Disease Reports* 14: 57–57.

Huang YY (2006) Monitoring of fruit flies species and preliminary investigation of host plant in Fujian province. *Subtropical agricultural Research* 49: 49–52.

Huang ZY, Liu X, Li LH, Qi JX, Liang AG (1994) Study on the biology of *Aculus fockeui*. *Entomological Knowledge* 31: 15–17 (abstract only).

Huber GA (1930) The *Aspergilli* and their relation to decay in apples. *Journal of Agriculture Research* 41: 801–807.

Hudson NM (1967) A list of the armoured scale insects (Diaspididae) and their hosts in Tasmania. *Papers and Proceedings of the Royal Society of Tasmania* 101: 91–95.

Hurtt SS, Podleckis EV (1995) *Apple scar skin viroid* is not seed transmitted or transmitted at a low rate in Oriental pear. *Acta Horticulturae (ISHS)* 386: 544–550.

Hwang KH (1974) Identification of ten species of leaf-rollers (Lepidoptera: Tortricidae) on apple trees in north China. *Acta Entomologica Sinica (China)* 17: 29–42.

ICTVdB Management (2014) Virus of plants in Australia: descriptions of Australian features of viruses. ICTVdB: The Universal Virus Database, version 4. http://www.ncbi.nlm.nih.gov/ICTVdb/Aussi/ausidesc.htm Accessed 2014.

INRA (1997) HYPPZ (Hypermédia pour la protection des plantes). Institut national de la recherche agronomique. http://www.inra.fr/hyppz/pa.htm Accessed 2014.

INRA (2006) Bonjour et bienvenue sur. Institut national de la recherche agronomique: HYPP zoology. http://www.inra.fr/ Accessed 22 March 2010.

IPPC (2013) Absence of Tomato ringspot virus from Australia. International Plant Protection Convention. https://www.ippc.int/countries/australia/basic-reporting/absence-tomato-ringspot-virus-australia Accessed 1 April 2014.

IPPC (2015) Little cherry virus 2 in Australia. https://www.ippc.int/en/countries/Australia/pestreports/2014/05/little-cherry-virus-2-in-australia/ Accessed 20 May 2015.

Ishiguri Y, Toyoshima S (2006) Larval survival and development of the peach fruit moth, *Carposina sasakii* (Lepidoptera: Carposinidae), in picked and unpicked apple fruits. *Applied Entomology and Zoology* 41: 685–690.

Jacobs S (2014) Entomological notes: brown marmorated stink bug *Halyomorpha halys*. Pennsylvania State University. http://ento.psu.edu/extension/factsheets/brown-marmorated-stink-bug Accessed December 2014.

James DG, Faulder RJ, Bartelt RJ (1995) Fauna and seasonal abundance of *Carpophilus* spp. (Coleoptera: Nitidulidae) in four stone fruit growing regions of southeastern Australia as determined by pheromone trapping. *Journal of the Australian Entomological Society* 34: 327–333.

James DG, Faulder RJ, Vogele B, Moore CJ (2000) Pheromone-trapping of *Carpophilus* spp. (Coleoptera: Nitidulidae) in stone fruit orchards near Gosford, New South Wales: fauna, seasonality and effect of insecticides. *Australian Journal of Entomology* 39: 310–315.

Jeffers WF (1940) Studies on *Caryospora putaminum*. *Mycologia* 32: 550–566.

Jensen FL, Flaherty DL, Luvisi DA (1992) Major insect and mite pests: Thrips. In Flaherty DL, Christensen LP, Lanini WT, Marois JJ, Phillips PA, Wilson LT (eds) *Grape pest management* 193–201. University of California, Oakland.

Jeppson LR, Keifer HH, Baker EW (1975) *Mites injurious to economic plants.* University of California, Berkeley.

JNGPC (2008) *Nezarra antennata* Scott. http://www.jngpc.cn/Page.aspx?guid=1610&iid=4355 Accessed 17 October 2008.

Johnstone GR, Munro D, Brown GS, Skotland CB (1995) Serological detection, occurrence and spread of ilarviruses in temperate fruit crops, hops and roses in Tasmania. *Acta Horticulturae (ISHS)* 386: 132–135.

Jones AL (1990) Brown rot diseases. In Jones AL, Aldwinckle HS (eds) *Compendium of apple and pear diseases* 32–32. The American Phytopathological Society Press, St. Paul, Minnesota.

Jones DR (2005) Plant viruses transmitted by thrips. *European Journal of Plant Pathology* 113: 119–157.

Jung CR, Han KS, Jung JK, Choi K, Lee SW, Boo KS (2001) Composition and activity of the Asiatic leafroller, *Archippus breviplicanus* (Lepidoptera: Tortricidae) sex phermone at apple orchards in Korea. *Korean Journal of Applied Entomology* 40: 219–226.

Kaneshiro KY (1983) *Drosophila* (*Sophophora*) *suzukii* (Matsumura). *Proceedings of the Hawaiian Entomological Society* 24: 179–179.

Kang ZX, Zhang FY, Sun Q, Lu X, Guo MZ (1989) Application of sex attractant of *Grapholitha molesta* for forecasting and control of *Grapholitha funebrana*. *Insect Knowledge [Kunchong Zhishi]* 26: 142–145.

Kanzawa T (1939) *Studies on Drosophila suzukii Mats*. Yamanashi Agricultural Experimental Station, Kofu.

Kaponi MS, Luigi M, Barba M, Sano T, Kyriakopoulou PE (2010) First report and molecular analysis of *Apple scar skin viroid* in sweet cherry. *Julius Kühn Archiv* 427: 361–365.

Kapoor VC (2002) Fruit-fly pests and their present status in India. *Proceedings of 6th International Fruit Fly Symposium* 23–33. CRP, South Africa.

Kassanis B (1970) *Tobacco necrosis virus*. Descriptions of Plant Viruses. http://www.dpvweb.net Accessed 5 August 2009.

Katsumata K (1934) Results of studies on *Rhynchites heros* Roelofs. *Publication of Ishikawa Agricultural Experimental Station* 45: 1–1.

Kaya K, Gazel M, Serçe CU, Elçi E, Cengiz FC, Cambra M, Caglayan K (2014) Potential vectors of *Plum pox virus* in the Eastern Mediterranean Region of Turkey. *Entomologia Generalis* 35: 137–150.

Kharizanov A (1976) *Argyrotaenia pulchellana* Haw.: a new pest of vine. *Rastitelna Zashchita* 24: 32–32.

Kim DS, Lee JH (2002) Egg and larval survivorship of *Carposina sasakii* (Lepidoptera: Carposinidae) in apple and peach and their effects on adult population dynamics in orchards. *Environmental Entomology* 31: 686–692.

Kim HR, lee SH, Lee DH, Kim JS, Park JW (2006) Transmission of *Apple scar skin viroid* by grafting, using contaminated pruning equipment, and planting infected seeds. *Journal of Plant Pathology* 22: 63–67.

Kitajima H, Sawamura K (1995) *Leucotelium pruni-persicae*. The American Phytopathological Society Press, St. Paul, Minnesota.

Koganezawa H (1986) Further evidence for viroid etiology of apple scar skin and dapple apple diseases. *Acta Horticulturae (ISHS)* 193: 29–33.

Koganezawa H, Yang X, Zhu SF, Hashimoto J, Hadidi A (2003) *Apple scar skin viroid*. In Hadidi A, Flores R, Randles JW, Semancik JS (eds) *Viroids* 137–141. Commonwealth Scientific and Industrial Research Organisation, Collingwood.

Koltunow AM, Krake LR, Rezaian MA (1988) *Hop stunt viroid* in Australian grapevine cultivars: potential for hop infection. *Australasian Plant Pathology* 17: 7–10.

Kondo T, Miyahara T (1930) Fruit borers and a summary of their life-histories in Kwangtung, China. *Journal of Plant Protection (Tokyo)* 17: 85–94.

Kuang C (1985) Studies on the biology and control of *Peridroma saucia* Hubner. *Insect Knowledge [Kunchong Zhishi]* 22: 61–64.

Kulshrestha S, Verma N, Hallan V, Raikhy G, Singh MK, Ram R, Zaidi AA (2005) Detection and identification of *Prunus necrotic ringspot virus* in *Pelargonium*. *Australasian Plant Pathology* 34: 599–601.

Kumral NA, Gencer NS, Coskuncu KS (2004) Life history of *Lepidosaphes conchiformis* (Gmelin) in fig orchards in Bursa, Turkey. Proceeding of the X International Symposium on Scale Insect Studies 19th-23th April, 2004. http://www20.uludag.edu.tr/~bitkik/scalecon_lep.pdf Accessed 19 April 2004.

Kuwana S (1902) *Dactylopius comstocki*. *Proceedings of California Academy of Science* 3: 52–56.

Labonne G, Quiot J (2001) Aphids can acquire *Plum pox virus* from infected fruits. *Acta Horticulturae (ISHS)* 550: 1–5.

Labonne G, Yvon M, Quiot J, Avinent L, Llacer G (1995) Aphids as potential vectors of *Plum pox virus:* comparison of methods of testing and epidemiological consequences. *Acta Horticulturae (ISHS)* 386: 207–218.

Lalancette N, Robison DM (2002) Effect of fungicides, application timing, and canker removal on incidence and severity of constriction canker of peach. *Plant Disease* 86: 721–728.

Lammers JW, Stigter H (2004) *Report of a pest risk analysis - Cnidocampa flavescens*. Plant Protection Service, The Netherlands.

Landcare Research (2014) Soft scale factsheets: *Pulvinaria vitis* (Linnaeus). Landcare Research: Manaaki Whenua. http://www.landcareresearch.co.nz/science/plants-animals-fungi/animals/invertebrates/systematics/scale-insects/species-information-sheets/pulvinaria-vitis Accessed 18 February 2014.

Lee JC, Bruck DJ, Curry H, Edwards D, Haviland DR, Van Steenwyk RA, Yorgey BM (2011) The susceptibility of small fruits and cherries to the spotted-wing drosophila, *Drosophila suzukii*. *Pest Management Science* 67: 1358–1367.

Lepp H (2006) Fungal ecology: fungi and invertebrates. Australian National Botanic Gardens. www.anbg.gov.au Accessed 2014.

Letham DB (1995) *Host-pathogen index of plant diseases in New South Wales*. New South Wales Agriculture, Rydalmere.

Lewis T (1973) *Thrips, their biology, ecology and economic importance.* Academic Press, London.

Li LY, Wang R, Waterhouse DF (1997) *The distribution and importance of arthropod pest and weeds of agriculture and forestry plantations in Southern China.* The Chinese Academy of Agricultural Sciences, Beijing, China and the Australian Centre for International Agricultural Research, Canberra.

Li SC, Liu H, Wu HT (2004) The occurrence of Comstock mealybug under bagging apple culture and its control. *China Fruits* 1: 44–51.

Li SC, Wu HT, Liu SY, Liu RX, Yuan XD (2001) The occurrence of common green stink bug on apple trees and its control. *China Fruits* 6: 31–32.

Li SF, Lu MG (2013) Research on virus of peach trees and the preventive and control measures (in Chinese). *China Fruit News* 30: 80–81.

Liang G, Zhang H, Li Z, Liu T (2007) Studies on the species of flower thrips and its occurrence in Dounan Chenggong county of Yunnan. *Southwest China Journal of Agricultural Sciences* 20: 1291–1295.

Liang GQ, Hancock DL, Xu W, Liang F (1993) Notes on the *Dacinae* of Southern China (Diptera: Tephritidae). *Australian Journal of Entomology* 32: 137–140.

Liberti D, Marais A, Svanella-Dumas L, Dulucq MJ, Alioto D, Ragozzino A, Rodoni B, Candresse T (2005) Characterization of apricot pseudo-chlorotic leaf spot virus, a novel Trichovirus isolated from stone fruit trees. *Phytopathology* 95: 420–426.

Liu Q, Zheng LY (1994) On the Chinese species of *Plautia* Stal (Hemiptera: Pentatomidae). *Entomotaxonomia* 16: 235–248.

Liu X, Ye H (2009b) Effect of temperature on development and survival of Bactrocera correcta (Diptera: Tephritidae). *Scientific Research and Essay* 4: 467–472.

Liu X, Ye H (2009a) Effect of temperature on development and survival of *Bactrocera correcta* (Diptera: Tephritidae). *Scientific Research and Essay* 4: 467–472.

Liu XQ (2002) The occurrence of fruit piercing moth in Wuhan area and its control. *South China Fruits* 31: 15–16.

Liu Y, Kuang Y (2001) Emergence and control of dominant population fruit-piercing moth in Hubei province. *Plant Protection Bulletin* 27: 31–32.

Liu Y, Meng X (2003) Trapping effect of synthetic sex pheromone of *Acleris fimbriana* (Lepidoptera: Tortricidae) in Chinese Northern orchard. *Zeitschrift fur Naturforschung: Section C, Biosciences* 58: 421–425.

Lo PKC (1968) Tetranychoid mites infesting fruit plants in Taiwan. *Bulletin Sun Yat-sen Cultural Foundation* 2: 97–137.

Lommel SA, Martelli GP, Rubino L, Russo M (2005) Family Tombusviridae. In Fauquet CM, Mayo MA, Maniloff J, Desselberger U, Ball LA (eds) *Virus taxonomy classification and nomenclature: eighth report of the International Committee on Taxonomy of Viruses* 907–936. Elsevier Academic Press, San Diego.

Lu H, Gong Y-J, Shi B, Jing-Yi S (2007) Spatial distribution pattern and sampling of the western flower thrips, *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae), on cucumber and green bean. *Acta Entomologica Sinica (China)* 50: 1187–1193.

Ma CS (2006) Pests, diseases and weeds of apples. Key Laboratory of Agriculture Department, China. http://www.ecolsafety.org.cn//db/Fruit/login_pg.asp Accessed 1 September 2006.

Ma L, Jia W, Hong XY, Wang DS (2005) Influences of different host plants on the development duration and egg deposition of *Tetranychus urticae* Koch and *Tetranychus cinnabarinus* (Boisduval. *Journal of Nanjing Agricultural University* 28: 60–64.

Ma YX, Li JJ, Li GF, Zhu SF (2014) First report of *Cherry mottle leaf virus* infecting cherry in China. *Plant Disease* 98: 1161–1161.

Maccarone LD, Sivasithamparam K, Barbetti MJ, Jones RAC (2008) Phylogenetic analysis of *Olpidium virulentus, Lettuce big-vein associated virus* and *Mirafiori lettuce big-vein virus* isolates from Western Australia. *Plant Health Research Symposium 2008* 1–6. Australian Plant Pathology Society, Western Australia.

Maciesiak A (1999) Pear leaf blister moth (*Leucoptera scitella* Zell.) appearance and control. *Progress in Plant Protection* 39: 444–447 (abstract only).

MAFF (1989) *Diseases of peach and nectarine sent by Ministry of Agriculture, Forestry and Fisheries, Japan*. Ministry of Agriculture, Forestry and Fisheries, Tokyo.

MAFF (1990) *Biological information sent by Japan*. Ministry of Agriculture, Forestry and Fisheries, Japan.

MAFF (2008) *Pest and disease status of pests relevant to stonefruit sent by Ministry of Agriculture, Forestry and Fisheries, Japan*. Ministry of Agriculture, Forestry and Fisheries, Tokyo.

MAFF (2010) *Information on Japanese peaches and nectarines sent by Ministry of Agriculture, Forestry and Fisheries, Japan*. Ministry of Agriculture, Forestry and Fisheries, Toyko.

Malumphy CP (2005) *Eulecanium excrescens* (Ferries) (Hemiptera: Coccidae), an Asian pest of woody ornamentalis and fruit trees, new to Britain. *British Journal of Entomology and Natural History* 18: 45–49.

Manson DCM (1987) A list of New Zealand mites and their host plants. *Department of Scientific and Industrial Research Bulletin* 240: 1–63.

Martin RR, Tzanetakis IE (2006) Characterization and recent advances in detection of strawberry viruses. *Plant Disease* 90: 384–396.

Martini C, Lantos A, Di Francesco A, Guidareli M, D'Aquino S, Baraldi E (2014) First report of Asiatic brown rot caused by *Monilinia polystroma* on peach in Italy. *Plant Disease* 98: 1585–1585 (abstract only).

Matsumoto K, Nakamuta K, Nakashima T (2007) Mating distruption controls the cherry tree borer, *Synanthedon hector* (Butler) (Lepidoptera: Sesiidae), in a steep orchard of cherry trees. *Journal of Forestry Research* 12: 34–37.

Mau RFL, Martin Kessing JL (1993) *Frankliniella occidentalis (*Pergande). Crop Knowledge Master. http://www.extento.hawaii.edu/kbase/Crop/SciName/cropsci.htm Accessed 15 October 2009.

May TW, Milne J, Shingles S, Jones RH (2003) *Fungi of Australia vol. 2B: catalogue and bibliography of Australian fungi 2. Basidiomycota p.p. & Myxomycota p.p.* Grgurinovic CA, Cayzer L (eds) Australian Biological Resources Study/Commonwealth Scientific and Industrial Research Organisation, Melbourne.

MBG Integrated Pest Management (2011) Nectria canker and dieback. http://www.mobot.org/gardeninghelp/plantfinder/IPM.asp?code=145&group=21&level=s Accessed 2014.

McDonald JR, Bale JS, Walter KFA (1997a) Rapid cold hardening in the Western flower thrips *Frankliniella occidentalis*. *Journal of Insect Physiology* 43: 759–766.

McDonald JR, Bale JS, Walters KFA (1997b) Low temperature mortality and overwintering of the western flower thrips *Frankliniella occidentalis* (Thysanoptera: Thripidae). *Bulletin of Entomological Research* 87: 497–505.

McDougall S (2006) Lettuce IPM. *Primefacts: Profitable and Sustainable Primary Industries* 154: 1–5.

McLaren GF, Grandison G, Wood GA, Tate G, Horner I (1999) *Summerfruit in New Zealand: management of pests and diseases.* HortResearch, Otago.

McLean GD, Price LK (1984) Virus, viroid, mycoplasma and rickettsial diseases of plants in Western Australia. *Western Australia Department of Agriculture Technical Bulletin* 68: 1–22.

McRitchie JJ (1991) The felt fungus, *Septobasidium*. *Plant Pathology Circular* 346: 1–2.

Meijerman L, Ulenberg SA (2000a) Arthropods of economic importance - Eurasian Tortricidae. http://wbd.etibioinformatics.nl/bis/tortricidae.php Accessed 2014a.

Meijerman L, Ulenberg SA (2000b) Eurasian Tortricidae: *Argyrotaenia ljungiana*. Arthropods of Economic Importance. http://nlbif.eti.uva.nl/bis/projects.php Accessed 17 June 2010b.

Meijerman L, Ulenberg SA (2004) Arthropods of economic importance - Eurasian Tortricidae. http://wbd.etibioinformatics.nl/bis/tortricidae. Accessed September 2012.

Men Q-L, Chen M-H, Zhang Y-L, Feng J-N (2013) Genetic structure and diversity of a newly invasive species, the codling moth, *Cydia pomonella* (L.) (Lepidoptera: Tortricidae) in China. *Biological Invasions* 15: 447–458.

Meulewaeter F, Seurinck J, Van Emmelo J (1990) Genome structure of *Tobacco necrosis virus* strain A. *Virology* 177: 699–709.

Migeon A, Dorkeld F (2012) Spider mites web: a comprehensive database for the Tetranychidae. http://www1.montpellier.inra.fr/CBGP/spmweb/ Accessed May 2012.

Migeon A, Dorkeld F (2013) Spider mites web: a comprehensive database for the Tetranychidae. http://www1.montpellier.inra.fr/CBGP/spmweb/ Accessed 2014.

Miller DR, Davidson JA (1990) Armoured scale insects as pests. In Rosen D (ed) *Armored scale insects: their biology, natural enemies and control. Vol. 4B* 299–657. Elsevier Science Publishers B.V., Amsterdam.

Miller DR, Davidson JA (2005) *Armored scale insect pests of trees and shrubs (Hemiptera: Diaspididae).* Cornell University Press, Ithaca & London.

Miller DR, Rung A, Venable GL, Gill RJ (2007) Scale insects - soft scales: identification tools for species of quarantine significance. http://www.sel.barc.usda.gov/ScaleKeys/ScaleInsectsHome/ScaleInsectsSoftScales.html Accessed 2014.

Milonas PG, Savopoulou-Soultani M (2000) Development, survivorship, and reproduction of *Adoxophyes orana* (Lepidoptera: Tortricidae) at constant temperatures. *Annals of the Entomological Society of America* 93: 96–102.

Ministry of Agriculture and Lands (2006) *Little cherry virus* disease. Government of British Columbia: Pest Management. http://www.agf.gov.bc.ca/cropprot/lcv2.htm Accessed 5 December 2006.

Mirab-balou M, Tong XL, Feng JN, Chen XX (2011) Thrips (Insecta: Thysanoptera) of China. *Check List* 7: 720–744.

Mitrofanova OV, Teslenko AV (1982) Diagnosis of virus diseases of peach in the Crimea. *Vrediteli i Bolezni Plodovykh i Dekorativnykh Kul'tur Kryma* nil: 89–99.

MOA (2007) *Quarantine pest list for import plants to the People's Republic of China*. Ministry of Agriculture, China.

Molinari F, Reguzzi MC, Quaglia M, Galliano A, Cravedi P (1995) Damage by noctuid larvae in peach orchards. *Informatore Fitopatologico* 45: 17–26 (abstract only).

Moore J, Wilkinson M, Conti A, Minnis D (2012) *Australia China agricultural cooperation agreement. Summerfruit delegation. 8th July - 22 July 2012*. Final report, Summerfruit Australia Limited (SAL), Australia.

Moritz G, Kumm S, Mound L (2004) *Tospovirus* transmission depends on thrips ontogeny. *Virus Research* 100: 143–149.

Morse JG, Hoddle MS (2006) Invasion biology of thrips. *Annual Review of Entomology* 51: 67–89.

Munro D (1987) Viruses infecting hop, *Humulus lupulus*, in Australia. *Australian Journal of Agricultural Research* 38: 83–90.

Murakami Y, Morimoto R, Kajita H (1967) Possibility of biological control of *Pseudococcus comstocki* in Japan. *Mushi* 39: 85–96.

Murrell VC, Lo PL (1998) Control of Oriental fruit moth *(Grapholita molesta)* on golden queen peaches. *Proceedings of the 51st New Zealand Plant Protection Conference, Quality Hotel, Hamilton, New Zealand, 11-13 August, 1998* 189–194. New Zealand Plant Protection Society, Wellington.

Naka H, Horie Y, Mochizuki F, Vang LV, Yamamoto M, Saito T, Watarai T, Tsuchida K, Arita Y, Ando T (2008) Identification of the sex pheromone secreted by *Synanthedon hector* (Lepidoptera: Sesiidae). *Applied Entomology and Zoology* 43: 467–474.

NAPPO (2010) Spotted wing drosophila, *Drosophila suzukii*, a fruit pest in the United States. North American Plant Protection Organization. http://www.pestalert.org/oprDetail.cfm?oprID=417&keyword=drosophila Accessed 3 March 2010.

Navajas M, Gutierrez J, Williams M, Gotoh T (2001) Synonymy between two spider mite species, *Tetranychus kanzawai* and *T. hydrangeae* (Acari: Tetranychidae), shown by ribosomal ITS2 sequences and cross-breeding experiments. *Bulletin of Entomological Research* 91: 117–123.

Navratil M, Safarova D, Karesova R, Petrzik K (2005) First incidence of *Plum pox virus* on apricot trees in China. *Plant Disease* 89: 338–338.

NCBI (2009) *Necrovirus*. National Centre for Biotechnology Information. http://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=12052 Accessed 14 August 2009.

NCPN-FT (2014) Fruit tree clean plant network: *Prunus* viruses. University of California National Clean Plant Network. http://nationalcleanplantnetwork.org/files/29279.pdf Accessed 17 December 2014.

Nemeth M (1986) *Tobacco necrosis virus*. *Virus, mycoplasma and rickettsia diseases of fruit trees* 572–575. Martinus Nijhoff Publishers, Dordrecht.

Neven LG (1999) Cold hardiness adaptations of codling moth, *Cydia pomonella*. *Cryobiology* 38: 43–50.

Neven LG (2013) Effects of short photoperiod on coddling moth diapause and survival. *Journal of Economic Entomology* 106: 523–523.

NIAS (2009) National Institute of Agrobiological Sciences databases. National Institute of Agrobiological Sciences Genebank. http://www.gene.affrc.go.jp/index_en.php Accessed 27 April 2010.

Niu FQ, Pan S, Wu ZJ, Jiang DM, Li SF (2012) First report of apricot pseudo-chlorotic leaf spot virus infection of peach in China. *Journal of Plant Pathology* 94: 1–1 (abstract only).

Noma T, Colunga-Garcia M, Brewer M, Landis J, Gooch A (2010) Summer fruit tortrix *Adozophyes orana*. Michigan State University's invasive species factsheets. http://www.ipm.msu.edu/uploads/files/forecasting_invasion_risks/summerfruittortrix.pdf Accessed 2015.

Northern Territory Government (2011) *Plant Health Regulations*. Northern Territory Government of Australia Department of the Chief Minister, Northern Territory.

Ogawa JM, Zehr EI, Biggs AR (1995) *Monilinia fructigena* . In Ogawa JM, Zehr EI, Bird GW, Ritchie DF, Uriu K, Uyemoto JK (eds) *Compendium of stone fruit diseases* 7–10. The American Phytopathological Society Press, St. Paul, Minnesota.

Oku T, Ohira Y, Wakou M (1988) Preliminary notes on a plum fruit moth, *Grapholita dimorpha* Komai (Lepidoptera: Tortricidae). *Bulletin of the Fruit Research Station, Series C, Morioka* 15: 49–64.

Ovsyannikova EI, Grichanov IY (2009) *Argyrotaenia ljungiana* (Thunberg): Grape tortrix. Interactive Agricultural Ecological Atlas of Russia and Neighbouring Countries: Economic Plants and their Diseases, Pests and Weeds. http://www.agroatlas.ru/en/ Accessed 12 May 2010.

Palmer JM, Mound LA, du Heaume GJ, Betts CR (1989) *Thysanoptera.* CAB International, Wallingford, U.K.

Pan H, Liu B, Lu Y, Desneux N (2014) Identification of the key weather factors affecting overwintering success of *Apolygus lucorum* eggs in dead host tree branches. *PloS ONE* 9: e94190–doi:10.1371/journal.pone.0094190.

Panait N, Ciortan G (1972) Semnalarea daunatorului *Gastropacha quercifolia* L. pe piersic in Rumania. *Analele Institutului de Cercetari pentru Protectia Plantelor* 10: 265–272 (abstract only).

Park KT, Lee JS, Lu.L. (2000) Gelechiidae (Lepidoptera) from Changbai-san in China. *Korean Journal of Applied Entomology* 39: 239–244.

Paschoal AD (1968) Um ácaro parasita de plantas frutíferas: *Tetranychus mexicanus* (Acarina: Tetranychidae). *Solo* 60: 75–77.

Paulechova K, Baumgartenerova H (1980) Some properties of *Tobacco necrosis virus* isolated from plums. *Acta Phytopathologica Academiae Scientarium Hungaricae* 15: 119–122.

Pellizzari G, Duso C, Rainato A, Pozzebon A, Zanini G (2012) Phenology, ethology and distribution of *Pseudococcus comstocki*, an invasive pest in northeastern Italy. *Bulletin of Insectology* 65: 209–215.

Persley DM, Thomas JE, Sharman M (2006) *Tospoviruses:* an Australian perspective. *Australasian Plant Pathology* 35: 161–180.

Phillips CB (1994) Leaf diseases. www.pir.sa.gov.au Accessed 30 November 2009.

Phillips JHH (1963) Life history and ecology of *Pulvinaria vitis* (L.) (Hemiptera: Coecoidea), the cottony scale attacking peach in Ontario. *The Canadian Entomologist* 95: 372–402.

Pickel C, Bentley WJ, Hasey JK, Day KR, Rice RE (2006) Peach: peach twig borer. UC IPM Online: Statewide integrated pest management program, University of California, Agriculture and Natural Resources. http://www.ipm.ucdavis.edu/ Accessed 21 July 2009.

Plant Health Australia (2001) Australian plant pest database, online database. www.planthealthaustralia.com.au/appd Accessed 2014.

Pollini A (2008) Combating certain fruit moths with specific preparations. *Informatore Agrario* 64: 11–12.

Poole MC (2010) *An annotated catalogue of insect and allied species associated with Western Australian agriculture and related industries: perennial draft, July 2010*. Department of Agriculture and Food, Government of Western Australia.

Poole MC, Wood CE, Lanoiselet V, Tuten SJ, Hammond NE (2011) *Final pest risk analysis report for the importation of fresh summerfruit from South Australia, Tasmania, New South Wales and Victoria into Western Australia*. Department of Agriculture and Food, Western Australia.

Priest M (2009) *Cherry rasp leaf virus (personal communication)*. Department of Primary Industries, New South Wales.

Raine J, McMullen RD, Forbes AR (1986) Transmission of the agent causing little cherry disease by the apple mealy bug *Phenacoccus aceris* and the dooder *Cuscuta lupuliformis* . *Canadian Journal of Plant Pathology* 8: 6–11.

Randles JW, Francki RIB (1965) Some properties of a *Tobacco ringspot virus* isolate from South Australia. *Australian Journal of Biological Sciences* 18: 979–986.

Rao WL, Zhang ZK, Li R (2009) First report of *Cherry virus A* in sweet cherry trees in China. *Plant Disease* 93: 425–425.

Rebenstorf K, Candresse T, Dulucq MJ, Buttner C, Obermeier C (2006) Host species-dependent population structure of a *Pollen-borne plant virus, Cherry leaf roll virus*. *Journal of Virology* 80: 2453–2462.

Reding ME, Alston DG (2003) Peach twig borer: *Anarsia lineatella*. Utah Pests Fact Sheet. http://extension.usu.edu/files/factsheets/twigbore.pdf Accessed 25 June 2003.

Reinking OA (1919) Diseases of economic plants in Southern China. *The Philippine Agriculturist* 8: 109–135.

Ren SZ (1984) Studies on the fine structure of egg-shells and the biology of *Megacopta Hsiao* et Jen from China (Hemiptera: Plataspidae). *Entomotaxonomia* 6: 327–332.

Reynolds B, Teakle DS (1976) Viruses infecting commercial gladiolus cultivars in Queensland. *APPS Newsletter* 5: 22–23.

Rice RE, Garnett WW, Steenwyk RA (1996) Insect and mite pest. In Micke WC (ed) *Almond production manual* 1–289. UCANR Publications, University of California, Division of Agriculture and Natural Resources, California.

Robinson GS, Ackery PR, Kitching IJ, Beccaloni GW, Hernández LM (2010) HOSTS: a database of the world's lepidopteran hostplants. National History Museum, London. http://www.nhm.ac.uk/hosts Accessed 2014.

Rochon D, Kakani K, Robbins M, Reade R (2004) Molecular aspects of plant virus transmission by Olpidium and Plasmodiophorid vectors. *Annual Review of Phytopathology* 42: 211–241.

Roques A (2006) *Frankliniella occidentalis* (Pergande, 1895) . Delivering Alien Invasive Species Inventories for Europe. http://www.europe-aliens.org/ Accessed 31 October 2006.

Rothschild GHL, Vickers RA (1991) Biology, ecology and control of the Oriental fruit moth. In Van der Geest LPS, Evenhuis HH (eds) *Tortricid pests: their biology, natural enemies and control. Vol. 5* 389–412. Elsevier Science Publishers B.V., Amsterdam.

Rott M, Jelkmann W (2011) Cherry necrotic rusty mottle and cherry rusty mottle viruses. In Hadidi A, Barba M, Candresse T, Jelkman W (eds) *Virus and virus-like diseases of pome and stone fruits* 133–136. The American Phytopathological Society, St. Paul, Minnesota.

Ruiting J, Feng W, Yuezhong L, Yuzhou D, Feng Z (2014) Effect of temperature, soil moisture, and soil depths on eclosion of overwintering *Setora postornata* (Hampson). *Acta Phytophylacica Sinica* 34: 396–400.

Saeed A, Saeed M, Yousuf M (2000) New species and records of some crickets (Gryllinae: Gryllidae: Orthoptera) from Pakistan. *International Journal of Agriculture and Biology* 2: 175–182.

Saeki K, Takahashi Y, Oh-oka H, Umeoka T, Oda Y, Fukuyama K (2001) Primary structure and phylogenetic analysis of the coat protein of a toyama isolate of *Tobacco necrosis virus*. *Bioscience, Biotechnology and Biochemistry* 65: 719–724.

Sampson PJ, Walker J (1982) *An annotated list of plant diseases in Tasmania*. Department of Agriculture, Tasmania.

Sasaya T, Koganezawa H (2006) Molecular analysis and virus transmission tests place *Olpidium virulentus*, a vector of *Mirafiori lettuce big-vein virus* and *Tobacco stunt virus,* as a distinct species rather than a strain of *Olpidium brassicae*. *Journal of General Plant Pathology* 72: 20–25.

Savela M (2009) Calpinae. http://www.funet.fi/pub/sci/bio/life/insecta/lepidoptera/ditrysia/noctuoidea/noctuidae/calpinae/calyptra/index.html Accessed 29 October 2009.

Savopoulou-Soultani M, Hatzivassiliadis A, Vlug HJ, Minks AK, Tzanakakis ME (1985) First records of the summerfruit tortricid, *Adoxophyes orana* F. v. R. in Greece. *Entomologia Hellenica* 3: 65–66.

Schaefer CW, Panazzi AR (2000) *Heteroptera of economic importance.* Cooperative Research Centre Press, Boca Raton.

Schimanski HH, Schmelzer K, Albrecht HJ (1976) Seed transmission of *cherry leaf roll virus* in black cherry (*Prunus serotina* Ehrh.). *Zentrablatt fur Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene* 131: 117–119.

Schneider WL, Damsteegt VD, Gildow FE, Stone AL, Sherman DJ, Levy LE, Mavrodieva V, Richwine N, Welliver R, Luster DG (2011) Molecular, ultrastructural, and biological characterization of Pennsylvania isolates of *Plum pox virus*. *Phytopathology* 101: 627–636.

Schreiner J (1914) Species of *Rhynchites* and *Anthonomus pomorum* injuring orchards. *Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture* 2: 65–65.

Scott R, Xu.F., Bugang W (2013) *China - People's Republic of, stone fruit annual 2013*. USDA Foreign Agricultural Service, Global Agricultural Information Network, USA.

Scott RR, Bugang W, Zhen X, Lesny V (2014) *China - People's Republic of, stone fruit annual*. GAIN report number: 14029, USDA Foreign Agricultural Service, Global Agricultural Information Network, USA.

Shanghai Insects Online (2014) Insect species inventory database. Shanghai Insect Science Network. http://www.insects.cn/ Accessed 2014.

Shiao SN (1977) Bionomics of the Camellia scale, *Pseudaonidia duplex* (Cockerell), in northern parts of Taiwan: i. life history and morality factors. *Plant Protection Bulletin (Taipei)* 19: 65–77.

Shivas RG (1989) Fungal and bacterial diseases of plants in Western Australia. *Journal of the Royal Society of Western Australia* 72: 1–62.

Shun XG, Liu ZY, Zhou CG, Qiao LQ (1996) Damage of *Eutetranychus orientalis* to *Euonymus japonicus*. *Plant Protection* 22: 29–30.

Shutova N (1978) Peach moth *(Carposina sasakii* Mats.). In Rao PM (ed) *A handbook of pests, diseases, and weeds of quarantine significance* 67–68. Amerind Publishing Company, New Dehli.

Sidney M, Brown K, Judd GJR, Gries G (2008) Stimuli affecting selection of oviposition sites by female peach twig borer, *Anarsia lineatella* Zeller (Lepidoptera: Gelechiidae). *Journal of Applied Entomology* 132: 538–544.

Simmonds JH (1966) *Host index of plant diseases in Queensland*. Department of Primary Industries, Brisbane.

Smith D, Beattie GAC, Broadley RH (1997) *Citrus pests and their natural enemies: intergrated pest management in Australia.* Queensland Department of Primary Industries, Brisbane.

Smith IM, Dunez J, Lelliot RA, Phillips DH, Archer SA (1988) *European handbook of plant diseases.* Smith IM, Dunez J, Lelliot RA, Phillips DH, Archer SA (eds) Blackwell Scientific Publications, Oxford.

Smith LM (1936) Biology of the mealy plum aphid, *Hyalopterus pruni* (Geoffroy). *Hilgardia* 10: 167–209.

Smith PR, Stubbs LL, Challen DI (1977) The detection of *Prune dwarf virus* in peach trees affected with peach rosette and decline with golden queen peach as an indicator, and the distribution of the virus in affected trees. *Australian Journal of Agricultural Research* 28: 115–123.

Smith RH (1929) The codling moth as a pest of stone fruits. *Monthly Bulletin of the Department of Agriculture, State of California* 18: 304–309.

Smith TM, Van Driesche R (2003) A review of Western flower thrips and *Tospoviruses*. Greenhouse Crops and Floriculture Factsheet, University of Massachusetts. http://www.umass.edu/umext/floriculture/fact_sheets/pest_management/wft_03.html Accessed 9 February 2009.

Sochor J, Babula P, Adam V, Krska B, Kizek R (2012) Sharka: the past, the present and the future. *Viruses* 4: 2853–2901.

Somma S, Perrone G, Logrieco AF (2012) Diversity of black Aspergilli and mycotoxin risks in grape, wine and dried vine fruits. *Phytopathologia Mediterranea* 51: 131–147.

Spence NJ (2001) Fungal transmission of plant viruses. In Jeger MJ, Spence NJ (eds) *Biotic interactions in plant-pathogen associations* 23–24. CAB International, Wallingford.

Staniulis J (2003) Detection of *Tobacco necrosis virus* in horticultural plants. *Hortic.Veg.Grow.* 22: 72–82.

Stará J, Kocourek F (2007) Insecticidal resistance and cross-resistance in populations of *Cydia pomonella* (Lepidoptera: Tortricidae) in Central Europe. *Journal of Economic Entomology* 100: 1587–1595.

Steck GJ (2002) A guava fruit fly *Bactrocera correcta*. Florida Department of Agriculture and Consumer Services. http://www.doacs.state.fl.us/ Accessed 2007.

Sullivan M, Molet T (2011) CPHST Pest Datasheet for *Ceroplastes japonicus*. USDA-APHIS-PPQ-CPHST. http://caps.ceris.purdue.edu/webfm_send/1552 Accessed 13 February 2014.

Summerfruit Australia (2014) About Australian summerfruit. Summerfruit Australia Ltd. http://www.summerfruit.com.au/Domestic/About-Australian-Summerfruit.aspx Accessed 2014.

Sun S, Wang J (1999) A preliminary list of insect pests on fruit trees in Beijing. *Journal of Beijing Agricultural College* 1: 1–6.

Svanella-Dumas L, Marais M, Lamorte J, Candresse T (2005) First report on the natural occurrence of *Cherry virus A* in Mirabelle plum (*Prunus domestica* var. *insititia*). *Plant Disease* 89: 433–433.

Sytenko LS (1960) On the specific composition of fruit moths in the Maritime Province. *Entmologicheskoe obozrenie* 39: 551–555 (abstract only).

Sztejnberg A (1995) Cercospora leaf spot. In Ogawa JM, Zehr EI, Bird GW, Ritchie DF, Uriu K, Uyemoto JK (eds) *Compendium of stone fruit diseases* 27–27. The American Phytopathological Society Press, St. Paul, Minnesota.

Tai FL (1979) *Sylloge fungorum sinicorum.* Science Press, Academia Sinica, Peking.

Takahashi R (1923) *Aphididae of Formosa. Part 2.* Department of Agriculture Government Research Institute, Formosa, Japan.

Tan HD, Li SY, Du XF (2010) First report of *Cucumber mosaic virus* in sweet cherry in the People's Republic of China. APSnet: Plant Pathology Online. http://www.apsnet.org/publications/plantdisease/2010/November/Pages/94_11_1378.1.aspx Accessed 29 July 2011.

Taverner P, Bailey P (1995a) *Commercial trial of citrus postharvest oil for removal of surface pests*. SARDI research report series no. 5, South Australian Research and Development Institute, Adelaide.

Taverner P, Bailey P (1995b) *Postharvest removal of lightbrown apple moth and mealy bug from citrus fruit. Final report CT339*. Horticultural Research and Development Corporation, Gordon, NSW.

Taylor R, Burt J (2007) *Growing olives in Western Australia*. Replaces Bulletin No. 4331, Department of Agriculture and Food, Government of Western Australia, South Perth.

Tayutivutikul J, Kusigemati K (1992) Biological studies of insects feeding on the Kudzu plant, *Pueraria lobata* (Leguminosae): i. list of feeding species. *Memoirs of the Faculty of Agriculture Kagoshima University* 28: 89–124.

Teakle DS (1988) *Tobacco necrosis necrovirus*. In Buchen-Osmond C, Crabtree K, Gibbs A, McLean G (eds) *Viruses of plants in Australia* 490–491. Australian National University Printing Service, Canberra.

Teng SC (1996) *Fungi of China.* Mycotaxon Limited, Ithaca.

Tian JX, Hu JW (1992) Study on the control of larvae of larvae of *Holotrichia morosa* and *H. diomphalia* (Coleoptera: Scarabaeidae) with *Beauveria tenella*. *Natural Enemies of Insects* 14: 62–64 (abstract only).

Toda MJ (1991) Drosophilidae (Diptera) in Myanmar (Burma) vii. the *Drosophila melanogaster* species-group, excepting the *D. montium* species sub-group. *Oriental Insects* 25: 69–94.

Tomlinson JA, Faithful EM, Webb MJW, Fraser RSS, Seeley ND (1983) Chenopodium necrosis: a distinctive strain of *Tobacco necrosis virus* isolated from river water. *Annals of Applied Biology* 102: 135–147.

Tommasini MG, Ceredi G (2007) Damages on nectarines by thrips in northern Italy: monitoring and control on late attacks. *Bulletin of Insectology* 60: 71–75.

Toyoshima S, Arai T, Yaginuma K (2010) Effect of constant temperatures on the development of peach fruit moth *Carposina sasakii* (Lepidoptera: Carposinidae). *Bulletin of National Institute of Fruit Tree Science* 10: 1–8.

Tremblay E (1966) *A. pulchellana* injurious to fennel in Campania. *Bollettino del Laboratorio di Entomologia Agraria "Filippo Silvestri"* 24: 31–48.

Turturo C, Minafra A, Ni H, Wang G, di Terlizzi B, Savino V (1998) Occurrence of *Peach latent mosaic viroid* in China and development of an improved detection method. *Journal of Plant Pathology* 80: 165–169.

Upsher FJ, Upsher CM (1995) *Catalogue of the Australian National Collection of Biodeterioration Microfungi*. DSTO-GD-0054, DSTO Aeronautical and Marine Research Laboratory, Melbourne, Australia.

USDA (1958) *Insects not known to occur in the United States: fruit weevil (Rhynchites heros Roelofs)*. Report No. 45, The United States Department of Agriculture, USA.

USDA (2002) *Expansion of the importation of fresh unshu orange fruit (Citrus reticulata blanco var. unshu Swingle) from the Republic of Korea in citrus producing states of the continental United States: a pathway-initiated pest risk assessment*. United States Department of Agriculture, Washington, D.C.

USDA (2010) Treatment schedules: T100-schedules for fruit, nuts, and vegetables. http://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment_pdf/05_05_t400schedules.pdf Accessed 5 January 2010.

USDA (2015) USDA treatment manual. United States Department of Agriculture. http://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf Accessed 4 March 2015.

USDA-APHIS (2002) *Importation of grapes (Vitis spp.) from Korea into the United States: a qualitative, pathway-initiated pest risk assessment*. Animal and Plant Health Inspection Service, United States Department of Agriculture, Riverdale, Maryland.

Uyemoto JK (1981) *Tobacco necrosis* and *satellite viruses*. In Kurstak E (ed) *Handbook of plant virus infections and comparative diagnosis* 123–146. Elsevier North-Holland Biomedical Press, Amsterdam.

Uyemoto JK, Gilmer RM (1972) Properties of *Tobacco necrosis virus* strains isolated from apple. *Phytopathology* 62: 478–481.

van Leeuwen GCM, Baayen RP, Holb IJ, Jeger MJ (2002) Distinction of the Asiatic brown rot fungus *Monilia polystroma* sp. nov. from *M. fructigena*. *Mycological Research* 106: 444–451.

Veer V (1985) Observations on the host preferences and biology of *Thrips flavus* Schrank (Thysanoptera: Thripidae) from Dehra Dun, India. *Annals of Entomology* 3: 39–48.

Veerman A (1985) Diapause. In Helle W, Sabelis MW (eds) *Spider mites: their biology, natural enemies and control. Vol. 1A* 279–316. Elsevier Science Publishers B.V., Amsterdam.

Vogelzang BK, Scott ES (1990) *Ceratocystis fimbriata*, causal agent of basal rot of syngonium cultivars, and host range studies of isolates of *C. fimbriata* in Australia. *Australasian Plant Pathology* 19: 82–89.

Wallis CM, Fleischer SJ, Luster D, Gildow FE (2005) Aphid (Hemiptera: Aphididae) species composition and potential aphid vectors of *Plum pox virus* in Pennsylvania peach orchards. *Journal of Economic Entomology* 98: 1441–1450.

Wang A, Sanfaçon H, Stobbs LW, James D, Thompson D, Svircev AM, Brown DCW (2006) *Plum pox virus* in Canada: progress in research and future prospects for disease control. *Canadian Journal of Plant Pathology* 28: 182–196 (abstract only).

Wang CQ, Xiao B, Ji ZX, Chui GL (2007) A study on the biological characteristics and control techniques of *Sinopticula sinica* Yang. *Journal of Hebei Normal University of Science and Technology* 21: 1–1 (abstract only).

Wang DA, An JH, Ren WY, Bu GH, He GL (1998) Damage of borers to kernel-edible apricot and their control. *Journal of Hebei Agricultural University* 21: 16–22 (abstract only).

Wang HF (1981) *Economic insect fauna of China: Acari: Tetranychoidea. Volume 23.* Science Press, Academia Sinica, Beijing.

Wang HF, Cui YQ, Zhang SY (1981) Tetranychid and tenuipalpid mites infesting fruit trees in the North of China. *Acta Phytophylacica Sinica* 8: 9–16.

Wang Y, Zhao Y, Niu J (2012) Molecular identification and sequence analysis of the *Apple Scar Skin Viroid* (ASSVd) isolated from four kinds of fruit trees in Xinjiang Province, China. *Molecular Pathogens* 3: 12–18.

Washington WS, Nancarrow RJ (1983) *List of diseases recorded on fruit and vegetable crops in Victoria before June 30, 1980*. Report No. 66, Victorian Department of Agriculture, Melbourne.

Watson GW (2005b) Arthropods of economic importance - Diaspididae of the world. http://wbd.etibioinformatics.nl/bis/diaspididae.php Accessed September 2012b.

Watson GW (2005a) Arthropods of economic importance - Diaspididae of the world. http://wbd.etibioinformatics.nl/bis/diaspididae.php Accessed 2014a.

Weakley CV, Kirsch PA, Zalom FG (1990) Within-orchard and within-tree distributions of peach twig borer (Lepidoptera: Gelechiidae) damage to peaches. *Journal of Economic Entomology* 83: 505–510.

Wei MS, Li GF, Ma J, Fan XH, Zhu SF, Zhu JG, Li WM, Xu XJ, Zhao WS, Yang J (2013) Plum pox virus survey and research in China. *Canadian Journal of Plant Pathology* 133–139.

Weires RW (1984) Economic impact of a flucythrinate-induced resurgence of the Comstock mealybug (Homoptera: Pseudococcidae) on apple. *Journal of Economic Entomology* 77: 186–189.

Weydert C (2011) *Drosophila suzukii*: situation in France and first test results. Fondazione Edmund Mach, Research and Innovation Centre (Istituto Agrario di San Michele all'Adige). http://cri.fmach.eu/Media/Files/Drosophila/Weydert Accessed 12 February 2014.

White IM, Elson-Harris MM (1992) *Fruit flies of economic significance: their identification and bionomics.* CAB International, Wallingford.

Whitfield AE, Ullman DE, German TL (2005) Tospovirus - thrips interactions. *Annual Review of Phytopathology* 43: 459–489.

Wijkamp I, Almarza N, Goldbach R, Peters D (1995) Distinct levels of specificity in thrips transmission of tospoviruses. *Phytopathology* 85: 1069–1074.

Wijkamp I, Goldbach R, Peters D (1996) Propagation of Tomato spotted wilt virus in *Frankliniella occidentalis* does neither result in pathological effects nor in transovarial passage of the virus. *Entomologia Experimentalis et Applicata* 81: 285–292.

Wijkamp I, van der Gaag DJ (2011) *Pest risk analysis for Plum pox virus*. Plant Protection Service, Ministry of Economic Affairs, Agriculture and Innovation, Wageningen, the Netherlands.

World Weather Online (2015) Monthly climate average. World Weather Online. http://www.worldweatheronline.com/ Accessed 2015.

WTO (1995) Agreement on the application of sanitary and phytosanitary measures. World Trade Organization, Geneva.

Wu J, Zhou P, Cheng W, Li Q (2006a) Influence of temperature on development and survival of *Pristiphora sinesis* and control effect of some insecticides. *Chinese Bulletin of Entomology* 43: 316–318.

Wu L, Huang ZY (1986) Studies on the bionomics of *Bhima undulosa* Walker and its control. *Entomological Knowledge* 23: 211–212.

Wu MX, Wu ZQ, Hua SMA (2006b) A preliminary study on some biological characters of globular stink bug, *Megacopta cribraria* and its two egg parasitoids. *Journal of Fujian Agricultural University* 35: 147–150.

Wu Y, Li C, Song X, Fu Y, Jia Q, Guo F (1995) Biological characters and control techniques of peach blossom weevil (*Anthonomus* sp.). *Hubei Agricultural Science* 4: 43–46.

Wu YF (2005) Geographical distribution model of Oriental fruit fly. *Journal of Fujian Agricultural University* 34: 168–171.

Xi D, Li J, Han C, Li D, Yu J, Zhou X (2008) Complete nucleotide sequence of a new strain of *Tobacco necrosis virus A* infecting soybean in China and infectivity of its full-length cDNA clone. *Virus Genes* 36: 259–266.

Xu Q, Sun X, Wu D, Zhang Z (1999) Biological characteristics and control methods of *Drosicha corpulenta* (Kanawa). *Journal of Jiangsu Forestry Science and Technology* 26: 52–54.

Xu QG, Hua BZ (2004) RAPD analysis on the speciation in host races of *Carposina sasakii* Matsumura (Lepidoptera: Carposinidae). *Acta Entomologica Sinica (China)* 47: 379–383.

Xu XM, Robinson JD (2000) Epidemiology of brown rot (*Monilinia fructigena*) on apple: infection of fruits by conidia. *Plant Pathology* 49: 201–206.

Yang C (1965) Two new leafhoppers of the genus *Pyramidotettix* (Homoptera: Jassidae) injuring apple trees. *Acta Entomologica Sinica (China)* 14: 196–202.

Yang C (1989) *Sinopticula sinica* (Lepidoptera: Nepticulidae): a new genus and species from China. *Entomotaxonomia* 6: 79–82.

Yang HQ, Xu YD, Chao XM, Guang W, Zhang JZ, Yuan JJ (2011) Occurance and control of *Pseudococcus comstocki* (in Chinese). *Shanxi Fruits* 3: 49–51.

Yang P, Carey JR, Dowell RV (1994) Temperature influences on the development and demography of *Bactrocera dorsalis* (Diptera: Tephritidae) in China. *Environmental Entomology* 23: 971–974.

Yang PJ (1991) Status of fruit fly research in China. In Vijaysegaran S, Ibrahim AG (eds) *Proceedings of the 1st International Symposium on Fruit Flies in the Tropics, 14-16 March 1988, Kuala Lumpur, Malaysia* 161–168. Malaysian Agricultural Research and Developement Institute (MARDI) and Plant Protection Society, Kuala Lumpur, Malaysia.

Yang S, Li H, Xu B, Tulake T, Abudureheman T, Zhu X (2008) Study on species, field identification and biological characters of scale insects in orchards in Tarim Basin. *Xinjiang Agricultural Sciences* 45: 276–281.

Yang S, Tulake T, Li J (2005) Occurrence and infestation of pest insects on apricot in Xinjiang, China. *Xinjiang Agricultural Sciences* 42: 363–365.

Yang YA, Wang HQ, Cheng ZM, Sano T, Li SF (2006) First report of *Hop stunt viroid* from plum in China. New Disease Reports. http://www.bspp.org.uk/publications/new-disease-reports/ndr.php?id=013041 Accessed 6 July 2009.

Yin BR, Kang ZX, Li GP, Wang XL (1987) A preliminary study on the bionomics of *Anthophila pariana* and its control. *Plant Protection* 13: 24–25.

Yin L, Chen S, Cai M, Li G, Luo C (2013) First Report of Brown Rot of Apricot Caused by Monilia mumecola. *Plant Disease* The American Phytopathological Society.

Yokoyama VY, Miller GT (1999) Host status of fresh prunes by potential quarantine pests in laboratory tests and evaluation of packinghouse culls. *Journal of Economic Entomology* 92: 485–489.

Yu GF (2001) Damage and control of *Culcula panterinaria*. *Forestry of Shanxi* 5: 27–28.

Yu TF (1940) A list of important crop diseases occurring in Kiangsu Province (1934-1937. *Lingnan Science Journal* 19: 67–78.

Yu Y, Zhao Z, Qin L, Zhao Y, Fan H, Zhang Z, Wu Z, Li S (2013) Incidence of major peach viruses and viroids in China. *Journal of Plant Pathology* 95: 603–607.

ZDCBIC (2005) Noctuidae; *Calyptra* genus. http://zd1.brim.ac.cn/specialist.asp?x_genus=Calyptra&z_genus=LIK Accessed 20 October 2008.

Zehr EI (1995a) Constriction canker. In Ogawa JM, Zehr EI, Bird GW, Ritchie DF, Uriu K, Uyemoto JK (eds) *Compendium of stone fruit diseases* 31–32. The American Phytopathological Society Press, St. Paul, Minnesota.

Zehr EI (1995b) Frosty mildew of peach. In Ogawa JM, Zehr EI, Bird GW, Ritchie DF, Uriu K, Uyemoto JK (eds) *Compendium of stone fruit diseases* 24–24. The American Phytopathological Society Press, St Paul, Minnesota.

Zhang AH, Li HH (2005) Catalogue of Eucosmini from China (Lepidoptera: Tortricidae). *SHILAP Revista de Lepidopterologia* 33: 265–298.

Zhang B, Huang Y (1990) A list of important plant diseases in China. *Review of Plant Pathology* 69: 97–118.

Zhang F, Fu YH (2004) The occurrence and preventative of *Tetranychus piercei* McGregor in Hainan. *South China Fruits* 6: 44–47.

Zhang L (2009) *Biodiversity study on aphids in the Forestry Park in Hebei.* Masters thesis, Hebei Agricultural University, Hebei (in Chinese).

Zhang L, French R, Langenberg WG (1993) Molecular cloning and sequencing of the coat protein gene of a Nebraskan isolate of *Tobacco necrosis virus:* the deduced coat protein sequence has only moderate homology with those of strain A and strain D. *Archives of Virology* 132: 291–305.

Zhang LM, Liao QY, Huang J, Luo XN, Huang BK (1995) New pests of plum and peach. *Entomological Journal of East China* 4: 110–111.

Zhang Y, Wu S (2007) *Metaphycus annasor* (Hymenoptera: Encyrtidae), an important parasitoid of *Pulvinaria vitis*. *Entomotaxonomia* 29: 318–320.

Zhang YP (2005) *Identification and control of pests and diseases of table grape (with colour plates).* Jindun, Beijing.

Zhang YW, Qi SY (2013) Occurrence of *Spilonota albicarla* [=*albicana*] and its preventative and control measures. *Qinghai Agro-Technology Extension* 4: 23–24.

Zhang ZQ (2003) *Mites of greenhouses: identification, biology and control.* CABI Publishing, Wallingford.

Zhao JD, Zhang XQ (1992) *The polypores of China.* J Cramer in der Gebrüder Borntraeger Verlagsbuchhandlung, Berlin.

Zhao Y, Niu J (2008a) Apricot is a new host of apple scar skin viroid. *Australasian Plant Disease Notes* 3: 98–100.

Zhao Y, Niu JX (2008b) Detection and sequencing of *Apple scar skin viroid* from peach in Xinjiang (in Chinese). *Journal of Fruit Science* 25: 274–276.

Zhou CG, Zhang WG, Qiao LQ, Sun XG, Wang ZY (2006a) The biological characteristics, effective accumulate temperature and occurrence regulation of *Eutetranychus orientalis*. *Scientia Silvae Sinicae* 42: 89–93.

Zhou JF, Wang GP, Kuang RF, Wang LP, Hong N (2011) First report of *Cherry green ring mottle virus* on cherry and peach grown in China. *Plant Disease* 95: 1319–1319.

Zhou JF, Wang GP, Qu LN, Deng CL, Wang Y, Wang LP (2013) First report of *Cherry necrotic rusty mottle virus* on stone fruit trees in China. *Plant Disease* 97: 290–290.

Zhou Y, Guo R, Cheng Z, Sano T, Li S (2006b) First report of *Hop stunt viroid* from peach (*Prunus persica*) with dapple fruit symptoms in China. New Disease Reports. http://www.bspp.org.uk/ndr/jan2006/2006-06.asp Accessed 10 April 2007b.

Zhou Y, Li S, Cheng Z, Zhao J, Jiang Q (2006c) Detection and sequence analysis of *Hop stunt viroid* isolated from peach in China. *Acta Phytopathologica Sinica* 36: 501–507.

Zhou YY, Ruan XF, Wu CL, Zhang QZ (1996) First report of sweet cherry viruses in China. *Plant Disease* December: 1429–1429.

Zhou ZS, Deng GR (2005) Preliminary study on the host plants of leaf rollers on longan and litchi. *Chinese Bulletin of Entomology* 42: 639–642.

Zhu JQ, Guo MM, Zhang AL (1985) Studies on the bionomics and control of *Culcula Panterinaria* Bremer et Grey. *Journal of Tea Science* 1985: 1–2.

Zhu XQ, Chen XY, Guo LY (2011) Population structure of brown rot fungi on stone fruits in China. *Plant Disease* 95: 1284–1291.

Zhu XQ, Guo LY (2010) First report of brown rot on plum caused by *Monilia polystroma* in China. *Plant Disease* 94: 478–478.

Zhuang WY (2005) *Fungi of Northwestern China.* Mycotaxon Limited, Ithaca.

Zitikaite I, Staniulis J (2009) Isolation and characterization of *Tobacco necrosis virus* detected on some vegetable species. *Biologija* 55: 35–39.