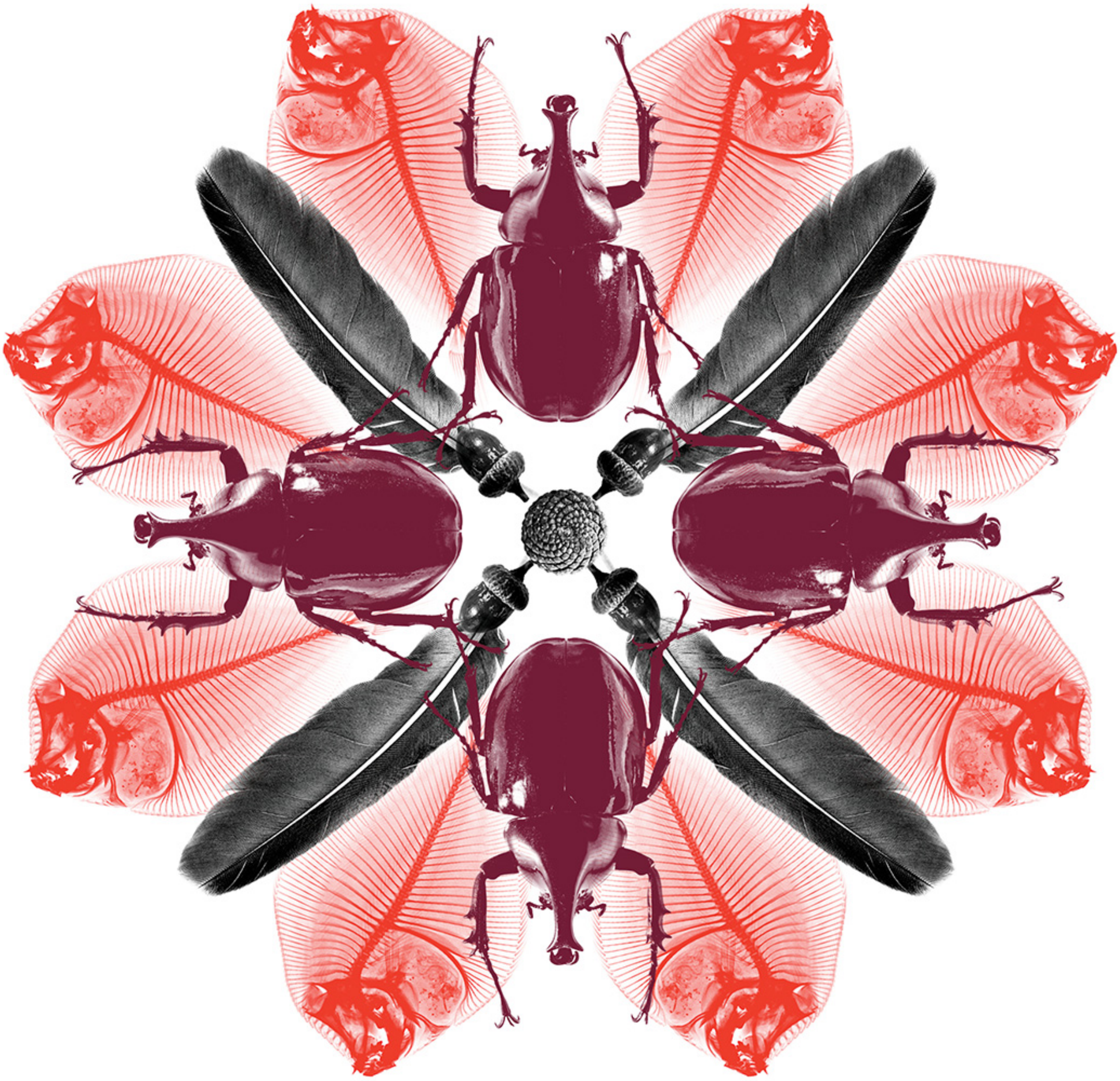
Australian Government
Department of Agriculture

Draft report for the non-regulated analysis of existing policy for table grapes from India

July 2015



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Stakeholder submissions on draft reports

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

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

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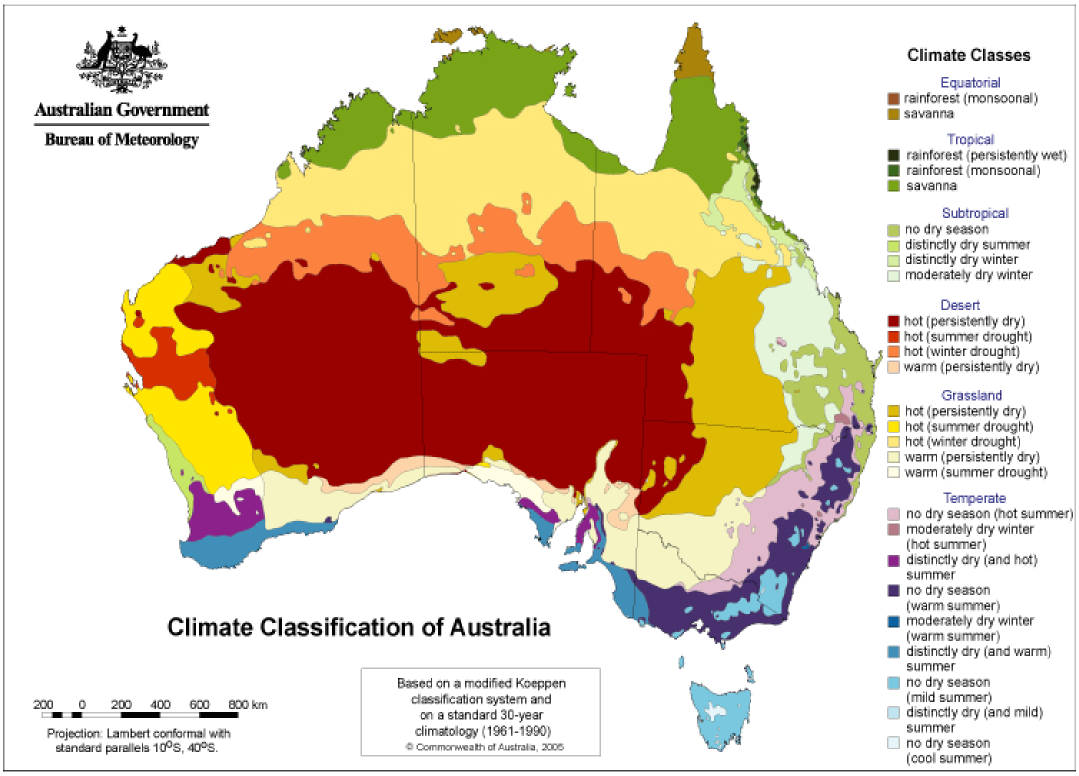

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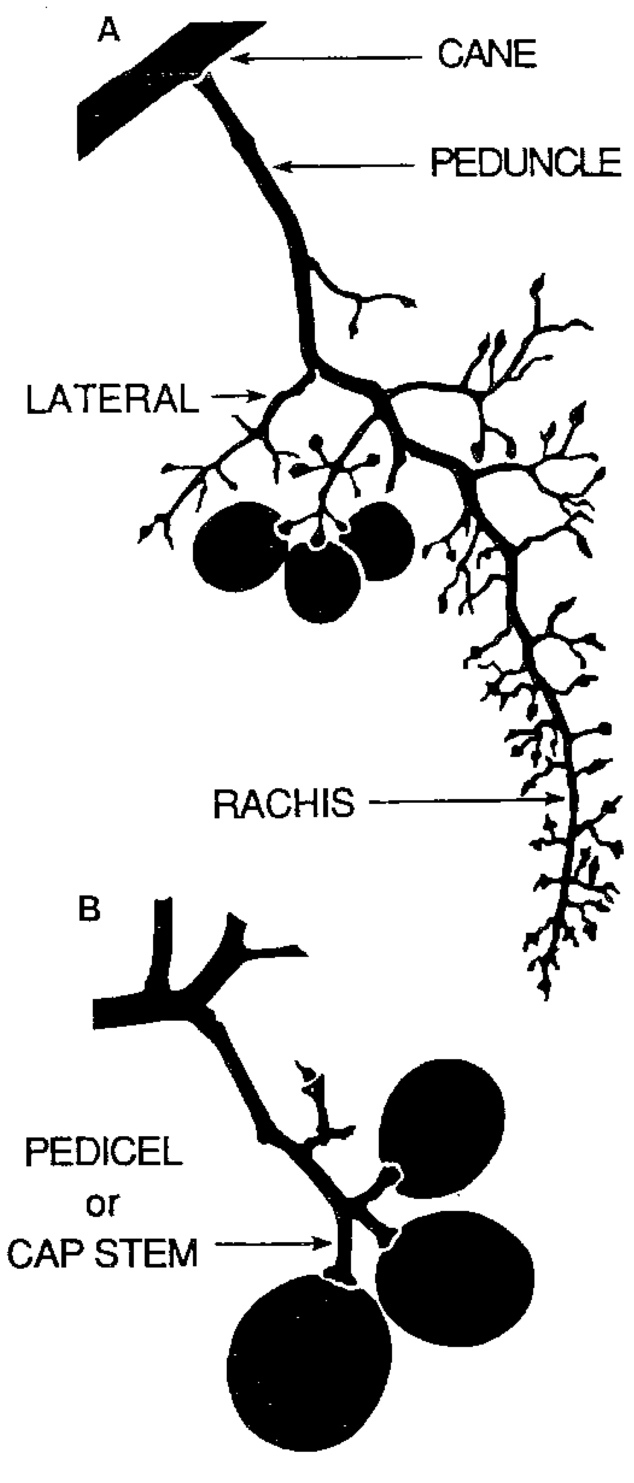


Acronyms and abbreviations

Term or abbreviation	Definition
ACT	Australian Capital Territory
ALOP	Appropriate level of protection
CABI	CAB International, Wallingford, UK
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAC	India's Department of Agriculture and Cooperation
DAFF	Acronym of the former Australian Government Department of Agriculture, Fisheries and Forestry, which is now the Australian Government Department of Agriculture
DAFWA	Government Department of Agriculture and Food, Western Australia
DPP	Directorate of Plant Protection, Ministry of Agriculture, India
EP	Existing policy
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization of the United Nations
ICON	The Australian Government Department of Agriculture Import Conditions database
IPC	International Phytosanitary Certificate
IPPC	International Plant Protection Convention
IRA	Import risk analysis
ISPM	International Standard for Phytosanitary Measures
NSW	New South Wales
NPPO	National Plant Protection Organisation
NT	Northern Territory
PIRSA	Department of Primary Industries and Regions of South Australia
PRA	Pest risk analysis
Qld	Queensland
SA	South Australia
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 India for market access to Australia for fresh table grapes.

Australia has existing policy for the import of table grapes for human consumption from Chile, the United States of America (California), New Zealand, the People's Republic of China, the Republic of Korea and Japan.

This draft report identifies pests that require phytosanitary measures to manage risks to a very low level in order to achieve Australia's appropriate level of protection (ALOP). Fifteen pests were identified as requiring phytosanitary measures. Out of these 15 pests, 12 are arthropods and three are pathogens.

The 12 arthropod pests requiring measures are: *Planococcus ficus* (grapevine mealybug), *Planococcus lilanicus* (coffee mealybug), *Planococcus minor* (Pacific mealybug), *Rastrococcus iceryoides* (Downey snowline mealybug), *Tetranychus kanzawai* (Kanzawa spider mite), *Archips machlopis* (leaf rolling moth), *Retithrips syriacus* (black vine thrips), *Rhipiphorothrips cruentatus* (grapevine thrips), *Bactrocera correcta* (guava fruit fly), *Bactrocera dorsalis* (oriental fruit fly), *Drosophila suzukii* (spotted winged drosophila) and *Daktulosphaira vitifoliae* (grapevine phylloxera).

The three pathogen pests requiring measures are: *Guignardia bidwellii* (black rot), *Monilinia fructigena* (brown rot) and *Phakopsora euvitis* (grapevine leaf rust).

The proposed phytosanitary measures take account of regional differences within Australia. One arthropod pest requiring measures, Kanzawa spider mite, has been identified as a quarantine pest for Western Australia.

This draft report proposes a range of risk management measures, combined with a system of operational procedures to ensure quarantine standards are met. These measures will reduce the risk posed by the 15 quarantine pests, and achieve Australia's ALOP. These measures include:

- Visual inspection and, if detected, remedial action for the mealybugs, spider mite, leaf rolling moth and thrips
- area freedom or fruit treatment (cold disinfestation or irradiation) for fruit flies
- area freedom, fruit treatment (irradiation, methyl bromide fumigation or combined sulphur dioxide/carbon dioxide fumigation followed by cold treatment) or a systems approach approved by the Australian Government Department of Agriculture for spotted winged drosophila
- area freedom or fruit treatment (sulphur pad or combined sulphur dioxide/carbon dioxide fumigation) for grapevine phylloxera
- area freedom or a systems approach approved by the Australian Government Department of Agriculture for black rot, brown rot and grapevine leaf rust
- a supporting operational system to maintain and verify the phytosanitary status of export consignments.

This 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 30–day 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 Department of Agriculture and Cooperation of India formally requested market access for fresh table grapes to Australia in a submission received in 2007 (DPP 2007). This submission included information on the pests associated with table grape crops in India, including the plant part affected, and the standard commercial production practices for fresh table grapes in India (DPP 2007).

In February 2008, India advised that market access for table grapes was its top priority. Additional production and pest information were received from India in 2009 (DPP 2009) and 2012 (DPP 2012).

On 26 November 2010, the Australian Government Department of Agriculture formally announced the commencement of this risk analysis, advising that it would be progressed as a non-regulated review of existing policy.

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 table grapes (*Vitis vinifera* and hybrids) (henceforth these will be referred to as table grapes) from India, for human consumption in Australia.

In this risk analysis, table grapes is defined as table grape bunches or clusters, which include peduncles, rachises, laterals, pedicels and berries (Pratt 1988), but not other plant parts (Figure 1). This risk analysis covers all commercially produced table grapes from all table grape producing states of India.

1.2.3 Existing policy

International policy

Import policy exists for table grapes from the United States of America (California) (AQIS 1999; AQIS 2000; Biosecurity Australia 2006a; DAFF 2013), Chile (Biosecurity Australia 2005), New Zealand (Department of Agriculture 2013), the People's Republic of China (Biosecurity Australia 2011a), the Republic of Korea (Biosecurity Australia 2011b) and Japan (Department of Agriculture 2014).

The import requirements for these commodity pathways can be found at the Australian Government Department of Agriculture website. The Australian Government Department of Agriculture has considered all the pests previously identified in the existing policies and where relevant, the information in these assessments has been taken into account in this risk analysis.

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.

Under Western Australia legislation, grape fruit, seeds and plants and machinery used in the growing or processing of grapes are prescribed potential carriers of various declared pests and are restricted entry into Western Australia. Import permits may be issued for the entry of grape plants and propagative material subject to post entry quarantine requirements.

On 15 September 2011, the Government Department of Agriculture and Food, Western Australia (DAFWA) announced the formal commencement of a pest risk analysis considering the importation of fresh table grapes into Western Australia from other Australian states and territories. In June 2015, DAWFA released a draft report for this pest risk analysis for stakeholder consultation until 1 August 2015 (DAFWA 2015a; DAFWA 2015b). Once the consultation period is completed, DAFWA will consider stakeholder submissions before releasing a final report.

1.2.4 Contaminating pests

In addition to the pests associated with fresh table grapes from India 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 Agriculture considers 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 26 November 2010, the Australian Government Department of Agriculture notified stakeholders in Biosecurity Advice 2010/37 of the formal commencement of a non-regulated analysis of existing policy to consider a proposal from India for market access to Australia for fresh table grapes.

The Australian Government Department of Agriculture has consulted with India's DAC and Australian state and territory government departments during the preparation of this draft report. The department provided a draft pest categorisation to Australian state and territory government departments on 29 October 2012 for their advance consideration of regional pests, prior to the formal release of this draft report.

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

Unrestricted risk is estimated taking into account the existing commercial production practices of the exporting country and that, on arrival in Australia, the Australian Government Department of Agriculture will 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 Agriculture in other risk assessments and for which import policies already exist, a judgement was made on the likelihood of entry of pests on the commodity and whether existing policy is adequate to manage the risks associated with its import. Where appropriate, the previous 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 probability 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 probability of entry, establishment and spread

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

Probability of entry

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

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

For the purpose of considering the probability of entry, the Australian Government Department of Agriculture divides this step into two components:

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

Factors considered in the probability of importation include:

- distribution and incidence of the pest in the source area
- occurrence of the pest in a life-stage that would be associated with the commodity
- 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 probability 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.

Probability 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 probability 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 probability of establishment.

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

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

Probability of spread

Spread is defined as 'the expansion of the geographical distribution of a pest within an area' (FAO 2012). The probability of spread considers the factors relevant to the movement of the pest, after establishment on a host plant or plants, to other susceptible host plants of the same or different species in other areas. In order to estimate the probability of spread of the pest, reliable biological information is obtained from areas where the pest currently occurs. The situation in the PRA area is then carefully compared with that in the areas where the pest currently occurs and expert judgement used to assess the probability of spread.

Factors considered in the probability of spread include:

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

Assigning qualitative likelihoods for entry, establishment and spread

In its qualitative PRAs, the Australian Government Department of Agriculture uses the term 'likelihood' for the descriptors it uses for its estimates of probability of entry, establishment and spread. Qualitative likelihoods are assigned to each step of entry, establishment and spread. Six descriptors are used: high; moderate; low; very low; extremely low; and negligible (Table 2.1). Descriptive definitions for these descriptors and their indicative probability ranges are given in Table 2.1. The indicative probability ranges are only provided to illustrate the boundaries of the descriptors and are not used beyond this purpose in qualitative PRAs. These indicative probability 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 probability (P) range
High	The event would be very likely to occur	$0.7 < P \leq 1$
Moderate	The event would occur with an even probability	$0.3 < P \leq 0.7$
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 Agriculture normally considers the likelihood of entry on the basis of the estimated volume of one year's trade. This is a convenient value for the analysis that is relatively easy to estimate and allows for expert consideration of seasonal variations in pest presence, incidence and behaviour to be taken into account. The consideration of the likelihood of entry, establishment and spread and subsequent consequences takes into account events that might happen over a number of years even though only one year's volume of trade is being considered. This difference reflects biological and ecological facts, for example where a pest or disease may establish in the year of import but spread may take many years.

The use of a one year volume of trade has been taken into account when setting up the matrix that is used to estimate the risk and therefore any policy based on this analysis does not simply apply to one year of trade. Policy decisions that are based on the Australian Government 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. . If there are substantial changes in the volume and nature of the trade in specific commodities then the department will 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 Agriculture assumed 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 probability of entry, establishment and spread and for potential consequences is completed, the unrestricted risk can be determined for each pest or groups of pests. This is determined by using a risk estimation matrix (Table 2.5) to combine the estimates of the probability of entry, establishment and spread and the overall consequences of pest establishment and spread. Therefore, risk is the product of likelihood and consequence.

When interpreting the risk estimation matrix, note the descriptors for each axis are similar (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 probability 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 of the year, production in a certification scheme
- options ensuring that the area, place or site of production or crop is free from the pest—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 programmes
- 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 India's commercial production practices for table grapes

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

3.1 Assumptions used in estimating unrestricted risk

India provided Australia with information on the standard commercial practices used in the production of table grapes in different regions and for all commercially produced table grape cultivars in India. 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 this commodity.

The Australian Government Department of Agriculture visited table grape production areas in Nasik, in the state of Maharashtra, from 10 to 16 April 2010, to verify the pest status and observe the harvest, processing and packing procedures of table grapes. The department's observations and additional information provided during the visit confirmed the production and processing procedures described in this chapter as standard commercial production practices for table grapes for export.

In estimating the likelihood of pest introduction it was assumed that the pre-harvest, harvest and post-harvest production practices for table grapes as described in this chapter are implemented for all regions and for all table grape cultivars 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 India's table grape production areas

While grapes are grown across the sub-continent, commercially grown table grapes are mainly produced in the peninsular region of the country, as shown in Map 3 (Shikhamany 2001; DPP 2012). The major grape growing states are Maharashtra and Karnataka, accounting for about 95 per cent of India's total grape production. Other table grape growing states include Tamil Nadu, Telangana, Andhra Pradesh, Mizoram, Punjab, Madhya Pradesh, Jammu and Kashmir, Nagaland, Haryana and Rajasthan (DPP 2007; DPP 2012; APEDA 2015). While most of the grapes are likely to be exported from the two major producing states, Maharashtra and Karnataka, India may also export grapes from other grape growing states.

3.3 Climate in production areas

Table grapes are grown under a variety of soil and climatic conditions in three distinct agro-climatic zones in India: sub-tropical, hot tropical and mild tropical climatic regions (DPP 2012). Climate data, including mean maximum and minimum temperatures, and mean rainfall for each of the production regions are presented in Figure 2.

3.3.1 Sub-tropical region

This region covers the northwestern plains and lies between the latitudes of 28 and 32 degrees north, including Haryana (Hissar and Jind districts) and Punjab (Bathinda, Ferozpur, Gurdaspur and Ludhiana districts) (Shikhamany 2001; DPP 2012). Winter temperatures in this region rarely go below 0 degrees Celsius. Vines are dormant over winter and bud break starts in the first week of March. With rain arriving in the first week of June, only 90–95 days are available from the initiation of growth to harvest. Single pruning and a single harvest is the accepted practice here (Shikhamany 2001; DPP 2012).

3.3.2 Hot tropical region

This region lies between the latitudes of 15 and 20 degrees north, covering Maharashtra (Nashik, Sangli, Solapur, Pune, Satara, Latur and Osmanabad districts), Andhra Pradesh and Telangana (Hyderabad, Ranga Reddy, Mahabubnagar, Anantapur and Medak districts) and northern Karnataka (Bijapur, Bagalkot, Belgaum and Gulberga districts). This is the major viticulture region accounting for 70 per cent of the grape producing areas in India as well as 70 per cent of the total harvest. Vines do not undergo dormancy. Maximum and minimum temperature is 42 and 8 degrees Celsius respectively. Double pruning and a single harvest is the general practice in this region (Shikhamany 2001; DPP 2012).

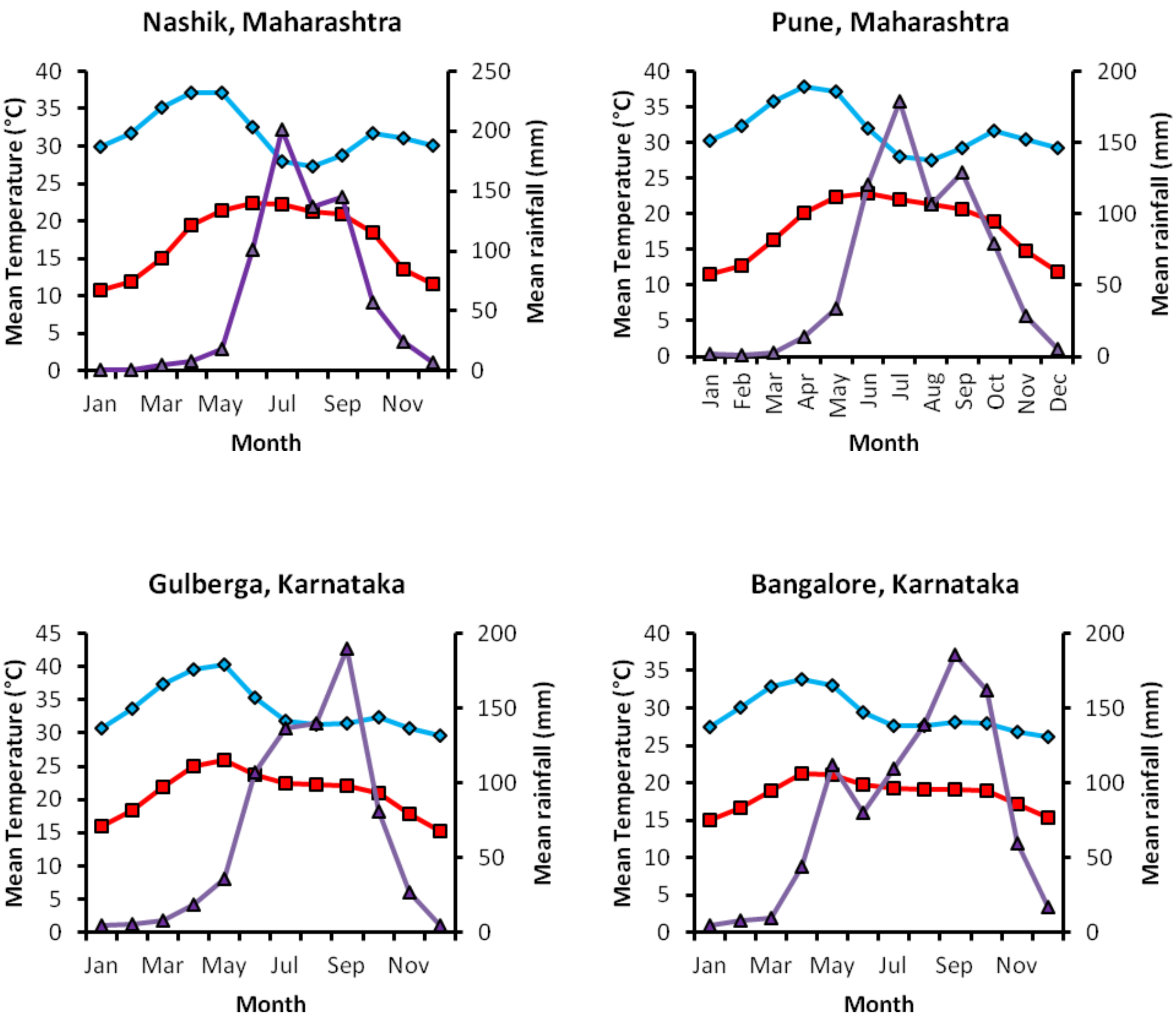
3.3.3 Mild tropical region

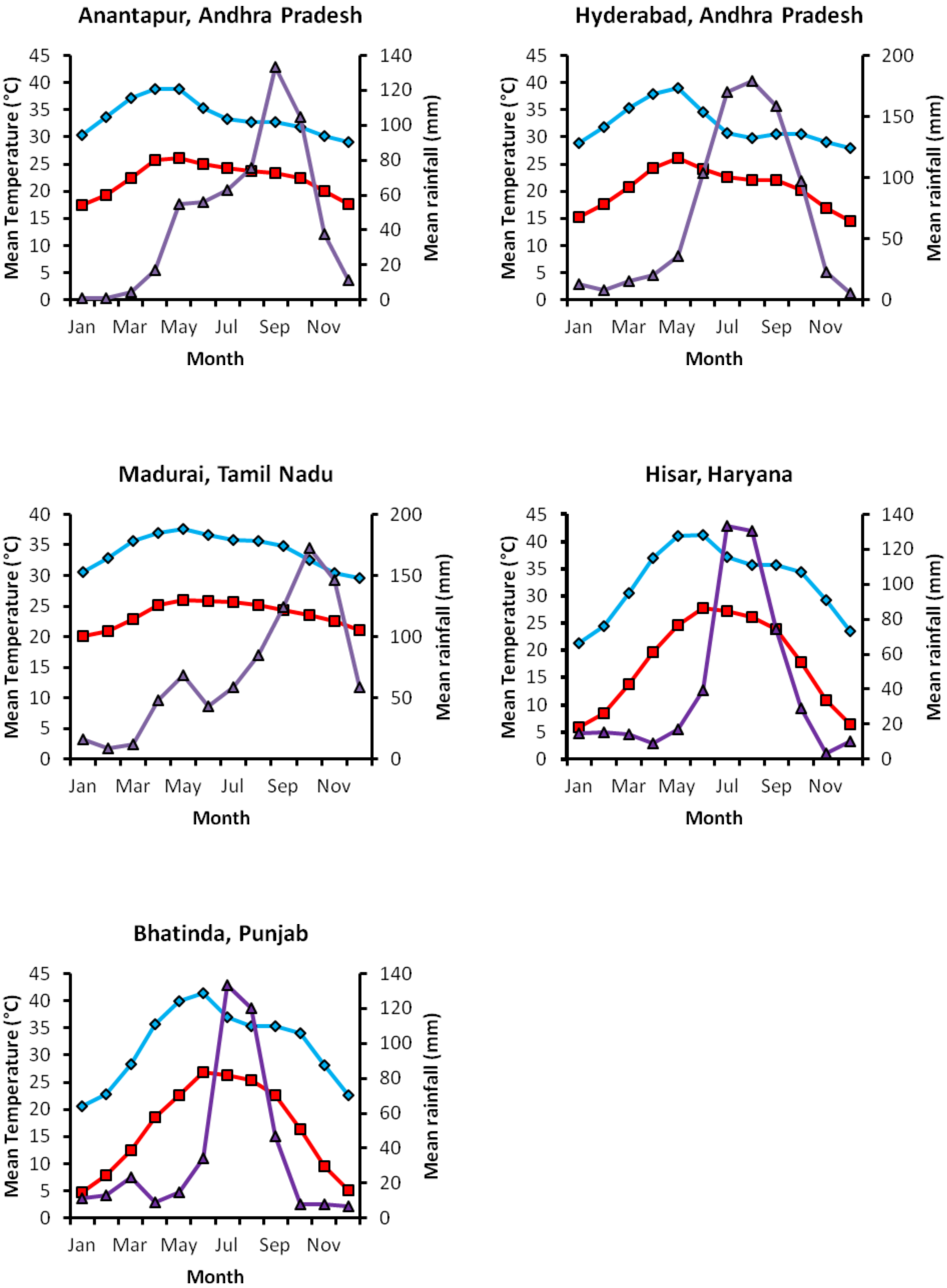
This region lies between the latitudes of 10 and 15 degrees north, covering Karnataka (Bangalore and Kolar districts), Andhra Pradesh (Chittoor district) and Tamil Nadu (Coimbatore, Madurai and Theni districts). Maximum temperatures in a year seldom exceed 36 degrees Celsius, while the minimum is about 12 degrees Celsius. Generally two crops are harvested in a year in this region (Shikhamany 2001; DPP 2012).

Map 3 Main table grape production areas in India (APEDA 2015) marked by a star (☆) Note: in 2014, the state of Andhra Pradesh was split into two states, Andhra Pradesh and Telangana, both major table grape production areas, nomenclature and territorial boundaries may not necessarily reflect government policy

Source: Adapted from CIA (2013)

Figure 2 Monthly mean maximum (—♦—) and minimum (—■—) temperatures (degrees Celsius) and monthly mean rainfall (millimetres) (—▲—) in the table grape producing districts of Nashik, Pune, Gulberga, Bangalore, Anantapur, Hyderabad, Madurai, Hisar and Bhatinda in India, based on average monthly weather data from 1901 to 2000





Source: India Meteorological Department (2000).

3.4 Pre-harvest

3.4.1 Cultivars

Grapes were introduced into India from Persia around the 14th century. Grapes are harvested almost all year round. However, in the main commercial production areas of Maharashtra and Karnataka, grapes are harvested between mid-February and the end of April (DPP 2009; DAFF 2010). More than 20 grape cultivars are grown in India (APEDA 2015). More than half of the grape cultivars produced in India are seedless, with Thompson Seedless being the dominant cultivar (DPP 2012). The cultivars produced commercially include Anab-e-Shahi (white, seeded), Bangalore Blue (black, seeded, also known as Isabella), Beauty Seedless (bluish black, seedless), Bhokri (white, seeded), Flame Seedless (red, seedless), Gulabi (purple, seeded, also known as Muscat Hamburg), Perlette (white, seedless), Pusa Seedless (white, seedless), Sharad Seedless (black, seedless) and Thompson Seedless and its mutants (white, seedless) (DPP 2012; APEDA 2015).

Anab-e-Shahi, Sharad Seedless, Flame Seedless and Thompson Seedless and its mutants are grown in the hot tropical region of India. Perlette and Thompson Seedless are grown in the sub-tropical region. Bangalore Blue, Anab-e-Shahi, Gulabi, Bhokri and Thompson Seedless are grown in the mild tropical region (DPP 2012).

The total commercial production area for grapes is approximately 55 000 hectares, distributed mainly in the states of Maharashtra and Karnataka (DPP 2012). Approximately 85 per cent of total grape production is consumed fresh, both for domestic and export industries. The rest are used for raisins, juice and in wine making (DPP 2012).

Harvest period and yield of some Indian table grape cultivars are shown in Table 3.1.

Table 3.1 Production and harvest period for different table grape cultivars in India (Shikhamany 2001; DPP 2012)

Cultivar	Area (ha)	Yield (t)	Harvest period (Month)
Anab-e-Shahi	3 000	135 000	February–May, July, November–December
Bangalore Blue	4 500	180 000	January–March, June–December
Bhokri	500	15 000	November–December, June–July
Gulabi	1 000	30 000	January–March, June–December
Perlette	1 500	60 000	June
Thompson Seedless and its mutants	22 000	550 000	January–April

The table grape cultivars India intends to export to Australia include Thompson Seedless and a mutant, Muscat, Bangalore Blue, Flame Seedless, Sharad Seedless, Anab-e-shahi and Perlette (DPP 2009).

3.4.2 Cultivation practices

Planting

Grapevines in India are planted by bed and furrow with spacing of 3 meters between rows and 2 meters between plants within a row. Several rootstocks are used in India, for example Dogridge, 110R, 99R, Ramsey and St. George (NRC 2013). The National Research Centre (NRC) for grapes has a disease-free rootstock planting programme. The NRC produces disease-free rootstocks on which they graft a desired cultivar. It takes 18 months to produce a grafted rootstock ready for planting (DAFF 2010).

Trellis systems

Two types of trellis system, T framed and Y framed, are used. The T framed trellis provides full canopy between the rows with drooping bunches. The benefits of this are minimal weed growth, cooler air and soil temperatures, minimal berry rot and drop and lower evaporation rates (DAFF 2010). The Y framed trellis promotes growth across the furrow and produces an open, incomplete canopy derived from vines trained to two horizontal cordons (bilateral cordon training). However, the canopy gap between rows can allow considerable sunlight onto the vineyard floor, which is conducive to weed growth, particularly under the drip line on beds and in furrows (DAFF 2010).

Pruning

In the tropical areas of India, pruning is done in March-April (summer) and September-October (winter) (Chand *et al.* 1991; DAFF 2010). The summer pruning, called back pruning, leaves basal single buds on the shoots near the cordon. The winter pruning cuts the mature canes back to the knot on subcanes or to the 6-7 bud position if the cane is straight. This is called fruit pruning because it prepares the vine for bearing fruits (NRC 2013).

Bagging

In India, paper bags are used to cover the grape bunches (Figure 3) in commercial vineyards, mainly to protect bunches from sunburn but may also help with pest management. Immediately prior to harvest, the paper bags are removed from the bunches and deposited in the irrigation channels. The bags are cleared from the channels after harvest, prior to flood irrigation (DAFF 2010).

Figure 3 A grape bunch covered with a paper bag

Irrigation

Drip irrigation is used during the dry season. The drip line is usually run 0.3–1.2 metres above the ground. One vineyard visited by Australian Government Department of Agriculture officers used a single line system hung at about 30–50 centimetres above the trunk base. This vineyard also used flood irrigation between harvest and pruning, which is generally done in October (DAFF 2010). Irrigation is scheduled as per advice received from the NRC which is based on evaluation of weather data (DAFF 2010).

3.4.3 Pest management

General pest surveillance and management programmes

India has a comprehensive pest monitoring and trace back system for table grapes for export to the European Union and other countries following the European Union food safety requirements. The detailed processes are available in Procedures for export of fresh table grapes to the European Union (APEDA 2013). The Agricultural and Processed Food Products Export Development Authority (APEDA) is responsible for this system. GrapeNet is the internet based electronic system used by APEDA for quality assurance and trace back of all table grapes intended for export.

All farms intending to produce table grapes for export must be registered; this is done through the state agriculture departments. Each vineyard is given a unique registration number. The APEDA and the NRC for Grapes provide recommended spray and cultivation programmes to growers that comply with the European Union's maximum residue limits (MRL) for chemicals. The NRC for grapes also provides weather forecast based advice at three day intervals which predict the level of pest risk and recommend management strategies.

Pest and disease management programmes

Pest and disease management programmes in table grape vineyards use a broad range of practices including nutrient and water management, specific pruning and canopy management techniques and bagging. Biological and chemical control measures are also used. Table 3.2 shows the common pests and integrated pest management procedures for production of quality table grapes (NRC 2013).

Export vineyards need to maintain a record of practices that includes information on cultural practices and application of fertilizer and chemicals. Before harvest and chemical testing, each vineyard is inspected by the respective state's agriculture department (APEDA 2013). The state agriculture department will inspect the crop for quality, pest and disease incidence as well as verify the records (APEDA 2013). The growers not passing this inspection will not be qualified for export.

Before harvest, table grapes from vineyards registered for export are randomly sampled and tested for chemical residue by APEDA authorised laboratory workers (APEDA 2013). If the sample conforms to MRL requirements the grapes can harvested for export.

Table 3.2 Pests and their management measures for grapevine in India (NRC 2013)

Pest/pathogen	Common name	India’s management measures
Elsinoe ampelina	anthracnose	• Remove all prunings • Sprays of carbendazim 50WP, ziram 27SL, chloronthalonil, COC 50WP, copper hydroxide 77WP, Bordeaux mixture, mancozeb, captan, difenconazole 25EC, fosetyl A1 and propineb 70WP at certain developmental times.
Spodoptera litura and others	caterpillar	• Field sanitation • Summer ploughing • Regular scouting and monitoring • Light traps to catch moths • Pheromone traps for *Spodoptera litura* • Sprays of methomyl 40SP, emamectin benzoate 5SG and lambda cyhalothrin 5CS at certain developmental times.
Plasmopara viticola	downy mildew	• Prune after 15 October for fruit pruning • Sprays of Bordeaux mixture, copper fungicides, ziram, mancozeb, captan, chloronthalonil, sulphur 80WDG with Bordeaux mixture, fosetyl A1, propineb 70WP, metataxyl 8WP, cymoxanil, dimethomorph 50WP, fenamidone, azoxystrobin 23SC, iprovalicarb, famoxidone, metiram 60WG, pyraclostrobin and kresoxim methyl 44.3SC at certain developmental times.
Rastrococcu iceryoides, *Maconellicoccus hirsutus* and others	mealybugs	• Field sanitation • Summer ploughing • Regular scouting and monitoring • Sprays of methomyl 40SP, bupprofezin 25SC and imidocloprid 17.8SL before veraison.
Uncinula necator	powdery mildew	• Remove all prunings • Sprays of sulphur 80WDG, potassium bicarbonate, Dinocap 48EC, hexaconazole, peconazole, flusilazole, myclobutanil, tetraconazole, azoxystrobin 23SC, kresoxim methyl 44.3SC, triademefon, mineral oils, fenarimol and difenoconazole at certain developmental times.

Pest/pathogen	Common name	India's management measures
Amrasca biguttula biguttula	leafhopper	• Field sanitation • Summer ploughing • Regular scouting and monitoring • Light traps • Sprays of fipronil 80WG, lambda cyhalothrin 5CS, imidacloprid 17.8SL and emamectin benzoate 5SG at certain developmental times.
Phakopsora euvitis	grapevine leaf rust	• Sprays of Bordeaux mixture, captafol, COC, copper hydroxide, difolatan, flusilazole 40EC, polycarbamate and prochloraz at certain developmental times • Use of resistant species and cultivars.
Scelodonta strigicola	flea beetle	• Field sanitation • Summer ploughing • Regular scouting and monitoring • Sprays of imidacloprid 17.8SL and lambda cyhalothrin 5SC at certain developmental times.
Stromatium barbatum, *Celosterna scrabrator*	stem borer	• Field sanitation • Summer ploughing • Regular scouting and monitoring • Make bore holes wider and try to hook the larvae out and kill them • Fine light traps for adults.
Tetranychus kanzawai	Kanzawa spider mite	• Field sanitation • Summer ploughing • Regular scouting and monitoring • If severe, use a jet spray of water before applying the chemical spray • Keep adequately irrigated • Sprays of sulphur 80WDG at certain developmental times.

Pest/pathogen	Common name	India's management measures
Tetranychus urticae	red spider mite	• Field sanitation • Summer ploughing • Regular scouting and monitoring. • If severe, use a jet spray of water before applying the chemical spray • Keep adequately irrigated • Sprays of sulphur 80WDG at certain developmental times.
Retithrips syriacus, *Rhipiphorothrips cruentatus*, *Scirtothrips dorsalis*	thrips	• Field sanitation • Summer ploughing • Regular scouting and monitoring • Sprays of fipronil 80WG, lambda cyhalothrin 5CS, imidacloprid 17.8SL and emamectin benzoate 5SG at certain developmental times.
Xanthomonas campestris pv. *viticola*	grapevine bacterial canker disease	• Copper fungicides can help to control this bacterial species.

3.5 Harvesting and handling procedures

The grape harvest period in India may vary greatly as shown in Table 3.1. Nevertheless, in the main commercial production areas of Maharashtra and Karnataka, grapes are harvested between mid-February and the end of April (DPP 2009; DAFF 2010). Market preference for colour and sweetness determines harvest timing of each cultivar (DPP 2012).

Grape bunches for export typically carry 130 to 150 berries of 16 millimetres in diameter or more, with a brix level of 17–18 per cent. Each bunch can weigh up to 1 kilogram. The diameter is checked using a collapsible grape-sizing gauge, comprising a series of flat plastic fingers with punched holes, ranging from 16 to 29 millimetres. Grape berries for domestic consumption are smaller (less than 16 millimetres in diameter), sweeter and are left on the vine for longer to deepen in colour (DAFF 2010).

Bags (paper wrapping) are removed in the morning just before the grapes are harvested. The grapes are harvested manually using scissors (DPP 2009; DAFF 2010). The picker examines the bunches for berry size, colour, uniformity and any blemishes or damage. The harvested grape bunches are placed into field crates. Field crates used in India are stackable, low-walled, vented plastic crates, which are lined with a polyethylene foam insert. The dimensions of the field crates are 600 millimetres in length, 400 millimetres in width and 250 millimetres in height. The filled crates are either loaded on a small field trolley or on a large trailer and then loaded onto trucks in front of the property. The trucks are covered and sealed when full and the load is transported to the packing house for processing (DAFF 2010).

3.6 Post-harvest

3.6.1 Packing house

All packing houses wishing to process table grapes for export must be registered with APEDA. The packing house is inspected by the Packhouse Recognition Committee and if passed a packing house recognition certificate is issued.

Upon arrival at the packing house the harvested grape bunches are put into a receiving room, which is isolated from the grading room. The fruit is held in the receiving room for an hour to cool (DAFF 2010).

Sorting and trimming

After the grape bunches have cooled they are moved to the grading room. Post-harvest trimming of bunches is done to improve the appearance of the bunch and prevent postharvest decay. Trimming is performed with sharp, long-nosed scissors to remove defective berries (Figure 4). Berries that are too small, overripe, split, shrivelled, diseased, immature, or off-coloured are removed (by their pedicels) from the selected bunches. Bunches that are too compact, too straggly, sun scorched, damaged or containing excessive amounts of water are promptly removed for disposal (DAFF 2010; DPP 2012).

The bunches are graded for size and colour. Grade designation and quality of table grapes is specified under the *Fruits and vegetables grading and marking rules, 2004* (DAC 2004), amended in 2007 (DAC 2007), in Schedule II: Grade designation and quality of table grapes. Parameters such as size, colour and Brix value are assessed and inspection made for visual diseases and defects (DPP 2009).

The graded bunches are put into clean crates and onto conveyor lines to move to the packing room (DPP 2009; DPP 2012). A line supervisor inspects the graded product before it is packed.

Figure 4 Grapes being trimmed in the packing house

Packing

In the packing room, the bunches are trimmed to the desired weight and placed into 500 gram plastic punnets or polythene pouches. Each punnet or pouch contains two bunches weighing between 350 and 650 grams and are packed into 5 kilogram cardboard carton lined with a plastic bag or a 4 kilogram vented polystyrene carton (DAFF 2010; DPP 2012) (Figure 5).

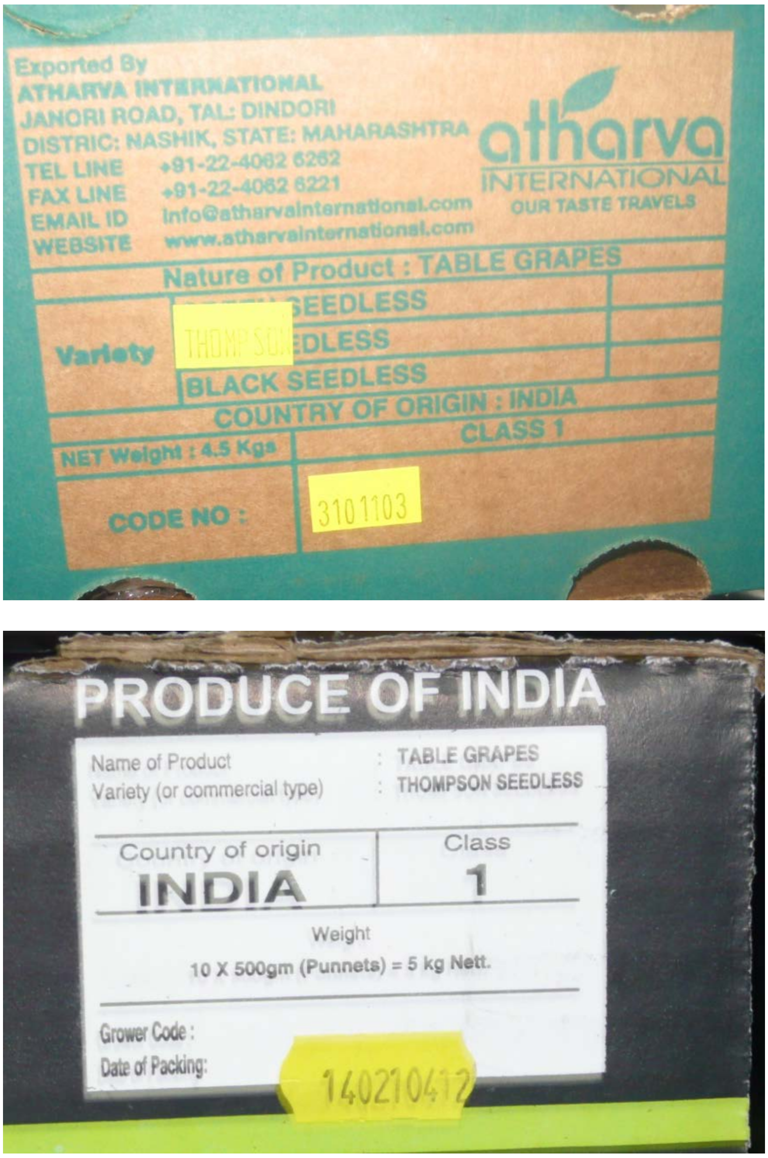
Figure 5 Grapes being packed in the packing house

Before placing the punnets or pouches in a carton, bubble sheet is spread with its rough surface facing towards the base of the carton. A polythene liner is spread over the top of the bubble sheet. After pre-cooling, dual purpose sulphur dioxide releasing pads are placed over the punnets and the polythene liner is folded in.

Labelling

All cartons are labelled for trace back purposes using a unique identification code, identifying the packing house, vineyard and plot and the date packed. Cartons are also marked with information on the name of the commodity, variety, grade or fruit size, net weight, and any additional requirements specified by the importing country (DPP 2012) (Figure 6).

Figure 6 Examples of labels showing trace back information on the carton



Pre-cooling and storage

As soon as possible after packing and the phytosanitary checks, grapes are pre-cooled to less than 4 degrees Celsius by forced air. This pre-cooling is best if it occurs within 4–6 hours of harvest. The grapes are pre-cooled for 6-8 hours to get down to less than 4 degrees Celsius (DPP 2009; DPP 2012; NRC 2013).

After pre-cooling, cartons are strapped and put into cold storage and held for shipment. Doors at the rear of each cool room open into a dispatch bay fitted with an insect zapper. Refrigerated shipping containers are backed up to the dispatch door for loading. Conditions are maintained at

0–2 degrees Celsius and 90–95 per cent humidity throughout storage and transport (DPP 2009; DAFF 2010; DPP 2012). For air freight, there is no pre-cooling (DPP 2012). Figure 7 summarises the vineyard and post-harvest processes for Indian table grapes produced for export.

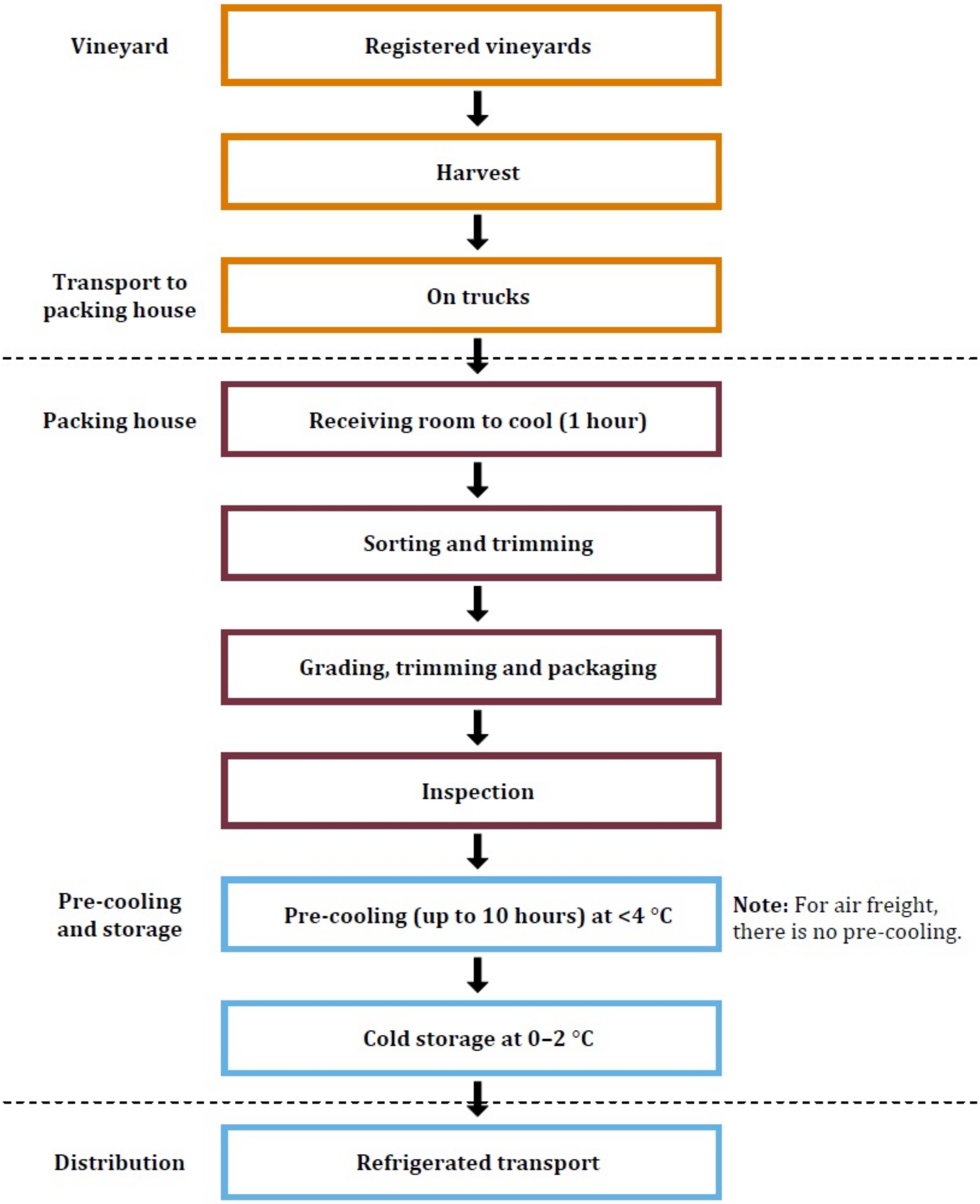
3.6.2 Export procedures

Cartons are randomly selected for inspection prior to storage. Quality control checks may be performed by packing house staff and phytosanitary checks for export certification are conducted by a district agriculture inspection officer from the National Horticulture Mission, which is a part of the Department of Agriculture and Cooperation, India. Once these checks are passed the palletised product is moved into pre-cooling.

3.6.3 Transport

Table grapes for export from India are transported by air or sea freight. When transported by sea freight, the grapes are in refrigerated containers, with temperature and humidity recorders (DPP 2009). The palletised boxes of grapes are loaded into a refrigerated container for shipment. Temperature and humidity recorders are placed inside the container and temperature sensors are calibrated prior to loading the container. When recommended temperature and humidity levels have been reached in the container, the pallets are arranged by placing them in an interlocking position to prevent movement within the container. The doors of the container are closed immediately after loading, and seals are affixed to the door lock (DPP 2012). For air freight, packed grapes are immediately loaded into refrigerated container trucks or vans and transported to the airport (DPP 2012).

Figure 7 Summary of vineyard and post-harvest processes practiced in India, for table grapes for export



3.7 Export capability

3.7.1 Production statistics

Approximately two and a half million tonnes of grapes are harvested annually in India. Table 3.3 shows the 2013–2014 grape production figures in India (APEDA 2015). Around 95 per cent of total production is from the two grape producing states, Maharashtra and Karnataka.

Table 3.3 Production and per cent share of total grape production in India in 2013–14 (APEDA 2015)

State	Production in metric tonnes	Per cent share
Maharashtra	2 160 000	83.55
Karnataka	302 390	11.70
Tamil Nadu	47 720	1.85
Telangana	25 790	1.00
Mizoram	23 870	0.92
Punjab	12 020	0.46
Andhra Pradesh	8 930	0.35
Madhya Pradesh	2 000	0.08
Nagaland	1 140	0.04
Jammu and Kashmir	740	0.03
Haryana	550	0.02
Himachal Pradesh	130	0.01
Rajasthan	70	0.00
Total	**2 585 350**	**–**

3.7.2 Export statistics

During the past five years, India exported between 64 000 and 148 000 tonnes of table grapes per year to more than 25 countries (International Trade Centre 2015). Key export markets include the Netherlands, Bangladesh, the United Arab Emirates, Russia and the United Kingdom (International Trade Centre 2015). Table 3.4 shows volumes of grapes exported from India to the top five countries from 2010 to 2014 (International Trade Centre 2015).

Table 3.4 Export volumes of fresh grapes from India to the top five export markets from 2010 to 2014 (International Trade Centre 2015)

	Volume (metric tonnes)				
Destination	**2010**	**2011**	**2012**	**2013**	**2014**
Netherlands	25 050	12 988	27 187	39 327	41 674
Russia	1 790	1 937	7 429	20 573	21 093
Bangladesh	6 951	34 538	31 058	29 181	20 141
UK	11 438	3 913	10 632	14 580	16 779
UAE	6 095	7 842	13 023	13 622	10 028
Total for top 5 export markets	51 324	61 218	89 329	117 283	109 715
Total for all export markets	64 334	75 387	114 306	148 521	136 740

3.7.3 Export season

The main export season for table grapes from India is from February to the end of April (DAFF 2010; DPP 2012; International Trade Centre 2015). However, small volumes of table grapes may be exported at other times of the year.

4 Pest risk assessments for quarantine pests

Quarantine pests associated with table grapes from India 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.

Pest categorisation identified 26 quarantine pests associated with table grapes from India. Of these, 18 pests are of national concern and eight are of regional concern. Table 4.1 identifies these quarantine pests, and full details of the pest categorisation are given in Appendix A. Additional quarantine pest data are given in Appendix B.

Assessments of risks associated with these pests are presented in this chapter unless otherwise indicated.

Pest risk assessments already exist for some of the pests considered here as they have been assessed previously by the Australian Government Department of Agriculture.

The likelihood of establishment and of spread of a pest in the PRA area will be comparable regardless of the fresh fruit commodity/country pathway in which the pest is imported into Australia, as these likelihoods relate specifically to events that occur in the PRA area and are independent of the importation pathway. The consequences of a pest are also independent of the importation pathway. For pests that have been assessed previously, the Australian Government Department of Agriculture reviewed the latest literature. If there is no new information available that would significantly change the risk ratings for establishment and for spread, and the consequences the pests may cause, the risk ratings given in the previous assessments for these components will be adopted.

The reassessment of the likelihood of distribution for pests with existing policy is considered on a case-by-case basis by comparing factors relevant to the importation of table grapes from India with those in the existing policy, such as the commodity type, time of year at which import takes place and availability and susceptibility of hosts during the time of import. After comparing these factors and reviewing the latest literature, the ratings of likelihood of distribution from the previous assessments will be adopted where the department considers that the likelihood of distribution for table grapes from India would be similar to, or at least not higher than, that given in the previous assessments. For some pests the likelihood of distribution was reassessed and the reason for reassessing is provided in the introduction to the relevant pest risk assessment.

The likelihood of importation could be different from the previous assessment due to differences in the commodity, country and commercial production practices in the export areas. For pests with existing policy, the department compared factors affecting the likelihood of importation and reviewed the latest literature. The overall outcome, i.e. the unrestricted risk estimate of achieving or exceeding Australia's ALOP, from the previous assessments will be adopted where the department considers that the likelihood of importation for table grapes from India would be comparable to that given in the previous assessments and/or where changes in the risk rating for importation will not change the overall outcome. Explanation text will be included in this chapter for pests where the overall outcome from the previous assessment is adopted.

The quarantine risks posed by *Drosophila suzukii* from all countries and for all commodities, including table grapes, were previously assessed in the final pest risk analysis (PRA) report for *Drosophila suzukii* (DAFF Biosecurity 2013). Therefore, there is no need to reassess this pest here. A summary of pest information and the likelihood estimates from the final PRA report for *D. suzukii* is presented in this chapter for convenience.

Some pests identified in this assessment have been recorded in some regions of Australia, and due to interstate quarantine regulations are considered pests of regional concern. The acronym for the state for which the regional pest status is considered, such as 'WA' (Western Australia), is used to identify these organisms.

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 and many priorities of names are still to be resolved, 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 grapes harvested, packed, stored and transported for export to Australia may need to travel variable distances to ports. Depending on the port of departure and arrival it could take up to four weeks for general sea freight from India to Australia. Table grapes could also potentially be air-freighted from India to Australia. While the unrestricted risk assessments undertaken in this risk analysis do not impose any mandatory measures during storage and transport, common commercial practices may impact on the survival of some pests. If these conditions are applied to all consignments for a minimum period of time, then those conditions can be considered as part of the unrestricted risk assessment.

Table 4.1 Quarantine pests for table grapes from India

Pest	Common name
Spider mite (Trombidiformes: Tetranychidae)	
Tetranychus kanzawai (EP, WA)	Kanzawa spider mite
Fruit fly (Diptera: Tephritidae)	
Bactrocera correcta (EP)	Guava fruit fly
Bactrocera dorsalis (EP)	Oriental fruit fly
Drosophila (Diptera: Drosophilidae)	
Drosophila suzukii (EP)	Spotted wing drosphila
Phylloxera (Hemiptera: Phylloxeridae)	
Daktulosphaira vitifoliae (EP)	Grapevine phylloxera
Soft scales (Hemiptera: Coccidae)	
Parthenolecanium corni (EP, WA)	European fruit lecanium
Mealybugs (Hemiptera: Pseudococcidae)	
Planococcus ficus (EP)	Grapevine mealybug
Planococcus lilacinus (EP)	Coffee mealybug
Planococcus minor (EP)	Pacific mealybug
Rastrococcus iceryoides (EP)	Downey snowline mealybug

Pest	Common name
Plume moth (Lepidoptera: Pterophoridae)	
Platyptilia ignifera (EP)	Large grape plume moth
Tortricid moths (Lepidoptera: Tortricidae)	
Archips machlopis	Leaf rolling moth
Thrips (Thysanoptera: Thripidae)	
Retithrips syriacus (EP)	Black vine thrips
Rhipiphorothrips cruentatus (EP)	Grapevine thrips
Bacteria	
Xanthomonas campestris pv. *viticola*	Grapevine bacterial canker disease
Fungi	
Greeneria uvicola (EP, WA)	Bitter rot
Guignardia bidwellii (EP)	Black rot
Monilinia fructigena (EP)	Brown rot
Pestalotiopsis menezesiana (EP, WA)	Fruit rot
Pestalotiopsis uvicola (EP, WA)	Fruit rot
Phakopsora euvitis (EP)	Grapevine leaf rust
Phomopsis viticola (EP, WA)	Phomopsis cane and leaf spot
Pilidiella castaneicola (EP, WA)	White rot
Pilidiella diplodiella (EP, WA)	White rot
Viruses	
Tobacco necrosis viruses (EP)	–
Tomato black ring virus	–

EP: Species has been assessed previously and import policy already exists.
WA: Regional pest for the state of Western Australia.

4.1 Kanzawa spider mite

Tetranychus kanzawai **(EP, WA)**

Tetranychus kanzawai was included in the final import policy for table grapes from China (Biosecurity Australia 2011a), from Korea (Biosecurity Australia 2011b) and from Japan (Department of Agriculture 2014). In these existing policies, the unrestricted risk estimate for *T. kanzawai* was assessed as exceeding Australia's ALOP and therefore specific risk management measures are required for this pest.

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

Tetranychus kanzawai has a wide host range and the likelihood of distribution for this pest for table grapes from India would be comparable to that for table grapes from the previous export areas. Accordingly, there is no need to reassess this component.

The Australian Government Department of Agriculture considered factors affecting the likelihood of importation for *T. kanzawai* for table grapes from India and those previously assessed. The department considers that the likelihood of importation for *T. kanzawai* for table grapes from India would be comparable to that in the previous assessments. Due to this reason, it is considered that there is no need to reassess this component for this species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for *T. kanzawai* in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for *T. kanzawai* for table grapes from India exceeds Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.2 Fruit flies

Bactrocera correcta **(EP),** ***Bactrocera dorsalis*** **(EP)**

Bactrocera correcta (guava fruit fly) and *Bactrocera dorsalis* (Oriental fruit fly) belongs to the fruit fly family Tephritidae which is a group considered to be among the most damaging pests of horticultural crops (White and Elson-Harris 1992; Kapoor 2002). The fruit fly species assessed here have been grouped together because of their related biology and taxonomy, and they are predicted to pose a similar risk and to require similar mitigation measures. Unless explicitly stated, the term 'fruit fly' is used to refer to both species and the information presented is considered as applicable to both species.

Bactrocera correcta is considered a potential pest in India where it often occurs sympatrically with serious pest species such as *B. dorsalis* and *B. zonata* and is a major threat to guava (White and Elson-Harris 1992; Kapoor 2002). In a survey of grapevine pests in India, Mani (1992) recorded *B. correcta* from grape (*Vitis vinifera*).

Bactrocera dorsalis has been recorded from table grapes in China (Chu and Tung 1996; Ye and Liu 2005) and has been observed to attack undamaged grapes in laboratory studies in Japan (Iwaizumi *et al.* 1994). There are no reports in the literature of *B. dorsalis* attacking grapes in other countries or in India.

Both *B. correcta* and *B. dorsalis* has four life stages: egg, larva, pupa and adult. Eggs are laid below the skin of the host fruit. Hatched larvae feed within the fruit. Pupation occurs in the soil under the host plant (Christenson and Foote 1960; White and Elson-Harris 1992; CABI 2012). They can produce several generations a year, depending on the temperature (Christenson and Foote 1960; CABI 2012).

The risk scenario of concern for *B. correcta* and *B. dorsalis* is the presence of eggs and developing larvae within table grapes.

Bactrocera correcta was assessed in the existing import policy for mangoes from India (Biosecurity Australia 2008). *Bactrocera dorsalis* was assessed in several existing import policies, for example, in the import policies for longan and lychee fruit from China and Thailand (DAFF 2004a) and for table grapes from China (Biosecurity Australia 2011a). The assessment of *B. correcta* and *B. dorsalis* presented here builds upon these previous assessments

Differences in horticultural practices, climatic conditions and the prevalence of the pests between previous export areas and India make it necessary to reassess the likelihood that *B. correcta* and B. dorsalis will be imported into Australia with table grapes from India.

Both *B. correcta* and *B. dorsalis* has a wide range of hosts and the likelihood of distribution after arrival in Australia of these species with table grapes from India would be comparable to that for table grapes from China (Biosecurity Australia 2011a). Accordingly, there is no need to reassess this component.

The likelihood of establishment and of spread of *B correcta* and *B. dorsalis* in Australia will be comparable regardless of the fresh fruit commodity in which these species 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 *B correcta* and *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 these species in the existing policies. Therefore, the likelihood ratings for *B correcta* and *B. dorsalis* in the existing policies will be adopted here.

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.

Likelihood of importation

The likelihood that *B. correcta* and *B. dorsalis* will arrive in Australia with the importation of table grapes from India is: **Very low**.

The following information provides supporting evidence for this assessment.

- Both *B. correcta* and *B. dorsalis* are widely distributed in India. *Bactrocera correcta* is recorded from Andhra Pradesh, Bihar, Goa, Gujarat, Haryana, Himachal Pradesh, Punjab, Karnataka, Kerala, Maharashtra, Tamil Nadu, Uttar Pradesh and West Bengal (CABI 2012). *Bactrocera dorsalis* is recorded from Andhra Pradesh, Assam, Bihar, Delhi, Goa, Himachal Pradesh, Punjab, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Orissa, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal (Drew and Hancock 1994; Kapoor 2002; Satarkar *et al.* 2009; CABI 2012). Grapes are commercially grown in many of these areas, for example Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu and Punjab (DPP 2007).
- While both *B. correcta* and *B. dorsalis* have a wide host range, grapes do not appear to be a prefer host for these two fruit fly species. *Bactrocera dorsalis* was recorded in table grapes in China, where it is considered a minor pest of grapevine (Chu and Tung 1996; Ye and Liu 2005). This species has also been observed to attack undamaged grapes in laboratory studies in Japan (Iwaizumi *et al.* 1994). There are no reports of *B. dorsalis* attacking grapes in India or other countries other than China. In a survey of grapevine pests in India, Mani (1992) recorded *B. correcta* from grape (*Vitis vinifera*). There have been no other reports that associate *B. correcta* with grapevines in India or in other countries.
- *Bactrocera dorsalis* undergoes hibernation during winter in northern India, but is active throughout the year in the southern part of India (Verghese *et al.* 2002). The overwintering and hibernation patterns of *B. correcta* are assumed to be similar.
- Table grapes are produced in the northern, central, and southern areas of India (DPP 2007).
- The main harvest season of table grapes in India is from February to the end of April (DAFF 2010; DPP 2012). Small volumes of table grapes may be harvested at other times of the year. There is potential for these fruit fly species to be active and could be present in Indian table grape vineyards during the harvest season.

- Studies in China, on other hosts, have demonstrated that *B. correcta* adults will oviposit at temperatures as low as 18 degrees Celsius (Liu and Ye 2009). Temperatures during the harvest season for Indian table grapes are likely to exceed 18 degrees Celsius (Shikhamany 2001).
- Damage caused by fruit flies consists of punctures of the host tissue by adults during oviposition and feeding by the larvae within the fruit pulp (Christenson and Foote 1960; Ye and Liu 2005). This allows for secondary infection from fungi or bacteria, which cause extensive rotting and dropping of fruit (Mau and Martin Kessing 2007).
- In the absence of blemishes and damage to the skin, eggs and early instar larvae, if present, are unlikely to be detected during picking, sorting and quality inspection. However, fruit that show obvious signs of attack or tissue decay, particularly those with secondary infection by fungi and/or bacteria, are likely to be removed from the export pathway during harvesting, sorting and packing processes.
- Cold temperature treatments of 1.7 degrees Celsius for 14 days or 1.0 degrees Celsius for 13 days killed third instar larvae (the most cold tolerant life-stage) in naturally-infested citrus and longans (Wu 2005). Armstrong *et al.* (1995) demonstrated that cold temperature treatment at 1.1 degrees Celsius for 12 days was sufficient to kill *B. dorsalis* eggs and larvae in carambolas. There is no specific research data available on the lethal effects of cold storage on *B. correcta.*
- Grapes are usually pre-cooled to less than 4 degrees Celsius after packing and cold stored at 0–2 degrees Celsius at 90–95 per cent humidity after palletizing until shipment (DPP 2009). These storage and transportation conditions, without a specific cold treatment, are likely to be only sub-lethal to *B. correcta* and *B. dorsalis* eggs and larvae.

The wide distribution of *B. correcta* and *B. dorsalis* in India including in the main grape production areas, the possibility that some infested fruit without obvious signs of infestation may escape detection during harvesting, sorting and packing processes, moderated by the information that there are no reports of *B. dorsalis* attacking grapes in India, the single report of *B. correcta* in grapes in India is from 1999 and not since and there have been no reports of *B. correcta* in grape in any other countries, support a likelihood estimate for importation of 'very low'

Likelihood of distribution

As indicated, the likelihood of distribution for *B. correcta* and *B. dorsalis* assessed here would be the same as that for *B. dorsalis* for table grapes from China (Biosecurity Australia 2011a), that is **Moderate**.

Overall likelihood of entry

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

The likelihood that *B. correcta* and *B. dorsalis* will enter Australia as a result of trade in table grapes from India and be distributed in a viable state to a susceptible host is: **Very low.**

4.2.2 Likelihood of establishment and spread

As indicated, the likelihood of establishment and of spread for *B. correcta* and *B. dorsalis* is being based on the assessment for longan and lychee from China and Thailand (DAFF 2004a), which was adopted for table grapes from China (Biosecurity Australia 2011a). The ratings from the previous assessments are:

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

4.2.3 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 *B. correcta* and *B. dorsalis* will enter Australia as a result of trade in table grapes from India, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **Very low.**

4.2.4 Consequences

As indicated, consequences of *B. correcta* and *B. dorsalis* in Australia assessed here are based on the previous assessment for *B. dorsalis* for longan and lychee from China and Thailand (DAFF 2004a), which was adopted for table grapes from China (Biosecurity Australia 2011a), that is: **High**.

4.2.5 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 *Bactrocera correcta* and *Bactrocera dorsalis*	
Overall likelihood of entry, establishment and spread	Very low
Consequences	High
Unrestricted risk	Low

As indicated, the unrestricted risk estimate for *Bactrocera correcta* and *Bactrocera dorsalis* have been assessed as 'low', which exceeds Australia's ALOP. Therefore, specific risk management measures are required for these pests.

4.3 Spotted wing drosophila

Drosophila suzukii (EP)

The quarantine risks posed by *Drosophila suzukii* from all countries and for all commodities, including table grapes, were previously assessed in the Final pest risk analysis (PRA) report for *Drosophila suzukii* (DAFF Biosecurity 2013). Therefore, there is no need to reassess this pest here. A summary of pest information and previous assessments from the final PRA report for *D. suzukii* is provided here.

In India, *Drosophila suzukii indicas* has been found in Kashmir (Hauser *et al.* 2009), northern India (Toda 1991) and Uttar Pradesh (Chamoli & Pauri region) at approximately 5000 feet (1524 metres) (Singh and Negi 1989) or at 6000 feet (1800 metres) above sea level (Singh and Bhatt 1988). *Drosophila suzukii* has also been recorded from Mysore in southern India at altitude (680 metres and above) where it is collected infrequently (Guruprasad *et al.* 2010).

Drosophila suzukii preferentially oviposit on ripe fruit but will also oviposit on unripe and overripe fruit (Kanzawa 1939; Lee *et al.* 2011; Brewer *et al.* 2012). Larvae feeding on very acidic fruit fail to complete development (Kanzawa 1935). In its native and introduced range, *D. suzukii* has been recorded to cause damage to a range of fruits including grapes, cherry, blueberry and red bayberry, mulberries, peaches, plums, strawberries and various caneberries.

On grapes, oviposition trials on wine and table grapes have shown that fully-ripe table grapes can be attacked (Maiguashca *et al.* 2010; Saguez *et al.* 2013; Atallah *et al.* 2014). Damaged fruit with low sugar levels will be oviposited in but larvae develop poorly and fail to pupate (Maiguashca *et al.* 2010). Kanzawa (1939) recorded that different grape varieties sustained different levels of attack and considered skin thickness was the factor that limited oviposition. Oviposition of *D. suzukii* has been reported on a number of grape varieties/cultivars which are 100 per cent *V. vinifera*, such as Gros Coleman, Muscat of Alexandra, Muscat of Hamburg, Foster's seeding Rose de Italy, Kyoshin (Kanzawa 1939), Thompson Seedless (Lee *et al.* 2011), Black Manuka and Perlette (WSUE 2010). Reports of oviposition on grape varieties/cultivars which are 100 per cent Vitis labrusca have not been found. There have been reports of a number of grape varieties/cultivars not being attacked by *D. suzukii*, some of these are 100 per cent *Vitis vinifera* (e.g. Koshu, Chasselas de Fontainbleau, Golden champion and White Malaga), some are 100 per cent *Vitis labrusca* (e.g. Concord, Eaton, Niagara and Hostess seedling) (Kanzawa 1939), and some are hybrids between *V. vinifera* and *V. labrusca* for which percentage of *V. vinifera* as parentage range from 25 per cent (e.g. Early Campbell) (Maiguashca *et al.* 2010) to 75 per cent (e.g. Brighton) (Kanzawa 1939).

When *D. suzukii* is given a choice between several host fruits (e.g. raspberry, cherry, strawberry, grape), grape ('Thompson Seedless') were the least preferred host on undamaged fruit (Lee *et al.* 2011; Atallah *et al.* 2014).

During the 1930s in Japan, *D. suzukii* was trapped in vineyards at high levels and there are reports of damage as high as 80 per cent (Kanzawa 1939). More recently there have been reports of outbreaks of *D. suzukii* on grapes in Hokkaido (CFIA 2010).

The risk scenario of concern for *D. suzukii* is the presence of the larvae in mature bunches of grapes.

4.3.1 Overall likelihood of entry, establishment and spread

Based on the Final pest risk analysis (PRA) report for *Drosophila suzukii* (DAFF Biosecurity 2013) the overall likelihood that *D. suzukii* will enter Australia as a result of trade in table grapes (*Vitis vinifera*) from India, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **Moderate**.

The final PRA for *D. suzukii* (DAFF Biosecurity 2013) recognises that the importation risk of *D. suzukii* on table grape pathway could be different for particular varieties and/or cultivars. The importation risk and hence the overall likelihood of entry, establishment and spread are likely to be lower for commercial quality grapes of varieties and/or cultivars of *V. vinifera* or hybrids demonstrated to be poor hosts for oviposition by *D. suzukii*.

4.3.2 Consequences

Based on the Final pest risk analysis (PRA) report for *Drosophila suzukii* (DAFF Biosecurity 2013) the potential consequences of the establishment of *D. suzukii* in Australia are: **High**.

4.3.3 Unrestricted risk estimate

Based on the Final pest risk analysis (PRA) report for *Drosophila suzukii* (DAFF Biosecurity 2013) the unrestricted risk estimate for *D. suzukii* has been assessed as 'high', which exceeds Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.4 Grapevine phylloxera

Daktulosphaira vitifoliae **(EP)**

Daktulosphaira vitifoliae was included in the final import policy for table grapes from China (Biosecurity Australia 2011a), from Korea (Biosecurity Australia 2011b) and from Japan (Department of Agriculture 2014). In these existing policies, the unrestricted risk estimate for *D. vitifoliae* was assessed as exceeding Australia's ALOP and therefore specific risk management measures are required for this pest.

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

Even though the main import windows differ between table grapes from the previous export areas and India, tissues susceptible to infection by *D. vitifoliae* will be available during the expected import window for table grapes from India as well as during the import windows for table grapes from the previous export areas. Therefore, the likelihood of distribution for this pest for table grapes from India would be comparable to that for table grapes from the previous export areas. Accordingly, there is no need to reassess this component.

The Australian Government Department of Agriculture considered factors affecting the likelihood of importation for *D. vitifoliae* for table grapes from India and those previously assessed. The department considers that the likelihood of importation for *D. vitifoliae* for table grapes from India would be comparable to that in the previous assessments. Due to this reason, it is considered that there is no need to reassess this component for this species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for *D. vitifoliae* in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for *D. vitifoliae* for table grapes from India exceeds Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.5 European fruit lecanium

Parthenolecanium corni (EP, WA)

Parthenolecanium corni was included in the final import policy for table grapes from China (Biosecurity Australia 2011a), from California (DAFF 2013) and from Japan (Department of Agriculture 2014). In these existing policies, the unrestricted risk estimate for *P. corni* was assessed as achieving Australia's ALOP and therefore specific risk management measures are not required for this pest.

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

Parthenolecanium corni has a wide host range and the likelihood of distribution for this pest for table grapes from India would be comparable to that for table grapes from the previous export areas. Accordingly, there is no need to reassess this component.

The Australian Department of Agriculture considered factors affecting the likelihood of importation for *P. corni* for table grapes from India and those previously assessed. The department considers that the likelihood of importation for *P. corni* for table grapes from India would be comparable to that in the previous assessments. Also, if the likelihood of importation is assessed as 'high' (the possible highest estimate) for *P. corni* for table grapes from India, the unrestricted risk estimate will still achieves Australia's ALOP. Due to this reason, it is considered that there is no need to reassess this component for this species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for *P. corni* in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for *P. corni* for table grapes from India achieves Australia's ALOP. Therefore, specific risk management measures are not required for this pest.

4.6 Mealybugs

***Planococcus ficus* (EP), *Planococcus lilacinus* (EP) and *Planococcus minor* (WA, EP), and *Rastrococcus iceyroides* (EP)**

Planococcus ficus (grapevine mealybug), *Planococcus lilacinus* (coffee mealybug), *Planococcus minor* (Pacific mealybug) and *Rastrococcu iceryoides* (downey snowline mealybug) belong to the Pseudococcidae or mealybug family. The mealybug species assessed here have been grouped together because of their related biology and taxonomy, and they are predicted to pose a similar risk and to require similar mitigation measures.

Several mealybug species were assessed previously in a number of existing import policy, for example, in the import policy for mangoes from India (Biosecurity Australia 2008), unshu mandarins from Japan (Biosecurity Australia 2009) and pineapples from Malaysia (DAFF 2012). In these existing policies, the unrestricted risk estimate for mealybugs was assessed as exceeding Australia's ALOP and therefore specific risk management measures are required for the pests.

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

Mealybugs have a wide host range and the likelihood of distribution for these pests for table grapes from India would be comparable to that for commodities assessed previously. Accordingly, there is no need to reassess this component.

The Australian Department of Agriculture considered factors affecting the likelihood of importation for mealybugs for table grapes from India and those previously assessed. The department considers that the likelihood of importation for mealybugs for table grapes from India would be comparable to that in the previous assessments. Due to this reason, it is considered that there is no need to reassess this component for these mealybug species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for mealybugs in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for mealybugs for table grapes from India exceeds Australia's ALOP. Therefore, specific risk management measures are required for these pests.

4.7 Large grape plume moth

Platyptilia ignifera (EP)

Platyptilia ignifera was included in the final import policy for table grapes from Japan (Department of Agriculture 2014). In this existing policy, the unrestricted risk estimate for *P. ignifera* was assessed as achieving Australia's ALOP and therefore specific risk management measures are not required for this pest.

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

Even though the main import windows differ between table grapes from the previous export area and India, tissues susceptible to infection by *P. ignifera* will be available during the expected import window for table grapes from India as well as during the import window for table grapes from the previous export area. Therefore, the likelihood of distribution for this pest for table grapes from India would be comparable to that for table grapes from the previous export area. Accordingly, there is no need to reassess this component.

The Australian Government Department of Agriculture considered factors affecting the likelihood of importation for *P. ignifera* for table grapes from India and that previously assessed. The department considers that the likelihood of importation for *P. ignifera* for table grapes from India would be comparable to that in the previous assessment. Due to this reason, it is considered that there is no need to reassess this component for this species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for *P. ignifera* in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for *P. ignifera* for table grapes from India achieves Australia's ALOP. Therefore, specific risk management measures are not required for this pest.

4.8 Leaf rolling moth

Archips machlopis

Archips machlopis (leaf rolling moth) belongs to the Tortricidae or the leafroller family. Leaf rolling moth larvae are known to damage fruit of several economic plant species by chewing large holes that usually allows entry to fungi that cause fruit rot (CABI 2012).

Archips machlopis has frequently been misidentified in the literature as *Archips micaceana* (Tuck 1990; Robinson *et al.* 1994; Rose and Pooni 2004; Meijerman and Ulenberg 2011). *Archips micaceana* is found in China, Hong Kong, South Vietnam, Burma and Northern Thailand. *Archips machlopis* is found in Pakistan, Nepal, India, Burma, Thailand, North Vietnam, China (Jiangxi), Malaysia, Sumatra and Java (Tuck 1990; Meijerman and Ulenberg 2011).

While older literature reported that *A. micaceana* was present in India (Puttarudriah *et al.* 1961), recent literature refers the leaf rolling moth present in India as *A. machlopis* (Rose and Pooni 2004).

Archips machlopis has four life stages: egg, larva (caterpillar), pupa and adult (moth) (Puttarudriah *et al.* 1961).

Adults of this species lay eggs on their hosts, or on glass surfaces in enclosures, in varying egg masses of 7 to 58. The eggs are held together by a glutinous material and take about eight days to hatch (Puttarudriah *et al.* 1961).

When fully grown, the larva is about 20 millimetres long (Puttarudriah *et al.* 1961).

The webbing or silken shelters are also used as a pupation site. The pupae are broad, around 10 millimetres long and 3 millimetres wide and take about a week to develop (Puttarudriah *et al.* 1961).

Adult moths are inactive during the day, but will fly away when disturbed. They become active after dusk and the males are attracted to bright light (Puttarudriah *et al.* 1961). Egg laying commences during the night, approximately two days after the moths emerge from the pupae (Puttarudriah *et al.* 1961).

No information was found about the number of generations per year *A. machlopis* can produce. However, a related species, *Archips podana*, has one generation per year in northern and central Europe, two generations per year in the south of the Republic of Belarus and Ukraine, and three generations per year in the Caucasus and Transcaucasia (Meijerman and Ulenberg 2000; Ovsyannikova and Grichanov 2009a; CABI 2014).

The risk scenario of concern for *Archips machlopis* is the presence of larvae on imported grape bunches.

Archips micaceana was included in the existing import policy for table grapes from China (Biosecurity Australia 2011a). *Archips machlopis* has similar biology to *A. micaceana* and the two species are predicted to pose a similar risk and to require similar mitigation measures. The assessment of *A. machlopis* presented here builds upon the previous assessment for *A. micaceana*.

Differences in horticultural practices, climatic conditions and the prevalence of the pests between the previously assessed export area and India make it necessary to reassess the likelihood that *A. machlopis* will be imported into Australia with table grapes from India.

Similar to *A. micaceana*, *A. machlopis* has a wide range of hosts and the likelihood of distribution after arrival in Australia of *A. machlopis* will be comparable to that for *A. micaceana* for table grapes from the previous export area (Biosecurity Australia 2011a). Accordingly, there is no need to reassess this component.

The likelihood of establishment and of spread of *A. machlopis* in Australia will be comparable regardless of the fresh fruit commodity in which this species 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. machlopis* 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. micaceana* in the existing policy. Therefore, those likelihood ratings and consequences estimate 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 *A. machlopis* will arrive in Australia with the importation of table grapes from India is: **Low**.

The following information provides supporting evidence for this assessment.

- *Archips machlopis* is present in Karnataka, Kerala, Punjab, Uttaranchal and Himachal Pradesh (Puttarudriah *et al.* 1961; Varma 1984; Rose and Pooni 2004). Karnataka is India's second biggest grape producing state (APEDA 2015). Grapes are also grown commercially in Punjab (DPP 2007; APEDA 2015).
- Within Karnataka, *A. machlopis* has been reported on grapevine, including on grape bunches, in Kenchanahalli, Bangalore city, Byatarayanapura and Yelahanka, with noticeable damage occurring during November and December (Puttarudriah *et al.* 1961).
- Puttarudriah (1961) reports that larvae were found in harvested grape bunches brought to a domestic market.
- The larvae feed under thin webbing on the epidermis of the leaves as well as on parts of the grape bunch, namely on the rachis, pedicels and both immature and mature grape berries (Puttarudriah *et al.* 1961).
- Feeding by the larvae on the rachis and pedicels causes the berries to become unattached from the bunch and shrivel up (Puttarudriah *et al.* 1961). Feeding by the larvae on berries causes cavities to form at the base of the affected berries (Puttarudriah *et al.* 1961). Cavities

usually allow entry for fungi that cause fruit rot (CABI 2012). Affected bunches with many shrivelled berries, many berries with cavities and/or rotten berries are likely to be detected and removed from the export pathway during harvesting, sorting and packing processes.

- Larvae of *A. machlopis* are of a noticeable size, about 20 millimetres long when fully grown (Puttarudriah *et al.* 1961), and silk webbing and frass are likely to be present on affected bunches. This increases the likelihood of affected bunches being detected and removed from the export pathway during harvesting, sorting and packing processes.
- No information was found about where on the host plant eggs of *A. machlopis* are laid. Moths of the Tortricidae family, for example *Lobesia botrana*, *Epiphyas postvittana, Archips podana, Platynota stultana, Eupoecilia ambiguella* and *Sparganothis pilleriana*, often lay their eggs on the leaves, shoots, buds or on or near flower clusters of grapevine (INRA 1997a; Loch 2007; Bentley *et al.* 2008; Zalom *et al.* 2011). Eggs of *Argyrotaenia franciscana* are laid on any smooth surface of the grapevine plant such as upper leaf surfaces, stems, canes or berries (Flaherty *et al.* 1992). Second generation of *E. ambiguella* and second and third generation of *L. botrana* lay their eggs on the berries (INRA 1997a; Zalom *et al.* 2011). Egg masses or young larvae, if present on grape bunches at harvest, would be more difficult to detect.
- Packed grapes are transported in cold humidified storage to ensure grape quality is maintained. In India, grapes are usually pre cooled to less than 4 degrees Celsius after packing and cold stored at 0–2 degrees Celsius at 90–95 per cent humidity after palletizing until shipment (DPP 2009). Leafroller larvae can survive cold conditions experienced during refrigerated transport, but survival rate, for example for *Platynota stultana*, decreases to around 6 per cent after two weeks at less than 1 degree Celsius (Yokoyama and Miller 2000).

The records of *A. machlopis* causing damage in some vineyards in grape production regions in India, moderated by the information that affected grape bunches are likely to be detected and removed from the export pathway due to the conspicuous nature of damage caused by this pest and the limited ability of leafroller larvae to survive more than two weeks of cold storage, support a likelihood estimate for importation of ‘low’.

Likelihood of distribution

As indicated, the likelihood of distribution for *A. machlopis* assessed here would be the same as that for *A. micaceana* for table grapes from China (Biosecurity Australia 2011a), that is **Moderate**.

Overall likelihood of entry

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

The likelihood that *A. machlopis* will enter Australia as a result of trade in table grapes from India and be distributed in a viable state to a susceptible host is: **Low.**

4.8.2 Likelihood of establishment and spread

As indicated, the likelihood of establishment and of spread for *A. machlopis* is being based on the assessment for *A. micaceana* for table grapes from China (Biosecurity Australia 2011a). The ratings from the previous assessment are:

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

4.8.3 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 *A. machlopis* will enter Australia as a result of trade in table grapes from India, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **Low**.

4.8.4 Consequences

As indicated, consequences of *A. machlopis* assessed here are based on the previous assessment for *A. micaceana* for table grapes from China (Biosecurity Australia 2011a), that is: **Moderate**.

4.8.5 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 *Archips machlopis*	
Overall likelihood of entry, establishment and spread	Low
Consequences	Moderate
Unrestricted risk	Low

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

4.9 Thrips

Retithrips syriacus **(EP) and** ***Rhipiphorothrips cruentatus*** **(EP)**

Retithrips syriacus (black vine thrips) and *Rhipiphorothrips cruentatus* (grapevine thrips) have been grouped together because of their related biology and taxonomy, and they are predicted to pose a similar risk and to require similar mitigation measures. Unless explicitly stated, the term 'thrips' is used to refer to both species and the information presented is considered as applicable to both species.

Several thrips species were assessed previously in a number of existing import policy, for example, in the import policy for persimmon from Israel (DAFF 2004b), mangoes from Taiwan (Biosecurity Australia 2006b) and table grapes from China (Biosecurity Australia 2011a). In these existing policies, the unrestricted risk estimate for thrips was assessed as exceeding Australia's ALOP and therefore specific risk management measures are required for the pests.

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

Thrips have a wide host range and the likelihood of distribution for these pests for table grapes from India would be comparable to that for commodities assessed previously. Accordingly, there is no need to reassess this component.

The Australian Government Department of Agriculture considered factors affecting the likelihood of importation for thrips for table grapes from India and those previously assessed. The department considers that the likelihood of importation for thrips for table grapes from India would be comparable to that in the previous assessments. Due to this reason, it is considered that there is no need to reassess this component for these thrips species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for thrips in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for thrips for table grapes from India exceeds Australia's ALOP. Therefore, specific risk management measures are required for these pests.

4.10 Grapevine bacterial canker disease

Xanthomonas campestris* pv. *viticola

Grapevine bacterial canker disease (GVBCD) was first detected in India in 1969 on 'Anab-e-Shahi' grapevines in Andhra Pradesh (Nayudu 1972). The causal organism was named as *Pseudomonas viticola* (Nayudu 1972), but was later changed to *Xanthomonas campestris* pv. *viticola* (Dye 1978). A large number of pathovars of *X. campestris* which were isolated in the 1950s and 60s, including *viticola*, have not been fully characterised and they are placed under *X. campestris* only provisionally (Parkinson *et al.* 2009).

Xanthomonas campestris pv. *viticola* is a gram negative, non pigmented, plant pathogenic bacterium (Trindade *et al.* 2007). Natural hosts of this bacterium appear to be limited to grapevine. Susceptibility to GVBCD varies among different *Vitis* species (Chand *et al.* 1999). Chand (1999) reported that cultivars of *V. vinifera* are susceptible or highly susceptible to GVBCD whereas those of *V. labrusca* are resistant or moderately resistant to GVBCD. Many other *Vitis* species such as *V. rotundifolia* and *V. rupestris* are resistant and some *Vitis* species such as *V. riparia* and *V. parviflora* are highly resistant to GVBCD (Chand *et al.* 1999).

Several parts of grapevines including canes, leaves and grape bunches can be affected by GVBCD. Evidence of a systemic mechanism of spread of the bacterium in the conductive elements of the plant was recently reported (Tostes *et al.* 2014). The bacterium was detected in symptomatic and asymptomatic seeds of the grape cultivar Red Globe, both on the surface and internal tissue (Tostes *et al.* 2014).

The ultimate symptoms of GVBCD include stunting, cracking, irregular growth, a reduction in the health and vigour of the infected vines and considerable loss in yield and quality (Chand *et al.* 1999; Jambenal 2008). On grape bunches, symptoms develop on pedicels, rachises and berries as dark coloured lesions, cankers and vascular discoloration (Chand *et al.* 1999; Lima *et al.* 1999; Nascimento and Mariano 2004; Trindade *et al.* 2007). Infected berries are irregular in size and colour and severely infected berries are small, shrivelled, wilted and dried (Chand and Kishun 1990; Chand *et al.* 1999; Lima *et al.* 1999; Nascimento and Mariano 2004; Nascimento *et al.* 2006; Trindade *et al.* 2007).

In addition to host specificity, many *Xanthomonas* species and pathovars show tissue specificity as well, invading either intercellular spaces of mesophyll tissue (mesophylic pathogens) and/or xylem elements of vascular tissue (vascular pathogens) (Ryan *et al.* 2011). Tostes *et al.* (2014) reported that *X. campestris* pv. *viticola* is both a mesophyllic and vascular pathogen.

Xanthomonas campestris pv. *viticola* survives mainly in the buds and canker lesions (Chand *et al.* 1999). The bacterium can survive in fallen leaves for about 45 days, and less under moist soil conditions (Chand *et al.* 1999).

The spread of *X. campestris* pv. *viticola* occurs through infected propagative material, agricultural equipment such as pruning and harvesting equipment, through dew, irrigation, rain splash and wind blown droplets (Chand *et al.* 1999). Although *X. campestris* pv. *viticola* has been detected in grapevine seeds (Tostes *et al.* 2014), seed transmission has not been demonstrated.

Epidemics of this disease in India are associated with rainfall in combination with wind, temperatures of between 20 and 30 degrees Celsius and humidity levels of around 80 per cent

(Jambenal 2008). When bud burst coincides with frequent rains during early winter pruning, there is often a severe outbreak of the disease (Chand *et al.* 1999).

Grapevine bacterial canker disease has also been reported in Brazil (Lima *et al.* 1999; Malavolta, *et al.* 1999; Nascimento and Mariano 2004; Halfeld-Vieira and de Lima Nechet 2006; Rodrigues Neto *et al.* 2011). The strains of the bacteria isolated from vineyards in Brazil were almost identical to the Indian strain of *X. campestris* pv. *viticola* (Trindade *et al.* 2005).

The risk scenario of concern for *X. campestris* pv. *viticola* is that infected grape bunches with mild or no symptoms may escape detection during harvesting and packing procedures and hence may be exported to Australia.

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 *X. campestris* pv. *viticola* will arrive in Australia with the importation of table grapes from India is: **High**.

The following information provides supporting evidence for this assessment.

- Cultivars of *Vitis vinifera* are susceptible or highly susceptible to grapevine bacterial canker disease caused by *X. campestris* pv. *viticola* (Chand *et al.* 1999).
- In India, the disease is wide spread in the major grape growing regions of Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu (Chand *et al.* 1999).
- On grape bunches, the pathogen causes lesions and cankers on the pedicels and rachises (Chand *et al.* 1999; Trindade *et al.* 2007). Necrosis on pedicels and rachises occurring at the beginning of fruit set was followed by wilting and drying of berries (Lima *et al.* 1999).
- Infected berries are irregular in size and colour with brown to black necrotic lesions, and are small and shrivelled (Chand *et al.* 1999; Nascimento and Mariano 2004). These symptoms are observed at the beginning of fruit development at the pea-sized stage (Lima *et al.* 1999).
- The bacterium has also been detected on and in seeds of asymptomatic 'Red Globe' berries collected from vineyards effected with GVBCD (Tostes *et al.* 2014).
- Grape bunches showing obvious symptoms are likely to be removed during harvesting, grading and packing processes and would not be packed for export. However, grape bunches with no or mild symptoms could still be packed for export.
- The bacterium has been detected on grapevine leaf samples in Punjab (Chand *et al.* 1999) where the winter temperatures can go down to 0 degrees Celsius, therefore it is likely that the bacterium will survive low temperatures during transport and storage.

The prevalence of *X. campestris* pv. *viticola* in the major grape growing regions of India, the high susceptibility of cultivars of *V. vinifera* to GVBCD and the potential presence of the bacterium on and in grape seeds of asymptomatic berries support a likelihood estimate for importation of 'high'.

Likelihood of distribution

The likelihood that *X. campestris* pv. *viticola* will be distributed within Australia in a viable state as a result of the processing, sale or disposal of table grapes from India and subsequently transfer to a susceptible part of a host is: **Very low**.

The following information provides supporting evidence for this assessment.

- Imported grapes are intended for human consumption. It is expected that grape bunches will be distributed to many localities within all states and territories by wholesale and retail trade and by individual consumers.
- As grapes are easily damaged during handling (Mencarelli *et al.* 2005), packed grapes may not be processed or handled again until they arrive at the retailers. Therefore, the bacterium, if present in packed grapes, is unlikely to be detected during transportation and distribution to retailers.
- Grape bunches with obvious symptoms of infection would not be marketable and would not be sold. Grape bunches without symptoms, or with only minor symptoms could be marketable and sold.
- Most fruit waste will be discarded into managed waste systems and will be disposed of in municipal tips and would therefore pose little risk of exposure to a suitable host.
- Consumers will discard small quantities of fruit waste in urban, rural and natural localities. Small amounts of fruit waste will be discarded in domestic compost. There is some potential for consumer waste being discarded near host plants, including commercially grown, household or wild host plants.
- In a study in Brazil the bacterium survived in infected grapevine tissues (fragmented shoots and leaves) on soil for at least 80 days but only 10 days when composted (Silva *et al.* 2012). In India the bacterium survived on fallen leaves normally for 45 days and up to 25 days under moist soil conditions (Chand *et al.* 1999).
- Generally survival of a pathogen in fruit waste is expected to be short due to dehydration and competition with other organisms. Based on the above studies in Brazil and India regarding survival of this bacterium on soil and fallen leaves, it is speculated that the bacterium could survive in fruit waste for some days.
- If present and still viable on fruit waste, the bacterium would then need to be transferred to a susceptible part of a host.
- To date, grapevine is the only confirmed natural host of *X. campestris* pv. *viticola.* In Australia, grapevines are grown in all states and territories, both commercially (ABS 2012a) and in household gardens.
- Peixoto (2007) reported that bacteria similar to *X. campestris* pv. *viticola* were isolated from the weeds *Alternanthera tenella*, *Amaranthus* sp., *Glycine* sp., and *Senna obtusifolia*. Artificial inoculation studies suggested a number of other plant species as possible alternative hosts for *X. campestris* pv. *viticola*, namely, *Azadirachta indica, Phyllantus maderaspatensis* (Nayudu 1972), *Mangifera indica* (Chand and Kishun 1990; Chand *et al.* 1999) and weed species *Chamaesych hirta, Dactyloctenium aegyptium, Eragrostis pilosa* and *Pileas* sp. (Peixoto *et al.* 2007). Some of these plants are distributed throughout Australia. However,

there have been no reports of infection of these hosts by *X. campestris* pv. *viticola* under natural conditions in the field.

- The bacterium can be transmitted by rain splash or wind driven rain. Outbreaks of the disease are correlated with frequent rains and cyclonic rains and hail storms (Chand *et al.* 1999). While rains with strong wind sometimes occur in parts of Australia, the transmission by rain splash and wind-blown droplets is still limited to a short distance for fruit waste on the ground.
- *Xanthomonas campestris* pv. *viticola* can be present in seeds of grape bunches from infected vines (Tostes *et al.* 2014). It is estimated that the majority of table grapes exported from India would be seedless, but some would be seeded.
- The proportion of grapevine seed that germinates depends on the cultivar, seed maturity, storage, stratification and planting conditions (Doijode 2001). Most grapevine seed is dormant and will not germinate unless it has been stratified. Night-time temperatures below 6 degrees Celsius during winter may be sufficient for stratification (Ellis *et al.* 1985; Doijode 2001). Seed of some cultivars will not germinate without stratification, other cultivars have very low germination rates when not stratified, but germination rates of up to 33 per cent from seed from fresh untreated berries of some cultivars has been reported (Scott and Ink 1950; Singh 1961; Forlani and Coppola 1977).
- Cold storage of imported table grapes during transport may stratify the seed and improve germination rates. Night-time temperatures in most temperate regions of Australia (Bureau of Meteorology 2010) may be low enough for stratification of grape seeds to occur naturally.
- A small proportion of grapevine seed from fruit waste may germinate. Successful germination will depend on local conditions. Many localities will not be suitable for grape seed germination.
- Grapevines are normally cultivated vegetatively, being propagated from cuttings by grafting onto rootstock or, less commonly, on their own roots (Zohary 1996). Seed is not used to establish vineyards because vines propagated from seed are likely to produce inferior berries; they are unlikely to be true to type after genetic segregation (Zohary 1996). This aspect of grapevine propagation is likely to deter members of the public from growing grapevines from seed from imported fruit, as will the relatively long time taken to grow a productive vine from seed (Olmo 1976) and the ready availability of grafted vines.
- Although *X. campestris* pv. *viticola* can be present in grapevine seeds (Tostes *et al.* 2014), seed to seedling transmission has not yet been demonstrated. A probability of seed transmission of 0.014 was reported for a related bacterium, *X. campestris* pv. *campestris* (Roberts *et al.* 1999).
- To date, there have been no vectors identified for this bacterium.

The potential presence of the bacterium in seeds, moderated by the limited potential for dispersal of the bacterium via rain splash or wind-blown droplets from infected fruit waste on the ground to a susceptible part of a host which appears to be limited to grapevines, the small chance that grapevine seed will germinate and the lack of confirmed seed to seedling transmission of this bacterium support a likelihood estimate for distribution of 'very low'.

Overall likelihood of entry

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

The likelihood that *X. campestris* pv. *viticola* will enter Australia as a result of trade in table grapes from India and be distributed in a viable state to a susceptible host is: **Very low.**

4.10.2 Likelihood of establishment

The likelihood that *X. campestris* pv. *viticola* will establish within Australia based on a comparison of factors in the source and destination areas that affect pest survival and reproduction, is: **Moderate.**

The following information provides supporting evidence for this assessment.

- Grapevines (*Vitis* spp.), the known host of *X. campestris* pv. *viticola*, are widely grown commercially and domestically across all states and territories of Australia.
- The pathogen can infect various tissues of grapevine, including leaves, grape bunches (rachises, pedicels, berries), canes (Chand *et al.* 1999; Nascimento and Mariano 2004; Trindade *et al.* 2007) and seeds (Tostes *et al.* 2014).
- The bacterium has also been detected on and in seeds, with and without symptoms, of asymptomatic berries collected from vineyards effected with GVBCD (Tostes *et al.* 2014). It is unlikely that asymptomatic infected hosts will be infected and destroyed.
- Peixoto (2007) reported that bacteria similar to *X. campestris* pv. *viticola* were isolated from the weeds *Alternanthera tenella, Amaranthus* sp., *Glycine* sp., and *Senna obtusifolia*. Artificial inoculation studies suggested that other plant species have potential to be alternative hosts of *X. campestris* pv. *viticola*, including *Phyllantus maderaspatensis, Azadirachta indica, Chamaesych hirta, Dactyloctenium aegyptium, Eragrostis pilosa, Mangifera indica* and *Phyllantus maderaspatensis* (Nayudu 1972; Chand *et al.* 1999; Peixoto *et al.* 2007; CABI 2012). Some of these plants are distributed throughout Australia. However, there have been no reports of infection of these hosts by *X. campestris* pv. *viticola* under natural conditions.
- Cultivars of *V. vinifera* are susceptible or highly susceptible to *X. campestris* pv. *viticola* (Chand *et al.* 1999). The spread of *X. campestris* pv. *viticola* occurs through infected propagative material, agricultural equipment such as pruning and harvesting equipment, through dew, irrigation, rain splash and wind blown droplets (Chand *et al.* 1999).
- Minimum inoculum dose required for successful infection in a field situation has not been determined for this pathogen. In artificial inoculations an inoculum concentration of 1012 CFU/ml was most effective to induce the disease with minimum incubation period of 15 days (Chand *et al.* 1999).
- Optimum conditions for disease development are temperatures between 20 and 30 degrees Celsius, humidity levels of around 80 per cent, rain and wind associated with rain (Jambenal 2008). These conditions are not common in the grape production regions of Australia.
- Currently *X. campestris* pv. *viticola* is known to be well established only in India and Brazil. Both India and Brazil have been exporting table grapes to a number of countries. There is no

information found with regards to specific conditions those importing countries require for *X. campestris* pv. *viticola* for table grapes from India or Brazil.

- The use of chemicals, including copper and antibiotics, was found not to be effective against *X. campestris* pv. *viticola*, especially in rainy weather (Chand *et al.* 1992; Jambenal 2008). The use of antibiotics to control plant diseases is currently not permitted in Australia. Copper-based chemicals are used in Australia but are unlikely to prevent the establishment of the disease.
- Presence of antagonistic organisms such as *Pseudomonas fluorescens* and *Bacillus subtilis* also give poor control on bunch infection in vivo (Jambenal 2008).
- GVBCD might establish in Australia from infected imported fruit if the infected seedlings survive.
- Few, if any, grapevine seedlings are likely to survive on agricultural land and in unmanaged localities in Australia. Seedling survival will depend on local conditions including rainfall.
- To date, there have been no vectors identified for this bacterium.

The ability of *X. campestris* pv. *viticola* to be transmitted from an infected volunteer grapevine by mechanical transmission, the high susceptibility of *Vitis vinifera* to this bacterium, asymptomatic plants are unlikely to be detected and destroyed, and the limited control measures available, moderated by the information that host of this bacterium is limited to grapevine, the likely limited climate conditions suitable for this bacterium in the grape production areas of Australia, the small chance that a volunteer grapevine seedling will survive and the lack of identified vector for this bacterium, support a likelihood estimate for establishment of 'moderate'.

4.10.3 Likelihood of spread

The likelihood that *X. campestris* pv. *viticola* will spread within Australia based on a comparison of factors in the source and destination areas that affect the expansion of the geographic distribution of the pest is: **Moderate**.

The following information provides supporting evidence for this assessment.

- Grapevines are grown commercially and domestically in all states and territories of Australia. Peixoto (2007) reported that bacteria similar to *X. campestris* pv. *Viticola* were isolated from the weeds *Alternanthera tenella, Amaranthus* sp., *Glycine* sp., and *Senna obtusifolia*. Artificial inoculation studies suggested that other plant species have potential to be alternative hosts of *X. campestris* pv. *viticola*, including *Azadirachta indica, Chamaesych hirta, Dactyloctenium aegyptium, Eragrostis pilosa, Mangifera indica* and *Phyllantus maderaspatensis* (Nayudu 1972; Chand *et al.* 1999; Peixoto *et al.* 2007; CABI 2012). Some of these plants are distributed throughout Australia. However, there have been no reports of infection of these hosts under natural conditions in the field.
- Epidemics of GVBCD in India are associated with rainfall coupled with wind, temperatures of between 20 and 30 degrees Celsius and humidity levels of around 80 per cent (Jambenal 2008). These conditions are not common in the grape production regions of Australia.
- Currently *X. campestris* pv. *viticola* is known to be well established only in India and Brazil. Both India and Brazil have been exporting table grapes to a number of countries. There is no

information found with regards to specific conditions those importing countries require for *X. campestris* pv. *viticola* for table grapes from India or Brazil.

- *Xanthomonas campestris* pv. *viticola* can be dispersed through infected propagative material, contaminated agricultural equipment such as containers, pruning shears and gloves, as well as rain splash and wind-blown droplets (Chand *et al.* 1999; Nascimento and Mariano 2004; Tostes *et al.* 2014).
- The long distance dispersal of *X. campestris* pv. *viticola* is more likely to be through the movement of infected grapevine planting material. The interstate movement of grapevine planting material is regulated in Australia (Plant Health Australia 2009b). Grapevine planting material certified as being free of pests and pathogens is available from accredited nurseries in Australia, as per the Vine Industry Nursery Accreditation Scheme (VINA 2008).
- It is possible that grapevine plants can be contaminated with *X. campestris* pv. *viticola* without showing symptoms (Tostes *et al.* 2014), which increases the potential for unintended spread of the bacterium.
- To date, there have been no vectors identified for this bacterium.

The ability of the bacterium to be dispersed through grapevine propagative materials and agricultural equipment and natural means, moderated by the limited natural dispersal of the bacterium, the information that host of this bacterium is limited to grapevine, the systems in place for the movement and certification of grapevine planting material in Australia, the likely limited climate conditions suitable for the development of GVBCD in the grape production areas of Australia, the lack of identified vector for this bacterium and the fact that the spread of the bacterium has so far been limited to India and Brazil support a likelihood estimate for spread of 'moderate'.

4.10.4 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 *X. campestris* pv. *viticola* will enter Australia as a result of trade in table grapes from India, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **Very low**.

4.10.5 Consequences

The potential consequences of the establishment of *X. campestris* pv. *viticola* in Australia have been estimated according to the methods described in Table 2.3.

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

Criterion	Estimate and rationale
Direct	
Plant life or health	**Impact score**: D—Significant at the district level. In India, *X. campestris* pv. *viticola* is a pest of major economic significance throughout the major grape growing provinces of Maharashtra, Karnataka, Andhra Pradesh, and Tamil Nadu (Chand *et al.* 1999; Jambenal 2008). There are reports of this disease causing yield losses of between 60 and 80 per cent in these regions in September pruned vineyards (Chand *et al.* 1991; Chand *et al.* 1999; Jambenal 2008). In Brazil, the disease is considered the most important bacterial disease in the major grape growing region of São Francisco, causing yield losses to eight varieties of grapes that are commonly grown (Nascimento and Mariano 2004; Nascimento *et al.* 2006; Trindade *et al.* 2007). The incidence of 100 per cent disease symptoms and nearly total yield loss in some cases was reported (Lima *et al.* 1999). The natural host range of *X. campestris* pv. *viticola* appears to be limited to grapevine. Grapevine are grown commercially in all Australian states and territories for wine industry, table grapes, and dried grapes (ABS 2012a). In 2010–11, 1 597 669 tonnes of grapes produced in Australia were used for wine making (ABS 2012a). In 2007–8 the value of the Australian wine produced was $4.77 billion (ABS 2009b). In 2013, the annual production of table grapes in Australia was about 120 000 tonnes with a farm gate value of $330 million and Australia exported more than 70 000 tonnes to 52 countries earning about $200 million (Australian Table Grape Association 2013). In 2010–11, approximately 11831 tonnes of grapes were used for drying (ABS 2012a). The bacterium is currently recorded in only two countries, India and Brazil. In India, even though the bacterium was found on grape leaves in Punjab, no economic damage was reported in this state. The extent of damage this bacterium may cause, if established, in Australia is uncertain. Optimum conditions for disease development are temperatures between 20 and 30 °C, humidity levels of around 80 per cent, rain and wind associated with rain (Jambenal 2008). These conditions are not common in the grape production regions of Australia. However, it is expected that the bacterium, if established, may cause significant damage to grapevine grown in some localised areas which have climate conditions suitable for GVBCD development.
Other aspects of the environment	**Impact score:** A—Indiscernible at the local level. There are currently no known direct consequences of this bacterium on other aspects of the natural environment.
Indirect	
Eradication, control	**Impact score:** D—Significant at the district level. The use of bactericides alone are not an effective control option and widespread control is mainly achieved through an integrated management system (Chand *et al.* 1992; Nascimento *et al.* 2006). The integrated management system involves using healthy propagative material, field inspection, chemical sprays, drastic pruning on infected plants, management of the time of production pruning, disinfection of agricultural equipment and vehicles, windbreaks to reduce pathogen dissemination and curbing the excess use of water (Nascimento and Mariano 2004; Nascimento *et al.* 2006; Trindade *et al.* 2007; Jambenal 2008). The integrated management system would incur significant management costs to the grape industry in areas which are suitable for disease development. The recent finding that the pathogen spreads systemically within the plants (Tostes *et al.* 2014) will require research investment on systemic control of the disease. While antibiotics are used in India to control GVBCD, antibiotics are currently not registered for use to control plant diseases in Australia. Eradication attempt on an outbreak in one property in the State of São Paulo in Brazil in 2009 resulted in the destruction of 4700 plants (Rodrigues Neto *et al.* 2011).
Domestic trade	**Impact score**: D—Significant at the district level. The presence of *X. campestris* pv. *viticola* in commercial production areas is likely to result in interstate trade restrictions on table grapes, potential loss of markets and significant industry adjustment at the district level.

Criterion	Estimate and rationale
International trade	**Impact score:** D—Significant at the district level. At present, *X. campestris* pv. *viticola* is only recorded in India and Brazil (Trindade *et al.* 2007; CABI 2012). The European Union and the United States do not require measures specific to this bacterium for table grapes imported from India or Brazil. The presence of this pathogen in commercial production areas of table grapes in Australia could potentially limit access to some overseas markets that are free of this pathogen
Environmental and non-commercial	**Impact score:** B—Minor significance at the local level. Any additional usage of pesticide sprays may affect the environment. Streptomycin or any other antibiotic sprays are not currently registered for the control of plant pests in Australia. It is possible that the use of antibiotics could be permitted for emergency use under strict controls in an eradication programme. Registration for more widespread use of antibiotics to control plant pests would require the evaluation of the environmental impact. Significant issues that would need to be considered include the potential that resistance to antibiotics may develop and the potential for residues in other products such as honey. Streptomycin resistance of *X. campestris* pv. *viticola* has been reported (Chand *et al.* 1994; Reddy 2011). Copper sprays are already in use in Australia to control a range of plant pests.

4.10.6 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 *Xanthomonas campestris* pv. *viticola*	
Overall likelihood of entry, establishment and spread	Very low
Consequences	Low
Unrestricted risk	Negligible

As indicated, the unrestricted risk estimate for *Xanthomonas campestris* pv. *viticola* has been assessed as ‘negligible’ which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.11 Bitter rot

Greeneria uvicola (EP, WA)

Bitter rot of grapevine is caused by the fungus *Greeneria uvicola*. The disease occurs on many *Vitis* spp. including *Vitis vinifera, V. labrusca, V. aestivalis, V. bourquina, V. rotundifolia* and *V. munsoniana* (Ridings and Clayton 1970; Farr *et al.* 2001; Longland and Sutton 2008) under warm and humid conditions (McGrew 1988; Farr *et al.* 2001). Bitter rot disease is, however, more severe on muscadine grapes (*V. rotundifolia*) (McGrew 1988). Under experimental conditions, the fungus has also been shown to infect wounded fruit of apple, cherry, strawberry, peach, blueberry and banana causing fruit rot (Ridings and Clayton 1970). However, *G. uvicola* is not known to cause problems on horticultural crops other than grapes.

In Australia, *G. uvicola* is known to be present in New South Wales (NSW) and Queensland (Qld) (Castillo-Pando *et al.* 1999; Castillo-Pando *et al.* 2001; Sergeeva *et al.* 2001; Plant Health Australia 2001b) but has not been recorded in Western Australia (DAWA 2006a; Taylor 2012) and is a pest of quarantine concern for that state.

The fungus can infect young shoots, leaves, tendrils, peduncle, rachis, pedicels and fruit of grapevine (Kummuang *et al.* 1996b; Ellis 2008). It has also been isolated from dormant canes, wood and bark (Castillo-Pando *et al.* 2001; Emmett 2006). *Greeneria uvicola* has been reported to cause girdling of shoots, flecking of young leaves, stems, shoots and individual flower buds (McGrew 1988; Tashiro 1992; Kummuang *et al.* 1996b; Momol *et al.* 2007).

Although *G. uvicola* can infect many different tissues of grapevine, the disease mainly damages fruit, particularly if rainy weather persists into the harvest season (Farr *et al.* 2001).

There are mixed reports on at what developmental stage berries are susceptible to infection. The incidence of bitter rot disease for muscadine grapes (*V. rotundifolia*) on non-sprayed vines was reported to be more severe on young berries and decreased drastically thereafter (Kummuang *et al.* 1996b). The authors stated that bitter rot symptoms had already been observed on some flower buds. Steel *et al.* (2012) reported on their inoculation study that inflorescences of Chardonnay grapes (*V. vinifera*) were also susceptible to infection by *G. uvicola*, and infection of inflorescences at mid-flowering led to berry rot at veraison. There are also reports to suggest that grapes of several *V. vinifera* cultivars become more susceptible to infection after veraison (Steel 2007; Steel *et al.* 2007). In inoculation studies conducted over two years using three *V. vinifera* cultivars, it was reported that the susceptibility of grapes increased from bloom until veraison in one year, and from bloom until two weeks before veraison in the other year (Longland and Sutton 2008).

Reports on the timing of first symptoms on berries also vary. For muscadine grapes on non-sprayed field-grown vines, the development of symptoms varies between different muscadine cultivars and vineyard locations, but disease symptoms were most prevalent on all cultivars at the young berry stage (Kummuang *et al.* 1996b). The authors also reported that *G. uvicola* was isolated from symptomless berries, especially those late in the growing season (Kummuang *et al.* 1996b). McGrew (1988) and Momol *et al.* (2007) reported that greenish brown lesions can be found on young muscadine berries as well as blight of pedicels, which causes the young berries to shrivel and break off. However, these same authors also stated, but did not mention on what type of grapes, that *G. uvicola* invades corky lenticular warts which form on the pedicel in the spring (shortly after flowering) but remains latent until the berry reaches maturity. The fungus then invades the pedicel and moves into the berry, where conidia are produced within four days (McGrew 1988; Momol *et al.* 2007). It is unknown if these reports (McGrew 1988; Momol *et al.* 2007) were based on field (vineyard) observation or results of inoculation studies. Longland and Sutton (2008) reported on their inoculation studies, where grapes were inoculated from bloom until two weeks before harvest, that symptoms were not observed until just before harvest.

Greeneria uvicola overwinters on mummified berries, damaged shoot tips, infected senescent and fallen leaves, and necrotic bark (Kummuang *et al.* 1996a; Farr *et al.* 2001; Momol *et al.* 2007; Smith 2012). The optimum temperature for infection is reported to be around 28–30 degrees Celsius (Ridings and Clayton 1970; Sutton and Gibson 1977; McGrew 1988; Momol *et al.* 2007; Taylor 2012). Even though one author stated that transmission of the fungus is via air-borne conidia (Sutton and Gibson 1977), most authors agree that conidia of *G. uvicola* are spread by rain splash (Kummuang *et al.* 1996a; MAFF 2008; Ellis 2008; Smith 2012).

The risk scenario of concern for *G. uvicola* is that symptomless infected grape bunches may be imported into Western Australia.

Greeneria uvicola was included in the existing import policy for table grapes from Japan (Department of Agriculture 2014). The assessment of *G. uvicola* presented here builds on this existing policy.

Differences in horticultural practices, climatic conditions and the prevalence of the pest between previously assessed export area (Japan) and India make it necessary to reassess the likelihood that *G. uvicola* will be imported into Western Australia with table grapes from India.

Due to the differences in the main import window and the expected import volume between table grapes from Japan and table grapes from India, the likelihood of distribution of *G. uvicola* after arrival in Western Australia with table grapes from India is reassessed here.

The likelihood of establishment and of spread of *G. uvicola* in Western Australia will be comparable regardless of the fresh fruit commodity in which this species is imported into Western Australia, as these likelihoods relate specifically to events that occur in Western Australia and are independent of the importation pathway. The consequences of *G. uvicola* 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 establishment, spread and consequences as set out for *G. uvicola* in the existing policy. 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. uvicola* will arrive in Western Australia with the importation of table grapes from India is: **High**.

The following information provides supporting evidence for this assessment.

- *Greeneria uvicola* has been recorded in Andhra Pradesh, Bihar (Reddy and Reddy 1983) and Karnataka (Ullasa and Rawal 1986). Andhra Pradesh and Karnataka are commercial grape production areas expected to export grapes to Australia (DPP 2009).
- *Greeneria uvicola* infects grape clusters (McGrew 1988). On young berries, symptoms first develop as brown lesions (Milholland 1991) or flecks (Kummuang *et al.* 1996b). Severe infection can cause blight on young berries and pedicels which causes young berries to shrivel and drop (McGrew 1988; Kummuang *et al.* 1996b; Momol *et al.* 2007).
- On maturing berries, the fungus causes brownish, water-soaked lesions, with concentric rings of spore bodies, which rapidly spread and eventually cover the entire berry (Momol *et al.* 2007; Ellis 2008; Taylor 2012). Black, raised acervuli form on the decaying fruit which can cause the epidermis and cuticle to rupture (McGrew 1988; Momol *et al.* 2007). Some infected berries soften and detach easily from the bunch, particularly in wet weather, whilst others continue to dry and shrivel (Ullasa and Rawal 1986; McGrew 1988; Momol *et al.* 2007; Taylor 2012). Grape bunches with several berries missing, or with several shrivelled berries, are likely to be discarded at harvesting or packing processes.
- Symptoms of infection are easily recognised on the berries and are reported to develop on healthy berries one week after contact with fungal spores and in less time on damaged fruit (Castillo-Pando *et al.* 1999; Ellis 2008). However, one study which pinned bitter-rotted berries onto healthy bunches did not result in infection of adjacent non-wounded berries (Ridings and Clayton 1970). Infected grape berries/bunches showing obvious symptoms are likely to be removed from the export pathway during harvesting or packing processes. It has also been reported that grapes inoculated with *G. uvicola* from bloom to two weeks before harvest did not show symptoms until just close to harvest (Longland and Sutton 2008). Some authors report that *G. uvicola* invades pedicels of grapes in the spring (shortly after flowering) but remains latent until the berry reaches maturity (McGrew 1988; Momol *et al.* 2007). The fungus then invades the berries, where conidia are produced within four days (McGrew 1988). Kummuang *et al.* (1996b) also reported that *G. uvicola* was isolated from symptomless berries, especially those late in the growing season. Infected grape bunches without or with only mild symptoms at harvest may escape detection and be picked and packed for export.
- The fungus can invade any injured tissue of *Vitis* spp. plants (McGrew 1988). Injury to mature, healthy berries due to bird and insect damage or cracking of berries due to rain can allow conidial infection and lead to rapid spread of the disease (McGrew 1988; Momol *et al.* 2007). Damaged grape berries/bunches are likely to be removed from the export pathway during harvesting or packing processes.
- The varieties known to be naturally infected in India are Anab-e-Shahi, Angur Kalan, Black Champa, Gulabi, Jaos Beli, Kali Sahabi, Khandari, Pandri Sahebi, Selection 94, Thompson Seedless and Taifi Rosovi (Reddy and Reddy 1983). Some of these varieties are likely to be exported to Australia (DPP 2007; DPP 2009).

- Measures used to control *G. uvicola* in India include pruning of infected canes (NHB 2011).
- Bitter rot symptoms develop quickly on mature berries. It could be expected that any berries with latent infection that were picked and packed for export via sea freight would show symptoms by the time they arrive in Western Australia. Grape bunches showing symptoms would be detected during routine inspection on arrival. However, grapes are usually stored at low temperatures to prolong shelf life. Information on the time required for symptoms to develop under cold storage conditions could not be found, but it is likely that symptoms will develop more slowly under low temperatures. Grapes via air freight may show no or mild symptoms at the time they arrive in Western Australia. Grape bunches without symptoms, or with only minor symptoms, may not be detected at routine inspection on arrival.

The possibility for some late infected berries to show no or mild symptoms and the uncertainty about the development of symptoms at low temperatures support a likelihood estimate for importation of 'high'.

Likelihood of distribution

The likelihood that *G. uvicola* will be distributed within Western Australia in a viable state as a result of the processing, sale or disposal of table grapes from India and subsequently transfer to a susceptible part of a host is: **Low**.

The following information provides supporting evidence for this assessment.

- Imported grapes are intended for human consumption. Distribution of the imported grapes would be for retail sale.
- As grapes are easily damaged during handling (Mencarelli *et al.* 2005), packed grapes may not be processed or handled again until they arrive at the retailers. Therefore, pathogens in packed grapes are unlikely to be detected during transportation and distribution to retailers.
- Bitter rot symptoms develop quickly on mature berries. It could be expected that infected berries would show symptoms by the time they arrive at the retailers. Grape bunches with obvious symptoms of infection would not be marketable and would not be sold. However, if grapes are transported at low temperatures, symptoms may develop more slowly. Grape bunches without symptoms, or with only minor symptoms, could be marketable and could be sold.
- Most fruit waste will be discarded into managed waste systems and will be disposed of in municipal tips and would therefore pose little risk of exposure to a suitable host.
- Consumers will discard small quantities of fruit waste in urban, rural and natural localities. Small amounts of fruit waste will be discarded in domestic compost. There is some potential for consumer waste being discarded near host plants, including commercially grown, household or wild host plants. If present in fruit waste, the pathogen would then need to be transferred to a susceptible host.
- The primary host of *G. uvicola* is *Vitis rotundifolia*, but other *Vitis* spp. are also susceptible including *V. vinifera, V. bourquina, V. labrusca* and *V. munsoniana* (Ridings and Clayton 1970; Farr *et al.* 2001; Longland and Sutton 2008). No other natural hosts are known. While it was reported more than 40 years ago that, under experimental conditions, *G. uvicola* can infect

wounded fruit of apple, cherry, strawberry, peach, blueberry and banana (Ridings and Clayton 1970), there have been no reports found on natural infection on these plant species.

- In Western Australia, *Vitis* spp. are grown commercially and are also common garden plants (Kiri-ganai Research Pty Ltd 2006; ABS 2009a; Waldecks 2013; ATGA 2013).
- Commercial table grape vineyards in Western Australia are located near the Western Australian coast, extending from the Gascoyne region (including Carnarvon) to the South-West region (including Harvey, Donnybrook, Margaret River and Busselton) (DAWA 2006b). The main wine grape production spans from Gingin just north of Perth, extending through the south-west and across to the Porongurup Range near Mount Baker (DAFWA 2006).
- Even though one author reports that transmission of the fungus is via air-borne conidia (Sutton and Gibson 1977), most authors agree that conidia of *G. uvicola* are spread by rain splash (Kummuang *et al.* 1996a; MAFF 2008; Ellis 2008; Smith 2012). In wet conditions, conidia present on the surface of infected grape bunches could be transmitted via rain splash and wind-driven rain to susceptible nearby host plants.
- The fungus can infect young shoots, leaves, tendrils, peduncle, rachis, pedicels and fruit of grapevine (Kummuang *et al.* 1996b; Ellis 2008). It has also been isolated from dormant canes, wood and bark (Castillo-Pando *et al.* 2001; Emmett 2006). The fungus can invade any injured tissue of *Vitis* spp. plants (McGrew 1988).
- The main export season for table grapes from India to Australia will be from February to the end of April (DAFF 2010; DPP 2012) (the end of summer to mid autumn in Australia). However small volumes of table grapes may come in at other times of the year. Grapevines in Western Australia would be susceptible to infection during the expected export window. Other hosts of the assessed fungi may also be susceptible to infection during the expected export window.

The host susceptibility during the expected export window, moderated by the limited range of potential conidia dispersal via rain splash and the limited host range support a likelihood estimate for distribution of 'low'.

Overall likelihood of entry

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

The likelihood that *G. uvicola* will enter Western Australia as a result of trade in table grapes from India and be distributed in a viable state to a susceptible host is: **Low.**

4.11.2 Likelihood of establishment and spread

As indicated, the likelihood of establishment and of spread for *G. uvicola* is being based on the assessment for table grapes from Japan (Department of Agriculture 2014). The ratings from the previous assessment are:

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

4.11.3 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 *G. uvicola* will enter Western Australia as a result of trade in table grapes from India, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **Very low**.

4.11.4 Consequences

As indicated, consequences of *G. uvicola* in Western Australia assessed here are based on the previous assessment for *G. uvicola* for table grapes from Japan (Department of Agriculture 2014), that is: **Low**.

4.11.5 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 *Greeneria uvicola*	
Overall likelihood of entry, establishment and spread	Very low
Consequences	Low
Unrestricted risk	Negligible

As indicated, the unrestricted risk estimate for *Greeneria uvicola* has been assessed as ‘negligible’, which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.12 Black rot

Guignardia bidwellii (EP)

Guidnardia bidwellii was included in the final import policy for table grapes from China (Biosecurity Australia 2011a) and from Japan (Department of Agriculture 2014). In these existing policies, the unrestricted risk estimate for *G. bidwellii* was assessed as exceeding Australia's ALOP and therefore specific risk management measures are required for this pest.

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

Guidnardia bidwellii has a wide host range and the likelihood of distribution for this pest for table grapes from India would be comparable to that for table grapes from the previous export areas. Accordingly, there is no need to reassess this component.

The Australian Department of Agriculture considered factors affecting the likelihood of importation for *G. bidwellii* for table grapes from India and those previously assessed. The department considers that the likelihood of importation for *G. bidwellii* for table grapes from India would be comparable to that in the previous assessments. Due to this reason, it is considered that there is no need to reassess this component for this species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for *G. bidwellii* in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for *G. bidwellii* for table grapes from India exceeds Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.13 Brown rot

Monilinia fructigena **(EP)**

Monilinia fructigena was included in several existing import policies, for example in the policies for apples from China (Biosecurity Australia 2010), for table grapes from China (Biosecurity Australia 2011a) and for table grapes from Japan (Department of Agriculture 2014). In these existing policies, the unrestricted risk estimate for *M. fructigena* was assessed as exceeding Australia's ALOP and therefore specific risk management measures are required for this pest.

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

Monilinia fructigena has a wide host range and the likelihood of distribution for this pest for table grapes from India would be comparable to that for table grapes from the previous export areas. Accordingly, there is no need to reassess this component.

The Australian Government Department of Agriculture considered factors affecting the likelihood of importation for *M. fructigena* for table grapes from India and those previously assessed. The department considers that the likelihood of importation for *M. fructigena* for table grapes from India would be comparable to that in the previous assessments. Due to this reason, it is considered that there is no need to reassess this component for this species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for *M. fructigena* in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for *M. fructigena* for table grapes from India exceeds Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.14 Fruit rot

Pestalotiopsis menezesiana (EP, WA), *Pestalotiopsis uvicola* (EP, WA)

Pestalotiopsis menezesiana and *Pestalotiopsis uvicola* are plant pathogenic fungi that cause fruit rot of grapevine (Mishra *et al.* 1974; Xu *et al.* 1999).

Pestalotiopsis menezesiana and *P. uvicola* are assessed together as the two species cause a similar disease and their biology is likely to be the same or very similar; and they are predicted to cause a similar risk and would be managed by similar mitigation measures if required. Unless explicitly stated, the information presented is considered as applicable to both species. In this section, the common name fruit rot is used to refer to both species. The scientific name is used when the information is about a specific species.

Pestalotiopsis menezesiana and *P. uvicola* are not known to be present in Western Australia and are pests of quarantine concern for that state. In Australia, *P. menezesiana* is known to be present in NSW (Plant Health Australia 2001a; Sergeeva *et al.* 2005a) and *P. uvicola* in NSW and Qld (Plant Health Australia 2001a).

On *Vitis* spp., both assessed fungi have mainly been reported on *Vitis vinifera* (Guba 1961; Kobayashi 2007). *Pestalotiopsis uvicola* has also been reported on *V. coignetia*, *V. indivisa* and *V. labrusca* (Guba 1961; Kobayashi 2007; Farr and Rossman 2013b). Both fungi have been reported on leaves, canes and fruit of *Vitis* spp. (Mundkur and Thirumalachar 1946; Guba 1961; Mishra *et al.* 1974; Bissett 1982; Nag Raj 1993; Sergeeva *et al.* 2005a; MAFF 2008). *Pestalotiopsis uvicola* has also been isolated from flowers, cankers and internal wood rot of grapevine, and has been associated with grapevine trunk disease (Sergeeva *et al.* 2005a; Úrbez-Torres *et al.* 2009; Úrbez-Torres *et al.* 2012).

In addition to *Vitis* spp., *P. menezesiana* has also been reported to cause leaf spot of kiwifruit (*Actinidia chinensis*) and plantain (*Musa paradisiaca*), and rot of cuttings of grape ivy (*Cissus rhombifolia*) (Bissett 1982; Park *et al.* 1997; Huang *et al.* 2007). *Pestalotiopsis uvicola* has been reported to cause leaf spot and stem blight of bay laurel (*Laurus nobilis*), stem blight of Kermandac pohutukawa (*Metrosideros kermadecensis*) and leaf spot of mango (*Mangifera indica*) and carob (*Ceratonia siliqua*) (Vitale and Polizzi 2005; Grasso and Granata 2008; Ismail *et al.* 2013; Carrieri *et al.* 2013).

Pestalotiopsis menezesiana, like many other species of *Pestalotiopsis*, has also been reported on dead or dying plant material (Guba 1961; Nag Raj 1993) and both assessed fungi have been isolated as endophytes on conifer trees in China (Liu *et al.* 2007; Liu *et al.* 2013).

Infection of *Pestalotiopsis spp*. can occur from a resting endophytic stage, mycelium, ascospores or conidium on healthy tissue (Maharachchikumbura *et al.* 2011). The infection develops into enlarging, circular to irregular lesions that contain either pycnidia or perithecia. Spores are then released to continue the infection (Maharachchikumbura *et al.* 2011). However, the sexual stage does not often develop and thus conidia (asexual spores) are thought to provide the inocula (Maharachchikumbura *et al.* 2011).

The risk scenario of concern for the assessed fungi is that symptomless infected grape bunches may be imported into Western Australia.

Pestalotiopsis menezesiana and *P. uvicola* were included in the existing import policy for table grapes from Japan (Department of Agriculture 2014). The assessment of *P. menezesiana* and *P. uvicola* presented here builds on this existing policy.

Differences in horticultural practices, climatic conditions and the prevalence of the pests between previously assessed export area (Japan) and India make it necessary to reassess the likelihood that *P. menezesiana* and/or *P. uvicola* will be imported into Western Australia with table grapes from India.

Differences in the main import window and the expected import volume between table grapes from Japan and table grapes from India make it necessary to reassess the likelihood of distribution of *P. menezesiana* and *P. uvicola* after arrival in Western Australia.

The likelihood of establishment and of spread of *P. menezesiana* and *P. uvicola* in Western Australia will be comparable regardless of the fresh fruit commodity in which these species are imported into Western Australia, as these likelihoods relate specifically to events that occur in Western Australia and are independent of the importation pathway. The consequences of *P. menezesiana* and *P. uvicola* 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 establishment, spread and consequences as set out for *P. menezesiana* and *P. uvicola* in the existing policy. Therefore, those likelihood 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 *P. menezesiana* and/or P. uvicola will arrive in Western Australia with the importation of table grapes from India is: **Moderate**.

The following information provides supporting evidence for this assessment.

- *Pestalotiopsis menezesiana* and *P. uvicola* are reported present on grapevine in India (Farr and Rossman 2015). *Pestalotiopsis menezesiana* has been reported present on grape berries in Bihar in 1970 (Mishra *et al.* 1974). *Pestalotiopsis uvicola* has been reported on *Acacia* from Kerala (Mohanan *et al.* 2005). Neither of these states are major table grape producing states (DPP 2007; DPP 2012; APEDA 2015). However, Bihar neighbours with Uttar Pradesh and Kerala neighbours with Tamil Nadu, both of which have commercial grape growing areas (DPP 2012).
- On grapevine, grape bunches are among tissues which can be infected by the assessed fungi (Mishra *et al.* 1974; Bissett 1982; Xu *et al.* 1999; MAFF 2008).
- When grape berries of different maturity stages were punctured and inoculated with P. *menezesiana*, the rates of infection were: 20.0 per cent for raw berries, 93.3 per cent for semi-ripe berries and 55.3 per cent for fully ripe berries (Mishra *et al.* 1974). Symptoms of

infection develop more quickly on mature berries. Rot symptoms were visible after four days for ripe berries and after nine days for semi-ripe berries (Mishra *et al.* 1974).

- Infection also occurred on uninjured berries inoculated with the assessed fungi (Mishra *et al.* 1974; Xu *et al.* 1999), but at lower infection rates compared to injured berries (Mishra *et al.* 1974). Inoculation onto healthy uninjured berries caused rot after four days at 25 degrees Celsius for *P. menezesiana* and after two weeks at the same temperature for *P. uvicola* (Xu *et al.* 1999), suggesting that the pathogenicity of *P. uvicola* on grape berries might be weaker than that of *P. menezesiana*.
- Inoculation studies with injured grape berries indicate that colony formation/growth of the assessed fungi and decay of berries seems to be highest at the temperature range of 20-30 degrees Celsius (Xu *et al.* 1999).
- Symptoms on grape clusters are obvious. In India, symptoms of *P. menezesiana* first appear near the peduncle when the fruit is about to ripen and cover the upper portion of the fruit within two days (Mishra *et al.* 1974). The lesions first appear water-soaked and then turn Sienna colour (yellow brown or reddish brown) with numerous acervuli (Mishra *et al.* 1974). Lesions are irregular and the acervuli are raised in severe cases (Mishra *et al.* 1974). The skin of the berry becomes brownish-black and leathery, and bunches become completely unmarketable (Mishra *et al.* 1974).
- Diseased grape clusters showing obvious symptoms are likely to be removed from the export pathway during harvesting and/or packing processes.
- In Japan, the assessed fungi have been isolated from healthy tissue of both mature and immature grape bunches in the vineyard and were also detected on damaged fruit in markets (Xu *et al.* 1999). Although the authors suggested that these fungi could potentially cause latent infection and a post-harvest disease of grapes (Xu *et al.* 1999) they did not report if latent infection still occurs at harvest or investigate the condition at harvest of the damaged fruit in markets where the assessed fungi were isolated from.
- As symptoms of the assessed fungi develop quickly on mature berries, it could be expected that any infected berries that were picked and packed for export via sea freight would show symptoms by the time they arrive in Western Australia. Grape bunches showing symptoms would be detected during routine inspection on arrival.
- However, grapes are usually stored and transported at low temperatures to prolong shelf life. Detailed information on the time for symptoms to develop under cold storage conditions could not be found, but the study by Xu *et al.* (1999) indicates that symptoms develop more slowly at low temperatures. Grape bunches without symptoms, or with only minor symptoms, may not be detected at routine inspection on arrival.

The possibility that the assessed fungi could be present on grape bunches without symptoms, or with only minor symptoms, at harvest, moderated by the fact that symptoms of the assessed fungi develop quickly on mature berries and that grape bunches showing obvious symptoms are likely to be removed from the export pathway, support a likelihood estimate for importation of 'moderate'.

Likelihood of distribution

The likelihood that *P. menezesiana* and/or *P. uvicola* will be distributed within Western Australia in a viable state as a result of the processing, sale or disposal of table grapes from India and subsequently transfer to a susceptible part of a host is: **Low**.

The following information provides supporting evidence for this assessment.

- Imported grapes are intended for human consumption. Distribution of the imported grapes would be for retail sale.
- As grapes are easily damaged during handling (Mencarelli *et al.* 2005), packed grapes may not be processed or handled again until they arrive at the retailers. Therefore, pathogens in packed grapes are unlikely to be detected during transportation and distribution to retailers.
- It could be expected that infected berries would show symptoms by the time they arrive at the retailers. Grape bunches with obvious symptoms of infection would not be marketable and would not be sold. If grapes are transported at low temperatures, symptoms may develop more slowly. Grape bunches without symptoms, or with only minor symptoms, could be marketable and sold.
- Most fruit waste will be discarded into managed waste systems and will be disposed of in municipal tips and would therefore pose little risk of exposure to a suitable host.
- Consumers will discard small quantities of fruit waste in urban, rural and natural localities. Small amounts of fruit waste will be discarded in domestic compost. There is some potential for consumer waste being discarded near host plants, including commercially grown, household or wild host plants. If present in fruit waste, the assessed fungi would then need to be transferred to a susceptible host.
- *Pestalotiopsis menezesiana* and *P. uvicola* reproduce through conidia (Guba 1961; Bissett 1982). Conidia are produced at 13–28 degrees Celsius, with the most conidia produced at 22 degrees Celsius (Huang *et al.* 2007). Similar to other Coelomycetes with appendage bearing conidia, conidia of the genus *Pestalotiopsis* are dispersed by rain splash or wind blown droplets (Nag Raj 1993; MAFF 2008; Maharachchikumbura *et al.* 2011).
- If present in fruit waste, the conidia would then need to be transferred from the fruit waste in water droplets to susceptible host tissue. This transmission is limited to a short distance for fruit waste on the ground.
- For both fungi, germination of conidia occurred at 10–33 degrees Celsius and no germination was observed at 35 degrees Celsius or higher (Xu *et al.* 1999). Optimum temperature for germination of conidia was 25 degrees Celsius for *P. menezesiana* and 23-25 degrees Celsius for *P. uvicola* (Xu *et al.* 1999).
- *Pestalotiopsis menezesiana* overwintered in diseased leaves of kiwifruit on the ground in Korea (Park *et al.* 1997).
- Members of the genus *Pestalotiopsis* are generally not very host specific (Maharachchikumbura *et al.* 2011). The known hosts of *P. menezesiana* include *Actinidia chinensis* (kiwifruit) (Park *et al.* 1997), *Cissus rhombifolia* (grape-ivy) (Bissett 1982), *Vitis vinifera* (grapevine) (Mishra *et al.* 1974; Xu *et al.* 1999) and *Musa paradisiaca* (plantain) (Huang *et al.* 2007). The known hosts of *P uvicola* include *Ceratonia siliqua*

(carob) (Carrieri *et al.* 2013), *Laurus nobilis* (bay laurel) (Vitale and Polizzi 2005), *Macademia integrifolia* (macademia nut), *Mangifera indica* (mango) (Ismail *et al.* 2013), Metrosideros kermadecensis (Kermandac pohutukawa) (Grasso and Granata 2008), *Vitis coignetia, V. indivisa*, *V. labrusca* and *V. vinifera* (Guba 1961; Xu *et al.* 1999; Kobayashi 2007; Farr and Rossman 2013b). A more comprehensive list of hosts is presented in Appendix B. Many of these hosts are grown in Western Australia, some of these are grown commercially such as grapevine, mango and kiwifruit.

- The main export season for table grapes from India to Australia will be from February to the end of April (DAFF 2010; DPP 2012) (the end of summer to mid autumn in Australia). However, small volumes of table grapes may come in at other times of the year. Grapevines in Western Australia would be susceptible to infection during the expected export window. Other hosts of the assessed fungi may also be susceptible to infection during the expected export window.
- In inoculation studies, *P. menezesiana* was able to form fungal colonies at temperatures as low as 5 degrees Celsius in four days (Xu *et al.* 1999). Cooling of grape bunches during transport and storage is unlikely to affect the viability of the assessed fungi.

The availability of host plants in Western Australia, moderated by the limited potential for dispersal of conidia via rain splash from fruit waste to a susceptible part of a host, the short time required for symptoms to develop on mature bunches and subsequent removal of such bunches from being sold, support a likelihood estimate for distribution of 'low'.

Overall likelihood of entry

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

The likelihood that *P. menezesiana* and/or *P. uvicola* will enter Western Australia as a result of trade in table grapes from India and be distributed in a viable state to a susceptible host is: **Low**.

4.14.2 Likelihood of establishment and spread

As indicated, the likelihood of establishment and spread for *P. menezesiana* and *P. uvicola* is being based on the assessment for table grapes from Japan (Department of Agriculture 2014). The ratings from the previous assessment are:

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 likelihoods of entry, of establishment and of spread using the matrix of rules shown in Table 2.2.

The overall likelihood that *P. menezesiana* and/or *P. uvicola* will enter Western Australia as a result of trade in table grapes from India, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **Low**.

4.14.4 Consequences

As indicated, consequences of *P. menezesiana* and *P. uvicola* in Western Australia assessed here are based on the previous assessment for *P. menezesiana* and *P. uvicola* for table grapes from Japan (Department of Agriculture 2014), that is: **Low**.

4.14.5 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 *Pestalotiopsis menezesiana* and *Pestalotiopsis uvicola*	
Overall likelihood of entry, establishment and spread	Low
Consequences	Low
Unrestricted risk	Very low

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

4.15 Grapevine leaf rust

Phakopsora euvitis **(EP)**

Phakopsora euvitis was included in the existing import policies for table grapes from China (Biosecurity Australia 2011a), Korea (Biosecurity Australia 2011b) and Japan (Department of Agriculture 2014). In these existing policies, the unrestricted risk estimate for *P. euvitis* was assessed as exceeding Australia's ALOP and therefore specific risk management measures are required for this pest.

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

Even though the main import windows differ between table grapes from the previous export areas and India, tissues susceptible to infection by *P. euvitis* will be available during the expected import window for table grapes from India as well as during the import windows for table grapes from the previous export areas. Therefore, the likelihood of distribution after arrival in Australia of *P. euvitis* will be comparable to that for table grapes from the previous export areas. Accordingly, there is no need to reassess this component.

The Australian Government Department of Agriculture considered factors affecting the likelihood of importation for *P. euvitis* for table grapes from India and those previously assessed. The department considers that the likelihood of importation for *P. euvitis* for table grapes from India would be comparable to that in the previous assessments. Due to this reason, it is considered that there is no need to reassess this component for this species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for *P. euvitis* in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for *P. euvitis* for table grapes from India exceeds Australia's ALOP. Therefore, specific risk management measures are required for this pest.

4.16 Phomopsis cane and leaf spot

Phomopsis viticola (EP, WA)

Phomopsis viticola was included in several existing import policies, for example for table grapes from Chile (Biosecurity Australia 2005), China (Biosecurity Australia 2011a), California to Western Australia (DAFF 2013) and Japan (Department of Agriculture 2014). In these existing policies, the unrestricted risk estimate for *P. euvitis* was assessed as achieving Australia's ALOP and therefore no specific risk management measures are required for this pest.

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

The likelihood of distribution was recently reassessed for table grapes from California to take account of new information available as well as the differences in the expected import window compared to that assessed previously. Similar to table grapes from California, the main import window for table grapes from India occurs during a period when Australian grapevines are considered less susceptible to infection and climatic conditions in most areas of Western Australia are warm and dry and not conducive to disease development. Therefore, the likelihood of distribution for *P. viticola* for table grapes from India will be comparable to that for table grapes from California to Western Australia. Accordingly, there is no need to reassess this component.

The Australian Government Department of Agriculture considered factors affecting the likelihood of importation for *P. viticola* for table grapes from India and those previously assessed. The department considers that the likelihood of importation for *P. viticola* for table grapes from India would be comparable or at least not higher than the highest rating in the previous assessments. Also, if the likelihood of importation is assessed as 'high' (the possible highest rating) for *P. viticola* for table grapes from India, the unrestricted risk estimate will still achieve Australia's ALOP. Due to this reason, it is considered that there is no need to reassess this component for this species for table grapes from India.

In addition, the department has also reviewed the latest literature and no new information is available that would significantly change the risk ratings for importation, distribution, establishment, spread and consequences as set out for *P. viticola* in the existing policies.

Similar to previous assessments, the unrestricted risk estimate for *P. viticola* for table grapes from India achieves Australia's ALOP. Therefore, no specific risk management measures are required for this pest.

4.17 White rot

Pilidiella castaneicola (EP, WA), *Pilidiella diplodiella* (EP, WA)

Pilidiella castaneicola (synonym *Coniella castaneicola*) and *Pilidiella diplodiella* (synonyms *Coniella diplodiella*, *Coniothyrium diplodiella*) are plant pathogenic fungi which cause white rot, also known as hail disease, of grapevine (Bisiach 1988; Yamato 1995; Kishi 1998).

Pilidiella castaneicola and *P. diplodiella* are assessed together as the two species cause the same disease and their biology is likely to be very similar, and they are predicted to pose a similar risk and would be managed by similar mitigation measures if required. Unless explicitly stated, the information presented is considered as applicable to both species. In this section, the common name white rot is used to refer to both species. The scientific name is used when the information is about a specific species.

Pilidiella castaneicola and *P. diplodiella* are not known to be present in Western Australia and are pests of quarantine concern for that state. *Pilidiella castaneicola* is known to be present on a number of hosts, but not on grapevine, in NSW, NT, Qld and Vic. (Plant Health Australia 2001a; Langrell *et al.* 2008). *Pilidiella diplodiella* is known to be present on grapevine in NSW and Qld (Simmonds 1966; Plant Health Australia 2001a). White rot of grapevine caused by *P. diplodiella* is rare in Australia and of little economic significance (Sergeeva 2010).

Pilidiella castaneicola and *P. diplodiella* affect peduncle, rachis, pedicel and berries of grapevine (Bisiach 1988; Yamato 1995; Kishi 1998). *Pilidiella diplodiella* is known to infect both young and mature grape berries (Lauber and Schuepp 1968). The assessed fungi are unable to infect intact grape berries directly (Bisiach 1988; Kishi 1998). Infection of intact berries occurs through the pedicel and progresses through the subepidermal layers of the berry (Locci and Quaroni 1972; Bisiach and Viterbo 1973). Peduncle, rachis and pedicel can be directly infected by the pathogens without wounding and symptoms progress down towards the berries (Locci and Quaroni 1972; Bisiach and Viterbo 1973; Kishi 1998). If conditions are favourable, the disease can also spread from an infected, injured berry through the pedicel to the rachis and lead to the decay of a major portion of the grape cluster (Lauber and Schuepp 1968; Bisiach and Viterbo 1973).

Pilidiella diplodiella is also known to cause cankers in nonlignified shoots of grapevine but it rarely infects leaves (Bisiach 1988).

The risk scenario of concern for *P. castaneicola* and/or *P. diplodiella* is that symptomless infected grape bunches may be imported into Western Australia.

Pilidiella castaneicola and *P diplodiella* were included in the existing import policy for table grapes from Japan (Department of Agriculture 2014). The assessment of *P. castaneicola* and *P. diplodiella* presented here builds on this existing policy.

Differences in horticultural practices, climatic conditions and the prevalence of the pests between previously assessed export area (Japan) and India make it necessary to reassess the likelihood that *P. castaneicola* and/or *P. diplodiella* will be imported into Western Australia with table grapes from India.

Due to the differences in the main import window and the expected import volume between table grapes from Japan and table grapes from India, the likelihood of distribution of *P. castaneicola* and *P. diplodiella* after arrival in Western Australia with table grapes from India is reassessed here.

The likelihood of establishment and of spread of *P. castaneicola* and *P. diplodiella* in Western Australia will be comparable regardless of the fresh fruit commodity in which these species are 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 *P. castaneicola* and *P. diplodiella* 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 establishment, spread and consequences as set out for *P. castaneicola* and *P. diplodiella* in the existing policy. 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 *P. castaneicola* and/or *P. diplodiella* will arrive in Western Australia with the importation of table grapes from India is: **Moderate.**

The following information provides supporting evidence for this assessment.

- *Pilidiella diplodiella* has been reported on *Vitis vinifera* and *Vitis* sp. in India (Farr and Rossman 2015) whereas *P. castaneicola* has only been reported on *Eucalyptus* sp. and *Quercus* sp. (Nag Raj 1993). However, in other countries, including Japan, *P. castaneicola* has also been reported on *Vitis* species (Nag Raj 1993; Yamato 1995; Kobayashi 2007).
- *Pilidiella castaneicola* has been reported present in Karnataka and Himachal Pradesh (Nag Raj 1993). *Pilidiella diplodiella* has been reported present in Bihar and Uttar Pradesh (CABI 2013). Karnataka is one of the major table grape producing states (DPP 2007; DPP 2012). Uttar Pradesh is also known to produce table grapes (DPP 2012).
- White rot of grapevine caused by *P. diplodiella* is common in areas that are prone to hailstorms (Bisiach 1988). In the absence of hailstorms, summer rain followed by persistent high humidity combined with temperatures of 24–27 degrees Celsius can also lead to disease outbreaks (Bisiach 1988). These climatic conditions are expected to be available in some of the export production regions in India (see Figure 2). However, no reports were found on the economic significance of *P. diplodiella* on grapevine in India. Sutton and Waterstone (1964) note that white rot of grapevine caused by *P. diplodiella* is sporadic.
- A number of studies and reports indicate that infections and outbreaks of white rot caused by *P. diplodiella* often seem to occur before or at veraison. Bisiach (1988) notes that typical symptoms of white rot are found on grape clusters before veraison, a few days after a hailstorm. During a study conducted in Slovakia, *P. diplodiella* was isolated frequently from

grape berries at early veraison and to a lesser extent at ripening before harvest (Mikusova *et al.* 2012). A study by David and Rafaila (1966) shows that attack by *P. diplodiella* increases with the increase in sugar content in the grape berries up to 3.0–3.5 per cent and that above 8 per cent sugar content, no fructification occurs in the attacked area.

- Berries infected with *P. diplodiella* turn yellow and later blue, lose their turgor and become covered with brown to violet pycnidia, which, when mature, turn white/grey (Lauber and Schuepp 1968; Bisiach 1988). The berries dry out and fall to the ground at the end of the season (Lauber and Schuepp 1968; Bisiach 1988). Berries on infected immature clusters turn pale green, become limp and later turn brown (Bisiach 1988). Symptoms on peduncle, rachis and pedicel begin as small, pale brown, elongated depressions, which may spread in favourable conditions (Bisiach 1988). If a lesion occurs on the rachis, the proportion of the cluster below the lesion dries quickly (Bisiach 1988). Symptoms of *P. castaneicola* and *P. diplodiella* on grapevine differ only slightly (Yamato 1995).
- Grape bunches may become contaminated with conidia of *P. diplodiella* when contaminated soil is splashed onto the vine by heavy rain, hail or machinery (Bisiach 1988; Kishi 1998). Under favourable conditions, conidia will germinate on the grape bunch and initiate infection (Bisiach 1988).
- Incubation periods of the assessed fungi can vary with temperature, humidity, means of penetration and the tissue infected from three to eight days (Bisiach and Viterbo 1973; Bisiach 1988; Kishi 1998). Infection of grapevine by *P. diplodiella* is favoured by warm temperatures and high relative humidity (Bisiach 1988). Disease development of *P. diplodiella* occurs rapidly at temperatures of 24–27 degrees Celsius, slowly at temperatures below 15 degrees Celsius and only slightly above 34 degrees Celsius (Locci and Quaroni 1972; Bisiach 1988). Infection is negligible if the temperatures are below 15 degrees Celsius for 24–48 hours following a hailstorm (Bisiach 1988).
- Grape bunches with obvious symptoms of infection are likely to be removed during routine harvesting, grading and packing processes and would not be packed for export. Grape bunches without symptoms, or with only minor symptoms such as small lesions on peduncle, rachis or pedicel could still be exported.
- Grapes are usually stored and transported at low temperatures to prolong shelf life. Conidia of *P. diplodiella* germinate and initiate infection slowly at temperatures below 15 degrees Celsius (Bisiach 1988). As a result, symptoms will develop more slowly under low temperatures. Some infected grapes may exhibit no or mild symptoms at the time they arrive in Western Australia. Grape bunches without symptoms, or with only minor symptoms, may not be detected at routine inspection on arrival.

A possibility for some infected grape bunches showing no or mild symptoms, moderated by the lack of reports of the economic importance of the disease in India, the short time required for symptom development and the obvious symptoms of infection on berries, support a likelihood estimate for importation of 'moderate'.

Likelihood of distribution

The likelihood that *P. castaneicola* and/or *P. diplodiella* will be distributed within Western Australia in a viable state as a result of the processing, sale or disposal of table grapes from India and subsequently transfer to a susceptible part of a host is: **Moderate**.

The following information provides supporting evidence for this assessment.

- Imported grapes are intended for human consumption. Distribution of the imported grapes would be for retail sale.
- As grapes are easily damaged during handling (Mencarelli *et al.* 2005), packed grapes may not be processed or handled again until they arrive at the retailers. Therefore, pathogens in packed grapes are unlikely to be detected during transportation and distribution to retailers.
- It could be expected that infected berries would show symptoms by the time they arrive at the retailers. Grape bunches with obvious symptoms of infection would not be marketable and would not be sold. However, if grapes are transported at low temperatures, symptoms may develop more slowly. Grape bunches without symptoms or with only minor symptoms could be marketable and could be sold.
- Most fruit waste will be discarded into managed waste systems and will be disposed of in municipal tips and would therefore pose little risk of exposure to a suitable host.
- Consumers will discard small quantities of fruit waste in urban, rural and natural localities. Small amounts of fruit waste will be discarded in domestic compost. There is some potential for consumer waste being discarded near host plants, including commercially grown, household or wild host plants. If present in fruit waste, the assessed fungi would then need to be transferred to a susceptible host.
- *Pilidiella castaneicola* has a variety of hosts including *Acer* sp., *Carya* sp., *Castanea* spp., *Eucalyptus* spp., *Fragaria* sp., *Liquidambar styracifolia* (sweet gum), *Metrosideros* sp., *Mangifera indica* (mango), *Quercus alba* (white oak), *Q. rubra* (red oak), *Quercus* sp., *Rhus copallina* (black sumac), *Rhus* sp., *Rosa rugosa-prostrata*, *Vitis cordifolia* and *V. vinifera* (Nag Raj 1993; Farr and Rossman 2012). Some of these hosts are widely distributed in Western Australia.
- *Vitis vinifera* is the principle host of *P. diplodiella* (Bisiach 1988; Van Niekerk *et al.* 2004). This fungus has also been reported to cause a disease on *Hibiscus sabdariffa* (Roselle) and *Artabotrys hexapetalos* (Ylang Ylang Vine) (Shreemali 1973; Sánchez *et al.* 2011). Single reports have been found for *P. diplodiella* on *Rosa* sp., *Geranium* sp. and *Anogeissus latifolia* (buttontree) in India and *Citrus aurantiifolia* (lime) in Mexico (Singh and Sinch 1966; Farr and Rossman 2013a). In Western Australia, *Vitis* spp. are grown commercially and are also common garden plants (Kiri-ganai Research Pty Ltd 2006; ABS 2009a; Waldecks 2013). Other possible hosts may also be available in Western Australia including *Hibiscus sabdariffa*, *Rosa* sp., *Geranium* sp. and *Citrus aurantiifolia*. *Hibiscus sabdariffa* is regarded an environmental weed and has widely naturalised in northern Western Australia (University of Queensland 2011).
- *Pycnidia* and conidia of *P. diplodiella* overwinter on dead plant material and in the soil in vineyards (Bisiach 1988). Dried pycnidia of *P. diplodiella* remain able to produce viable conidia for more than 15 years and released conidia remain viable for two to three years (Bisiach 1988). Pycnidia and conidia of the assessed fungi are likely to survive storage and transport.
- Conidia of the assessed fungi are dispersed over short distances by water splash from infected plant material or contaminated soil (Sutton and Waterston 1964; Bisiach 1988; Kishi 1998). In wet conditions, conidia present on the surface of infected grape bunches or

fruit waste could be transmitted via rain splash and wind-driven rain to susceptible nearby host plants.

- Infection of grapevine by *P. diplodiella* is favoured by warm temperatures and high relative humidity (Bisiach 1988). Germination of conidia and development of infection progress rapidly at 24–27 degrees Celsius, slowly below 15 degrees Celsius and only slightly above 34 degrees Celsius (Locci and Quaroni 1972; Bisiach 1988). Infection is negligible if the temperatures are below 15 degrees Celsius for 24–48 hours following a hailstorm (Bisiach 1988). In laboratory studies, infection with *P. diplodiella* was stimulated by high relative humidity (90–100 per cent) (David and Rafaila 1966).
- The main export season for table grapes from India to Australia will be from February to the end of April (DAFF 2010; DPP 2012) (the end of summer to mid autumn in Australia). However small volumes of table grapes may come in at other times of the year. The assessed fungi can infect rachis, pedicel and berries of grapevine (Bisiach 1988; Yamato 1995; Kishi 1998). The fungus rarely infects grapevine leaves, but on some cultivars, it can also infect non lignified shoots (Bisiach 1988). Grapevines in Western Australia would be susceptible to infection during the expected export window. Other hosts of the assessed fungi may also be susceptible to infection during the expected export window.

The wide distribution of a number of hosts in Western Australia, the host susceptibility during the expected export window and the ability for pycnidia and conidia of at least one of the assessed fungi, *P. diplodiella*, to remain viable for a long period of time on dead plant material and in the soil, moderated by the limited range of potential conidia dispersal via rain splash, support a likelihood estimate for distribution of 'moderate'.

Overall likelihood of entry

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

The likelihood that *P. castaneicola* and/or *P. diplodiella* will enter Western Australia as a result of trade in table grapes from India and be distributed in a viable state to a susceptible host is: **Low**.

4.17.2 Likelihood of establishment and spread

As indicated, the likelihood of establishment and of spread for *P. castaneicola* and/or *P. diplodiella* is being based on the assessment for table grapes from Japan (Department of Agriculture 2014). The ratings from the previous assessment are:

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

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 *P. castaneicola* and/or *P. diplodiella* will enter Western Australia as a result of trade in table grapes from India, be distributed in a viable state to a susceptible host, establish in Western Australia and subsequently spread within Western Australia is: **Low**.

4.17.4 Consequences

As indicated, consequences of *P. castaneicola* and *P. diplodiella* in Western Australia assessed here are based on the previous assessment for *P. castaneicola* and *P. diplodiella* for table grapes from Japan (Department of Agriculture 2014), that is: **Low**.

4.17.5 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 *Pilidiella castaneicola* and *Pilidiella diplodiella*	
Overall likelihood of entry, establishment and spread	Low
Consequences	Low
Unrestricted risk	Very low

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

4.18 Tobacco necrosis viruses

***Tobacco necrosis virus A* (TNV-A) and *Tobacco necrosis virus D* (TNV-D), *Tobacco necrosis virus Nebraska isolate* or related 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 one of them.

TNVs were assessed in many existing import policies, for example, for apples from China (Biosecurity Australia 2010) and table grapes from China (Biosecurity Australia 2011a). The assessment of TNVs presented here builds on these existing policies.

Differences in commodity, commercial production practices, climate conditions and the prevalence of pests between previous export areas and India make it necessary to reassess the likelihood that TNVs will be imported into Australia with table grapes from China.

TNVs have a wide range of hosts and the likelihood of distribution after arrival in Australia of TNVs with table grapes from India will be comparable to that for table grapes or other fruits from previous export areas (Biosecurity Australia 2010; Biosecurity Australia 2011a).

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.

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. Therefore, those risk ratings will be adopted for this assessment.

The consequences of a TNV species outbreak in Australia have been reviewed in light of the taxonomic changes and additional information and analysis.

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 *Tobacco necrosis viruses* will arrive in Australia with the importation of table grapes from India is: **Low**.

Supporting information for this assessment is provided below:

- TNV was first reported in India in Madras and Tamil Nadu (Ramachandraiah *et al.* 1979). The virus isolate was able to cause typical TNV symptoms of leaf mottling, necrotic leaf lesions and ringspots in cluster bean, French bean and cowpea. The virus strain was tentatively designated as TNV-D (Ramachandraiah *et al.* 1979).
- Grapes are commercially grown in Madras and Tamil Nadu (DPP 2007), however, no information was found about the incidence or distribution of TNVs in grapevines in India.
- A strain of TNV was found naturally infecting several grapevine cultivars in South Africa (Cesati and Van Regenmortel 1969). The taxonomy, incidence and global distribution of the grapevine-infecting TNVs are not known.
- The strain of TNV found in grapevine in South Africa is graft-transmissible and spreads systemically in grapevine (Cesati and Van Regenmortel 1969). The virus is likely to be present in grape bunches.
- TNVs can infect a few species systemically (Kassanis 1970; Uyemoto 1981). Detectable systemic infection only occurs with certain combinations of host species and TNV species or strains (Kassanis 1970; Uyemoto 1981; Brunt and Teakle 1996). Some TNV species and strains may not infect grapevine and some may infect grapevines but not systematically and may not be in grape bunches.
- Some fruit species infected with TNV may not show adverse effects (Nemeth 1986). TNV usually causes necrotic lesions (Kassanis 1970), but no record was found indicating that infected grapevine showed symptoms.

The possible systemic infection in grapevine, moderated by the information that some TNV species and strains may not infect grapevine or infect grapevine but not systemically and the lack of reports of TNVs in grapevine in India, support a likelihood estimate for importation of 'low'

Likelihood of distribution

As indicated, the likelihood of distribution for TNVs assessed here would be the same as that for TNVs for apples and table grapes from China (Biosecurity Australia 2010; Biosecurity Australia 2011a), that is: **Moderate**

Overall likelihood of entry

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

The likelihood that *Tobacco necrosis viruses* will enter Australia as a result of trade in table grapes from India and be distributed in a viable state to a susceptible host is: **Low**.

4.18.2 Likelihood of establishment and spread

As indicated, the likelihood of establishment and of spread for TNVs for Indian table grapes would be the same as that assessed for apples from China (Biosecurity Australia 2010), which was adopted for table grapes from China (Biosecurity Australia 2011a). The likelihood estimates from the previous assessments 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 likelihood that TNVs will enter Australia as a result of trade in table grapes from India, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **Low**.

4.18.4 Consequences

The consequences of the establishment of TNVs in Australia have been estimated according to the methods described in Table 2.3:

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

Criterion	Estimate and rationale
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	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 degrees Celcius (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).

Criterion	Estimate and rationale
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
Environmental and non-commercial	A— Indiscernible at the local level There are no known indirect consequences of these species on the environment

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 *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 achieves Australia's ALOP. Therefore, no specific risk management measures are required for this pest.

4.19 Tomato black ring virus

Tomato black ring virus

Tomato black ring virus (TBRV) is a member of the genus *Nepovirus*, Comoviridae family, and infects over 50 plant species, including grapevines and a wide range of economically important crop species (carrots, tomato, strawberry), cultivated garden plants (ash, daffodils) and weeds (chickweed, privet) (Murant 1983; Taylor and Brown 1997; Harris *et al.* 2002; Harper *et al.* 2011).

The virus has several strains including beet ringspot, celery yellow vein, lettuce ringspot, potato bouquet and potato pseudo-aucuba (Murant 1970; CABI-EPPO 1997d). Antigenic variations between the strains separate the virus into two groups, the "English" serotype contains the type, lettuce ringspot, celery yellow vein and potato bouquet isolates, whereas the "Scottish" serotype contains the beet ringspot and potato pseudo-aucuba isolates (Harrison 1958; Murant 1970).

The virus was first reported in India in 1966 and has since been confirmed to be present in Andhra Pradesh, Karnataka and Tamil Nadu, (Madhusudan and Govindu 1985; CABI-EPPO 1997d; CABI 2012). Grapes are commercially grown in these states (DPP 2007). It is unknown which virus strains are present in India.

Most naturally infected weed and crop plants may show few or no symptoms especially in the first year of infection (Murant 1983), or when the infection occurs through the seed (CABI-EPPO 1997d). Despite this, infection with TBRV ultimately reduces plant growth and vigour (Harper *et al.* 2011; DPP 2012).

When symptoms do present, they may include systemic chlorotic ringspot, leaf mottle and deformation, black coalescent rings on the leaves, vein yellowing and stunting as well as flecking and reddish streaking on the petiole and stem on symptomatic host species (Brunt *et al.* 1996; Chowfla *et al.* 1999). Where infection occurs through nematode transmission, TBRV infection often appears as patches of poor growth which slowly extend in size each year (CABI-EPPO 1997d).

On grapevine, it has been reported to cause yellow rings and blotches, malformed leaves, asymmetrical leaves, premature senescence and leaf fall (Martelli 1999; Harris *et al.* 2002; DPP 2012). Fruit may be small and poorly set or malformed (Stobbs and van Schagen 1984; DPP 2012). *Tomato black ring virus* has also been detected in asymptomatic vines (Laveau *et al.* 2013).

The virus is transmitted and disseminated by several mechanisms. The virus is transmitted through the soil by nematode species. The English strain is efficiently transmitted by *Longidorus attenuatus* (Brown *et al.* 1989), whereas strains which are more related to the Scottish strain are more efficiently transmitted by *Longidorus elongatus* (Brown *et al.* 1989). Transmission of TBRV through grapevine seed to the emerging seedlings has not been studied. Martelli (1978) assumes that TBRV is seed borne in grapevines. It is believed that nearly all of the nematode borne viruses, such as TBRV, are transmitted and distributed to some extent through the seed of their principal hosts (Murant 1983). *Tomato black ring virus* was shown to be transmitted through seed in 19 out of 28 species in a study by Lister and Murant (1967). The virus can also be transmitted by mechanical inoculation and grafting (Harrison 1996).

The virus is able to be transmitted horizontally by pollen and may infect the plant through the fertilised flower (Card *et al.* 2007). *Tomato black ring virus* is able to be transmitted via pollen in plants such as raspberry (*Rubus idaeus* L.) (Lister and Murant 1967; Murant 1983; Harrison 1996; Harris *et al.* 2002).

The risk scenario of concern is the importation of fruit infected with TBRV, distribution of fruit waste, germination of some grape seeds from the waste, seed transmission and replication of the virus, survival of infected seedlings and the transmission of TBRV to other host plants in Australia.

Tomato black ring virus was included in the existing import policy for truss tomatoes from the Netherlands (Biosecurity Australia 2003). However, the risk assessment for truss tomato from the Netherlands was in a different format as that currently used by the Australian Government Department of Agriculture. Therefore a full risk assessment is undertaken here for table grapes from India.

4.19.1 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 *Tomato black ring virus* will arrive in Australia with the importation of table grapes from India is: **Moderate**.

The following information provides supporting evidence for this assessment.

- *Tomato black ring virus* can be transmitted through grapevine seed (Martelli 1978). There is some risk of fresh grapes with TBRV-infected seed being imported. It is estimated that the majority of table grapes exported from India would be seedless, but some would be seeded.
- *Tomato black ring virus* has been reported in grapevine in India (DPP 2007; DPP 2012). The virus has been found in Andhra Pradesh, Karnataka and Tamil Nadu (Madhusudan and Govindu 1985; CABI-EPPO 1997d; CABI 2012). These states produced 1.27 per cent, 12.92 per cent and 1.75 per cent, respectively, of the total grape production in India in 2012-13 (APEDA 2015).
- One of the vectors of TBRV, the nematode species *Longidorus elongatus*, has been reported in Tamil Nadu and Uttar Pradesh in India (CABI 2012; DPP 2012). DPP (2012) states there are no reports of *L. attenuatus* in India.
- *Tomato black ring virus* occurs systemically and most naturally infected weed and crop plants may show few or no symptoms especially in the year of infection, or when the infection occurs through the seed (Murant 1970; CABI-EPPO 1997d). *Tomato black ring virus* has been detected in asymptomatic grapevines (Stellmach 1970; Laveau *et al.* 2013).
- Fruit from infected vines may be small and poorly set or malformed (Stobbs and van Schagen 1984; DPP 2012).
- Infected bunches showing symptoms are likely to be culled during harvesting, grading and packing.

- Healthy looking grape bunches carrying TBRV, and in some cases containing infected seeds, might be imported into Australia.

Systemic infection and the possibility of asymptomatic infection of grape bunches, moderated by the fact that infected fruit which show symptoms are likely to be culled during harvesting and packing processes, support a likelihood estimate for importation of 'moderate'

Likelihood of distribution

The likelihood that *Tomato black ring virus* will be distributed within Australia in a viable state as a result of the processing, sale or disposal of table grapes from India and subsequently transfer to a susceptible part of a host is: **Very low**.

The following information provides supporting evidence for this assessment.

- If table grapes are imported, they will be distributed through the domestic supply chain and sold to the public for consumption.
- Most fruit waste will be discarded into managed waste systems and will be disposed of in municipal tips. Consumers will discard small quantities of fruit waste in urban, rural and natural localities.
- Some table grape waste may go to household compost.
- The proportion of grapevine seed that germinates depends on the cultivar, seed maturity, storage, stratification and planting conditions (Doijode 2001). Most grapevine seed is dormant and will not germinate unless it has been stratified. Night-time temperatures below 6 degrees Celsius during winter may be sufficient for stratification (Ellis *et al.* 1985; Doijode 2001). Seed of some cultivars will not germinate without stratification, other cultivars have very low germination rates when not stratified, but germination rates of up to 33 per cent from seed from fresh untreated berries of some cultivars has been reported (Scott and Ink 1950; Singh 1961; Forlani and Coppola 1977).
- Cold storage of imported table grapes during transport may stratify the seed and improve germination rates. Night time temperatures in most temperate regions of Australia (Bureau of Meteorology 2010) may be low enough for stratification of grape seeds to occur naturally.
- A small proportion of grapevine seed from fruit waste may germinate. Successful germination will depend on local conditions. Many localities will not be suitable for grape seed germination.
- Grapevines are normally cultivated vegetatively, being propagated from cuttings by grafting onto rootstock or, less commonly, on their own roots (Zohary 1996). Seed is not used to establish vineyards because vines propagated from seed are likely to produce inferior berries; they are unlikely to be true to type after genetic segregation (Zohary 1996). This aspect of grapevine propagation is likely to deter members of the public from growing grapevines from seed from imported fruit, as will the relatively long time taken to grow a productive vine from seed (Olmo 1976) and the ready availability of grafted vines.
- Transmission of TBRV through grapevine seed to the emerging seedlings has not been studied. However, rates of TBRV transmission through seed have been documented in at least 24 other species in 13 botanical families, ranging from 3 to 100 per cent transmission

effectiveness (Murant 1983; CABI 2012). The capacity to be seed transmitted is known to vary among strains of other virus species, and to vary between cultivars of the same plant species (Albrechtsen 2006); this may also be true of TBRV and *Vitis* species. Some strains of TBRV are probably seed transmitted in some grapevine cultivars.

- If grape seedlings grow from TBRV-infected seed, they may be infected with the virus.

The small chance that grapevine seed will germinate and the small chance that the virus will be transmitted from seed to seedling, supports a likelihood estimate for distribution of 'very low'.

Overall likelihood of entry

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

The likelihood that *Tomato black ring virus* will enter Australia as a result of trade in table grapes from India and be distributed in a viable state to a susceptible host is: **Very low**.

4.19.2 Likelihood of establishment

The likelihood that *Tomato black ring virus* will establish within Australia, based on a comparison of factors in the source and destination areas that affect pest survival and reproduction, is: **Very low**

The following information provides supporting evidence for this assessment.

- *Tomato black ring virus* has been reported in India, Turkey and the European Union (CABI-EPPO 1997d) and has demonstrated its ability to establish in a range of environments.
- *Tomato black ring virus* might establish in Australia from infected imported fruit if the infected seedlings survive.
- In Europe, volunteer grapevines grow as weeds in small numbers. Most of these weedy vines are probably rootstocks that have escaped cultivation and grown vegetatively, but some may have grown from seed (Zohary 1996; Arrigo and Arnold 2007; Ocete *et al.* 2008), suggesting seedlings sometimes survive in unmanaged environments. Small numbers of seedlings may survive in some regions of Europe because of the favourable climate and soils.
- *Vitis vinifera* is very infrequently encountered as a weed in Australia (Office of the Gene Technology Regulator 2003). There are reports of *V. vinifera* growing as a weed on roadsides and in disturbed areas in NSW, Vic. and WA (Richardson *et al.* 2006), but the number of plants is very small. Vines have been found near established vineyards and water-courses (Conn 2010). *Vitis vinifera* has been recorded as naturalised in WA and on the North Coast and North Western Slopes of NSW (Conn 2010). Reports indicating the origins of the naturalised plants were not found. It is likely that most or all of the plants found outside of vineyards have grown vegetatively from cultivated vines. Those found on roadsides and in watercourses may have grown from plants taken from gardens or vineyards that have been discarded with other vegetation. Some weedy grapevines may be very old and the rate of successful invasion may be extremely small. If a plant grew from seed, it is likely the seed was from a rootstock, as rootstocks are more hardy.

- Few, if any, grapevine seedlings are likely to survive on agricultural land and in unmanaged localities in Australia. Seedling survival will depend on local conditions including rainfall.
- If an infected grapevine seedling survives, TBRV may be transmitted to other host plants through soil by species of the free living soil inhabiting nematodes *Longidorus elongatus* and *Longidorus attenuatus* (Chowfla *et al.* 1999; Martelli 1999). *Longidorus elongatus* has been recorded in South Australia and Tasmania. Other unidentified specimens of *Longidorus* spp. have been recorded in NSW, Qld and Vic. (McLeod *et al.* 1994; Plant Health Australia 2001c). Transmission efficacies of each of these nematode species varies from between 5 and 78 per cent depending on the serotype and the vector used (Martelli 1978; Brown *et al.* 1989; CABI 2012).
- Both larvae and adult nematodes transmit the virus but the virus does not multiply in the vector, and it is not retained after moulting, nor is it passed to nematode progeny (CABI 2012). Experiments have shown that *L. elongatus* retained infectivity only up to nine weeks when maintained in fallow soil (Lister and Murant 1967).
- The vector potential of each of these nematodes is dependent somewhat on which virus serotype is present in India.
- Investigations have shown that nematode transmission of nepoviruses alone are not effective dispersal agents of the virus in terms of distance, and may only spread the disease between one and two metres per year, which is the case for similar viruses (Martelli 1978).
- *Tomato black ring virus* has been found naturally infecting over 30 species of commercial and cultivated crops and weeds including *Capsella bursa-pastoris* (shepherd's purse), *Cerastium vulgatum* (mouse-eared chickweed), *Chenopodium album* (fat hen), *Chenopodium quinoa* (quinoa), *Fragaria x ananassa* (strawberry), *Fraxinus* spp. (ash), *Gladiolus* spp., *Glycine max* (soybean), *Ligustrum vulgare* (privet), *Lycopersicon esculentum* (tomato), *Narcissus pseudonarcissus* (daffodil), *Petunia violacea* (petunia), *Poa annua* (winter grass), *Polygonum aviculare* (wireweed), *Polygonum convolvulus* (black bindweed), *Prunus dulcis* (almond), *Quercus robur* (English oak), *Ribes nigrum* (black currant), *Ribes rubrum* (red currant), *Ribes sanguineum* (flowering currant), *Rubus* (blackberry/raspberry), *Senecio vulgaris* (common groundsel), *Solanum melongena* (aubergine), *Solanum tuberosum* (potato), *Stellaria media* (chickweed) *Syringa vulgaris* (lilac), *Tulipa* (tulip) and *Vitis* (grapevine) (Murant 1983; Taylor and Brown 1997; Harris *et al.* 2002; Harper *et al.* 2011). Most of these host species grow in Australia and some are widely distributed.
- The natural infection of several plant species suggests that the vector nematodes are able to transmit TBRV between different plant species in the field.

The possibility of TBRV being transmitted through nematodes from an infected grapevine seedling to other host plants nearby, moderated by the small chance that a volunteer grapevine seedling will survive, the uncertainty about the presence of nematode vectors in Australia and the virus serotype present in India and the limited vector potential of the nematodes supports a likelihood estimate for establishment of 'very low'.

4.19.3 Likelihood of spread

The likelihood that *Tomato black ring virus* will spread within Australia, based on a comparison of factors in source and destination areas that affect the expansion of the geographic distribution of the pest, is: **Moderate.**

The following information provides supporting evidence for this assessment.

- Potential hosts of TBRV are widely available in Australia, both commercially and in home gardens.
- *Tomato black ring virus* is transmitted through the soil between host plants by species of the free living soil inhabiting nematodes, *Longidorus elongatus* and *Longidorus attenuatus* (Chowfla *et al.* 1999; Martelli 1999). *Longidorus elongatus* has been recorded in South Australia and Tasmania. Other unidentified specimens of *Longidorus* spp. have been recorded in NSW, Qld and Vic. (McLeod *et al.* 1994; Plant Health Australia 2001c). Transmission efficacies of each of these nematode species varies from between 5 and 78 per cent depending on the serotype and the vector used (Martelli 1978; Brown *et al.* 1989; CABI 2012).
- Both larvae and adult nematodes transmit the virus but the virus does not multiply in the vector, and it is not retained after moulting, nor is it passed to nematode progeny (CABI 2012). Experiments have shown that *L. elongatus* retained infectivity only up to nine weeks when maintained in fallow soil (Lister and Murant 1967).
- The vector potential of each of these nematodes is dependent somewhat on which virus serotype is present in India.
- Investigations have shown that nematode transmission of nepoviruses alone are not effective dispersal agents of the virus in terms of distance, and may only spread the disease between one and two metres per year, which is the case for similar viruses (Martelli 1978).
- There is the potential that nematodes could be moved long distances through contaminated soil and machinery from farming practices (Watson 2004). Each could potentially contain nematodes which carry the virus which would facilitate the dispersal of the virus to new areas. This was believed to be the case in France, where nematode vectors (*Xiphinema index*) of Grapevine fanleaf virus were thought to be inadvertently transported short and long distances with both the movement of soil and farm machinery (Villate *et al.* 2008).
- *Tomato black ring virus* has the potential to transfer both horizontally and vertically (Card *et al.* 2007). This means that the virus is able to be transmitted horizontally by pollen and may infect the plant through the fertilised flower, and it may be transmitted vertically, in which case it may infect the seed and the seedling that will grow from that seed (Card *et al.* 2007).
- *Tomato black ring virus* is able to be transmitted via pollen in plants such as raspberry (*Rubus idaeus* L.) (Lister and Murant 1967; Murant 1983; Harrison 1996; Harris *et al.* 2002). The capacity for TBRV to be pollen transmitted would likely vary between species and cultivars, and it is possible that some grape cultivars will be effective pollen transmitters.
- The evidence of the role of nepovirus pollen transmission from virus contaminated pollen to the mother plant only through fertilization in the field is inconclusive (Mink 1993).

- *Vitis vinifera* can be wind pollinated, and studies have shown that pollen from some cultivars of *Vitis vinifera* has the potential to travel from between 500 metres and 3 kilometres throughout the landscape (Di Vecchi-Staraz *et al.* 2009).
- Transmission of TBRV through grapevine seed to the emerging seedlings has not been studied. However, rates of TBRV transmission through seed have been documented in at least 24 other species in 13 botanical families, ranging from 3 to 100 per cent transmission effectiveness (Murant 1983; CABI 2012). The capacity for TBRV to be seed transmitted would likely vary between species and cultivars, and it is possible that some grape cultivars will be effective seed transmitters.
- Transmission of TBRV through seed of infected weeds could contribute to the dispersal of the virus over a wide area. Infected weed seeds could also provide a reservoir of the virus in the soil.
- Infection through the seed often leads to few or no visible symptoms and therefore, infected weeds or crops in commercial or ornamental plantings may not be detected (Murant 1983; CABI-EPPO 1997d).
- *Tomato black ring virus* is transmitted by grafting and is disseminated with infected propagation material (Harrison 1996).
- In Germany, preliminary surveys for viruses affecting vineyards identified TBRV from only one region. However, nearly all vineyards in this region were infected and there was an active spread of the virus from vine to vine (Rüdel 1985).

The possibilities of transmission by two species of nematodes (*Longidorus elongatus* and *Longidorus attenuatus*) or spread in seed or pollen and the large host range, moderated by the uncertainty about the presence of nematode vectors in Australia and the limited vector potential of the nematodes, support a likelihood estimate for spread of 'moderate'.

4.19.4 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 *Tomato black ring virus* will enter Australia as a result of trade in table grapes from India, be distributed in a viable state to a susceptible host, establish in Australia and subsequently spread within Australia is: **Extremely low**.

4.19.5 Consequences

The potential consequences of the establishment of *Tomato black ring virus* in Australia have been estimated according to the methods described in Table 2.3.

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

Criterion	Estimate and rationale
Direct	
Plant life or health	E—Significant at the regional level *Tomato black ring virus* has a very wide host range with host species being grown in both commercial and ornamental situations (Harris *et al.* 2002; CABI 2012). The main commercially grown crops which could be affected in Australia are asparagus, blackberry, currants, grapes, potatoes, raspberry, strawberry and tomato. *Tomato black ring virus* causes a range of symptoms in grapevine which is similar to many of the nepoviruses (Martelli 1978; CABI 2012). These include distortion of the vine, malformation and chlorotic ringspots of the leaves, premature leaf fall and senescence, as well as the ultimate decline and death of the vine (Martelli 1978; Martelli 1999; Harris *et al.* 2002). This virus also causes low quantity and quality of yield, reduced rooting ability, shortening of reproductive life and low graft take (Martelli 1978). In Germany, despite only being recorded in one region, observations indicated that this virus is capable of inducing very high crop losses in grape (Rüdel 1985). *Tomato black ring virus* has been recorded to cause significant crop losses in strawberry crops, especially when present with other viral infections or adverse environmental conditions (Martin and Tzanetakis 2006). Symptoms in indicator plants vary from being asymptomatic to causing yellow blotching, ring spots, crinkling of the leaves, stunting and plant death (Martin and Tzanetakis 2006). In raspberry, TBRV causes ringspot on the leaves and may decrease the yield of "tolerant" cultivars. In the cultivar, 'Seedling V', it causes many short, spindly and brittle young shoots with ill defined chlorotic markings on the leaves. In 'Malling Exploit' leaves develop faint chlorotic mottling or ringspots initially and later the canes are stunted, yield is decreased and some drupelets are aborted. In 'Norfolk Giant' the leaves develop leaf-curl (Murant 1987). In red currant, TBRV was found in plants that showed pronounced yellow line-pattern symptoms (Jones and McGavin 1996). Yield losses due to TBRV have also been reported for various other crops, such as potatoes in Germany, a 20 per cent yield reduction of asparagus also infected with other viruses (Harris *et al.* 2002) and the report that young tomato plants infected with the virus are frequently killed (Chowfla *et al.* 1999). *Tomato black ring virus* also affects a range of ornamental plant species, which may affect a variety of environments such as street and city plantings, home gardens or the nursery sector. The value of total grape production for all uses (wine, dried and table) was $1 040.6 million for the 2011–12 financial year (ABS 2012b). The production value in 2011–12 for the Australian strawberry industry was approximately $200 million (Plant Health Australia 2014). This production occurs in Queensland, Victoria, South Australia, Western Australia, Tasmania and New South Wales (Plant Health Australia 2010). *Tomato black ring virus* is listed as a pathogen of quarantine concern to this industry (Plant Health Australia 2010). The annual Australian production in 2011–12 for *Rubus* spp. was over 1000 tonnes, worth approximately $25 million. *Tomato black ring virus* is listed as a pathogen of quarantine concern to this industry (Plant Health Australia 2013b). Potato production in Australia in 2011–12 was 1 288 186 tonnes, which was worth $625.6 million (Ausveg 2013a). *Tomato black ring virus* is listed as a pathogen of quarantine concern to this industry (Plant Health Australia 2013a). In 2010–11, Australia produced 10 276 tonnes of asparagus, which was worth $68.7 million (Ausveg 2013b). The tomato production for 2011–12 was 371 514 tonnes and was worth $351.8 million (Ausveg 2013a). *Tomato black ring virus* is listed as a pathogen of quarantine concern to the vegetable industry, although the overall risk is estimated as very low (Plant Health Australia 2011).
Other aspects of the environment	A—Indiscernible at local level *Tomato black ring virus* naturally infects a range of common weeds including *Capsell bursa-pastoris* (shepherd's purse), *Ligustrum vulgare* (privet), *Senecio* (common groundsel), *Sonchus oleraceus* (sowthistle) and *Stellaria media* (chickweed) (CABI 2012). These weeds are distributed throughout Australia and infection may reduce the weed burden within some ecosystems.

Criterion	Estimate and rationale
Indirect	
Eradication, control	E—Major significance at the district level In the absence of nematode vectors, eradication of TBRV could be achieved through removal and destruction of infected plants in combination with monitoring and weed control (Stobbs and van Schagen 1984). Eradication and control in the field can be difficult and may not be possible if weeds are infected and vector nematodes are present. It could also be difficult because the virus does not express clear symptoms in many of its possible hosts (Harper *et al.* 2011). The virus may be maintained in certain weeds and nematodes may spread it to new plantings. If a TBRV outbreak was detected in a vineyard, it is likely that local eradication would be undertaken. Detection in a vineyard may be delayed because symptoms take time to develop and are not diagnostically distinctive. Laboratory testing is required to confirm a diagnosis (Laveau *et al.* 2013). Vines infected with the virus would be destroyed. Properties in contact with the infected property would be traced and surveyed, and adjoining and nearby properties would be surveyed. Surveillance may continue for several seasons. Surveillance and testing is costly. Vines that are destroyed would probably be replaced with pathogen-free planting material. In Australia, disease tested grapevine planting material is available through the Vine Industry Nursery Accreditation Scheme (VINA 2008). If an outbreak was detected in a greenhouse or field tomato crop it would probably be eradicated through action coordinated at the state or national level. An outbreak of TBRV in tomato, potato or other crop hosts may not be detected until it has spread to several crops, properties and species. Quarantine would probably be enforced on infected properties. Laboratory testing would be required to confirm a diagnosis. If a potato crop was infected and detected then it would be destroyed. An infected tomato or grapevine crop might not be destroyed but infected plants identified through testing would be destroyed. Infected plant material would be buried or incinerated. Entire crops may be surveyed or random surveillance may be done because infected plants may be symptomless, especially in the first year of infection or when the infection occurs through the seed (CABI-EPPO 1997d). Tracing and surveillance would be done on other properties that are thought to be at risk of infection. Typically plants, propagating material, machinery and implements may not be moved from properties where a virus outbreak has been detected. Machinery and equipment would be disinfected. Potatoes produced on an infected property would be quarantined. Continued sales of tomato fruit or grapes produced on an infected property might be permitted. Methods used to control nematode-borne viruses include: • Use of certified planting material • Soil fumigation with nematicides before planting • Weed control • Avoiding the movement of nematodes with contaminated equipment from an infected to an uninfected field • Removal of infected plants and neighbouring plants followed by spot treatment with nematicides • Crop rotation with crops that are not a host of the virus Plants grown in potato seed certification schemes in Australia are currently inspected for symptoms of virus infection (ViCSPA 2009; DAFWA 2009a; DAFWA 2009b). Disease tested grapevine, strawberry and raspberry planting material is available in Australia through voluntary certification schemes (Menzies and Brien 2002; VINA 2008; Plant Health Australia 2009a). The virus has been eliminated from infected potato tubers by hot air treatment (Kaiser 1980).

Criterion	Estimate and rationale
Domestic trade	D—Significant at the district level If TBRV became established in an Australian state, restrictions might be introduced on the interstate trade of affected produce and germplasm and, if this occurred it would lead to the loss of markets. As the virus can be transmitted through tomato seed, trade in tomato fruit might be affected. If potato crops were infected, trade in potato tubers from the district might cease. Trade restrictions might be limited to the affected properties, but could be placed on produce from a district, while the pest status of the district was determined and might be placed on trade from a state. Eradication campaigns have been launched in response to every recent outbreak of PSTVd in Australia. No movement of plants or machinery from the affected properties is permitted during the campaigns.
International trade	D—Significant at the district level. *Tomato black ring virus* is a regulated pathogen in the North American plant protection organisation territory, as well as New Zealand (Harper *et al.* 2011). It is regulated for nursery stock, vegetative material, seed and pollen importation in New Zealand (MAF Biosecurity New Zealand 2011). If TBRV became established in Australia, additional restrictions might be introduced on the international trade of nursery stock and propagative material, and possibly some fruit with seed that is possibly infected. This could potentially lead to the loss of international markets and could lead to industry adjustment. Part of the Australian fresh tomato fruit crop is exported, as is a part of the Australian ware potato crop and seed potato crop. These exports might be affected if TBRV becomes established in Australia. Australia has markets for fresh tomatoes to New Zealand, Singapore, Hong Kong, Brunei, Malaysia, New Caledonia, Indonesia, French Polynesia, Fiji, and USA, and markets for potatoes to Republic of Korea, Malaysia, Mauritius, Singapore, Hong Kong, Indonesia, Philippines, United Arab Emirates, Thailand, Taiwan and Brunei, and markets for tomato seed to Thailand and New Zealand (DAFF 2008; HAL 2012).
Environmental and non-commercial	**Impact score**: B—Significant at the local level. The application of nematicides to the soil may affect the environment

4.19.6 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 *Tomato black ring virus*	
Overall likelihood of entry, establishment and spread	Extremely low
Consequences	Moderate
Unrestricted risk	Negligible

As indicated, the unrestricted risk estimate for *Tomato black ring virus* has been assessed as ‘negligible’ which achieves Australia’s ALOP. Therefore, no specific risk management measures are required for this pest.

4.20 Pest risk assessment conclusions

Key to Table 4.2 (starting next page)

Genus species (EP): pests for which policy already exists. The outcomes of previous assessments and/or reassessments in this IRA are presented in Table 4.2

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

Assessment of consequences from pest entry, establishment and spread

PLH	plant life or health	
OE	other aspects of the environment	
EC	eradication, control	
DT	domestic trade	
IT	international trade	
ENC	environmental and non-commercial	
A-G	consequence impact scores are detailed in section 2.2.3	
	A	Indiscernible at the local level
	B	Minor significance at the local level
	C	Significant at the local level
	D	Significant at the district level
	E	Significant at the regional level
	F	Significant at the national level
	G	Major significance at the national level
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 table grapes from India

Pest name	Likelihood of						Consequences							URE
	Entry			**Establishment**	**Spread**	**EES**								
	Importation	Distribution	**Overall**				Direct	Indirect					**Overall**	
							PLH	**OE**	**EC**	**DT**	**IT**	**ENC**		
Spider mite [Trombidiformes: Tetranychidae]														
Tetranychus kanzawai (EP, WA)	The URE outcome of exceeding Australia’s ALOP from existing policy has been adopted													
Fruit fly [Diptera: Tephritidae]														
Bactrocera correcta (EP)	VL	M	**VL**	H	H	VL							H	**L**
Bactrocera dorsalis (EP)														
Spotted wing drosophila [Diptera: Drosophilidae]														
Drosophila suzukii (EP)						M							H	**H**
Phylloxera [Heniptera: Phylloxeridae]														
Daktulosphaira vitifoliae (EP)	The URE outcome of exceeding Australia’s ALOP from existing policy has been adopted													
Soft scale [Hemiptera: Coccidae]														
Parthenolecanium corni (EP, WA)	The URE outcome of achieving Australia’s ALOP from existing policy has been adopted													
Mealybugs [Hemiptera: Pseudococcidae]														
Planococcus ficus (EP)	The URE outcome of exceeding Australia’s ALOP from existing policy has been adopted													
Planococcus lilacinus (EP)														
Planococcus minor (EP)														
Rastrococcus iceryoides (EP)														
Plume moth [Lepidoptera: Pterophoridae]														
Platyptilia ignifera(EP)	The URE outcome of achieving Australia’s ALOP from existing policy has been adopted													

Pest name	Likelihood of						Consequences							URE
	Entry			Establishment	Spread	EES								
	Importation	Distribution	Overall				Direct	Indirect					Overall	
							PLH	OE	EC	DT	IT	ENC		
Moth [Lepidoptera: Tortricidae]														
Archips machlopis	L	M	**L**	H	H	L							M	**L**
Thrips [Thysanoptera: Thripidae]														
Retithrips syriacus (EP) *Rhipiphorothrips cruentatus* (EP)			The URE outcome of exceeding Australia's ALOP from existing policy has been adopted											
Bacteria														
Xanthomonas campestris pv. *viticola*	H	VL	**VL**	M	M	VL	D	A	D	D	D	B	L	**N**
Fungi														
Greeneria uvicola (EP, WA)	H	L	**L**	L	L	VL							L	**N**
Guignardia bidwellii (EP)			The URE outcome of exceeding Australia's ALOP from existing policy has been adopted											
Monolinia fructigena (EP)			The URE outcome of exceeding Australia's ALOP from existing policy has been adopted											
Pestalotiopsis menezesiana (EP, WA) *Pestalotiopsis uvicola* (EP, WA)	M	L	**L**	H	H	L							L	**VL**
Phakopsora euvitis (EP)			The URE outcome of exceeding Australia's ALOP from existing policy has been adopted											
Phomopsis viticola (EP, WA)			The URE outcome of achieving Australia's ALOP from existing policy has been adopted											
Pilidiella castaneicola (EP, WA) *Pilidiella diplodiella* (EP, WA)	M	M	**L**	M	M	L							L	**VL**

Pest name	Likelihood of						Consequences							URE
	Entry			Establishment	Spread	EES								
	Importation	Distribution	**Overall**				Direct	Indirect					**Overall**	
							PLH	**OE**	**EC**	**DT**	**IT**	**ENC**		
Viruses														
Tobacco necrosis viruses (EP)	L	M	**L**	H	H	L	D	A	D	C	C	A	L	**VL**
Tomato black ring virus	M	VL	**VL**	VL	M	EL	E	A	E	D	D	B	M	**N**

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 India have been considered, as have post-harvest procedures and the packing of fruit.

In addition to India's existing commercial production practices for table grapes 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 table grapes sourced from India. 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 table grapes from India

Pest	Common name	Measures
Arthropods		
Planococcus ficus (EP) *Planococcus lilacinus (*EP) *Planococcus minor* (EP) *Rastrococcus iceryoides* (EP) *Tetranychus kanzawai* (EP, WA) *Archips machlopis* *Retithrips syriacus* (EP) *Rhipiphorothrips cruentatus* (EP)	Grapevine mealybug Coffee mealybug Pacific mealybug Downey snowline mealybug Kanzawa spider mite Leaf rolling moth Black vine thrips Grapevine thrips	Visual inspection and, if detected, remedial action **a** (for example methyl bromide fumigation)
Bactrocera correcta (EP) *Bactrocera dorsalis* (EP)	Guava fruit fly Oriental fruit fly	Area freedom **b** OR Fruit treatment known to be effective against all life stages of *Bactrocer correcta* and *Bactrocera dorsalis* (for example irradiation **c** OR cold disinfestation treatment)
Drosophila suzukii (EP)	Spotted wing drosophila	Area freedom **b** OR Systems approach OR Fruit treatment known to be effective against all life stages of *Drosophila suzukii* (for example irradiation **c** OR SO_2/CO_2 fumigation followed by cold treatment)
Daktulosphaira vitifoliae (EP)	Grapevine phylloxera	Area freedom **b** OR Fruit treatment known to be effective against all life stages of *Daktulosphaira vitifoliae* (for example sulphur pad treatment)
Pathogens		
Guignardia bidwellii (EP) *Monilinia fructigena* (EP) *Phakopsora euvitis* (EP)	Black rot Brown rot Grapevine leaf rust	Area freedom **b** OR Systems approach

a Remedial action by DAC may include: withdrawing the consignment from export to Australia or applying approved treatment of the consignment to ensure that the pest is no longer viable.
b Area freedom may include pest free areas, pest free places of production or pest free production sites.
c Irradiation at a minimum absorbed dose of 400 Gray (Gy) is accepted for class insecta (except for pupae and adult Lepidoptera) (USDA 2015). Some species of Tetranychus may also be effectively managed by irradiation subject to supporting information.
(EP) Species has been assessed previously and import policy already exists.
(WA) Pests of regional concern for Western Australia only.

This non-regulated analysis of existing policy builds on the existing policies for the import of table grapes from California (AQIS 1999; AQIS 2000; Biosecurity Australia 2006a; DAFF 2013), Chile (Biosecurity Australia 2005), China (Biosecurity Australia 2011a), Korea (Biosecurity Australia 2011b), and Japan (Department of Agriculture 2014), which include most of the pests identified in Table 5.1.

Considerable trade in table grapes from California has taken place since 2002. Trade for table grapes from Korea commenced in 2014. To date, no table grapes have been imported under the policy for table grapes from Chile, China or Japan. The management options proposed in this draft report are consistent with the existing policies and include:

- visual inspection and, if detected, remedial action for spider mites, mealybugs, moths and thrips
- area freedom or fruit treatment known to be effective against all life stages of fruit flies
- area freedom, systems approach or fruit treatment known to be effective against all life stages of spotted wing drosophila
- area freedom or fruit treatment known to be effective against all life stages of grapevine phylloxera
- area freedom or a systems approach for black rot, brown rot and grapevine leaf rust.

The International Plant Protection Convention (IPPC) acknowledges the application of irradiation as a phytosanitary treatment for regulated pests or articles in ISPM 18: *Guidelines for the use of irradiation as a phytosanitary measure* (FAO 2003). Irradiation dose rates up to a maximum of 1000 Gy have recently been permitted for quarantine purposes for a range of fruits and vegetables including table grapes, in the Australia New Zealand Food Standards Code (FSANZ 2015). Irradiation is proposed for table grapes from India as one of the management options for fruit flies and spotted wing drosophila.

Management for *Tetranychus kanzawai*, *Planococcus ficus*, *Planococcus lilacinus*, *Planococcus minor*, *Rastrococcus iceryoides*, *Archips machlopis*, *Retithrips syriacus* and *Rhipiphorothrips cruentatus*

Tetranychus kanzawai (Kanzawa spider mite); *Planococcus ficus* (grapevine mealybug), *Planococcus lilacinus* (coffee mealybug), *Planococcus minor* (Pacific mealybug) and *Rastrococcus iceryoides* (downey snowline mealybug); *Archips machlopis* (leaf rolling moth); *Rhipiphorothrips cruentatus* (grapevine thrips) and *Retithrips syriacus* (black vine thrips) 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, if detected, remedial action as a measure for these pests. The objective of the proposed visual inspection is to ensure that any consignments of table grapes from India infested with these pests are identified and subjected to appropriate remedial action. The appropriate remedial action will reduce the risk associated with these pests to at least 'very low', which would achieve Australia's ALOP.

The proposed measure is consistent with the existing policy for table grapes from the United States of America (California) for the same, or similar, pests listed here. The efficacy of visual inspection and, if detected, remedial action is supported by considerable trade of table grapes from California to Australia since 2002.

Visual inspection and, if detected, remedial action

All table grape consignments for export to Australia must be inspected by the Department of Agriculture and Cooperation of India (DAC) 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 lots or consignments from export to Australia or, if available, applying approved treatment to the export lots or consignments to ensure that the pest is no longer viable.

Management for *Drosophila suzukii*

Drosophila suzukii (spotted wing drosophila) was assessed, in the Final pest risk analysis report for *Drosophila suzukii* (DAFF Biosecurity 2013), to have an unrestricted risk estimate that exceeds Australia's ALOP. Measures are required to manage this risk.

Options recommended for this pest in the Final pest risk analysis report for *Drosophila suzukii* (DAFF Biosecurity 2013) are area freedom, irradiation, systems approach, or fruit treatment known to be effective against all life stages of *D. suzukii*.

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).

If area freedom from *D. suzukii* could be demonstrated for any areas in India, the likelihood of importation of this pest with table grapes sourced from those areas would be reduced to at least 'extremely low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Systems approach

A systems approach that uses the integration of different risk management measures, at least two of which act independently, and which cumulatively achieve the required level of phytosanitary protection could be used to reduce the risk of *D. suzukii* being imported into Australia with consignments of table grapes. More information on a systems approach is set out in ISPM 14: *The use of integrated measures in a systems approach for pest risk management* (FAO 2002).

The Australian Government Department of Agriculture considers a systems approach to address the risks posed by *D. suzukii* on table grapes may be feasible. The approach could be based on a combination of fruit protection e.g. fruit bagging, vineyard preventative measures and monitoring, and pest control with post-harvest measures. The approach could be used to progressively reduce the risk of infested fruit being imported into Australia with consignments of table grapes.

Should India wish to use a systems approach as a measure to manage the risk posed by *D. suzukii*, DAC 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 DAC.

Treatment of fruit

A treatment that is known to be effective against all life stages of *D. suzukii* is a measure that might be applied to manage the risk posed by this pest in imports of host fruits. Treatment of fruit, with suitable efficacy, would reduce the likelihood of importation of infested fruit to at least 'extremely low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Treatments of fruit will need to be applied offshore to ensure that any live adult flies in consignments of fruit do not enter Australia.

Treatment options that might be applied to manage the risk posed by *D. suzukii* in imports of table grapes include:

Irradiation

Irradiation treatment is considered a suitable measure option for *D. suzukii.* Australia proposes that 400 Gy as minimum generic dose rate for the class Insecta (except pupae and adults of the Order Lepidoptera) (USDA 2015) would reduce the likelihood of importation of infested fruit to at least 'extremely low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Methyl bromide fumigation

Preliminary methyl bromide fumigation trials have shown 100 per cent mortality on all life stages. Methyl bromide fumigation of exported fruit might be used as a stand-alone treatment to achieve Australia's ALOP. However, before methyl bromide could be recommended as a permanent phytosanitary measure for *D. suzukii* in table grapes, a complete efficacy treatment proposal by a proponent country would need to be reviewed and accepted by the Australian Government Department of Agriculture.

Combined sulphur dioxide (SO_2)/carbon dioxide (CO_2) fumigation followed by cold disinfestation treatment

The Australian Government Department of Agriculture reviewed the efficacy data in support of a combination treatment of SO_2/CO_2 fumigation followed by a cold disinfestation treatment (listed below), and considered it suitable to manage the risk of *D. suzukii* in table grapes (*Vitis vinifera*).

- 6 per cent carbon dioxide (CO_2) and 1 per cent sulphur dioxide (SO_2) by volume for 30 minutes, at a pulp temperature of 15.6 degrees Celsius or greater, followed by;
- A cold treatment for 6 days or more at a pulp temperature of –0.50 degrees Celcius ± 0.50 degrees Celsius.

OR

- 6 per cent carbon dioxide (CO_2) and 1 per cent sulphur dioxide (SO_2) by volume for 30 minutes, at a pulp temperature of 15.6 degrees Celcius or greater, followed by;

- A cold treatment for twelve days or more at a pulp temperature of 0.9 degrees Celcius ± 0.50 degrees Celcius.

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

Alternative treatments

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

Management for *Bactrocera correcta* and *Bactrocera dorsalis*

Bactrocera correcta (guava fruit fly) and *Bactrocera dorsalis* (Oriental fruit fly) 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 the options of area freedom, irradiation, or cold disinfestation treatment as measures to reduce the risks associated with these pests.

Area freedom

Area freedom is a measure that might be applied to manage the risk posed by guava fruit fly and Oriental fruit fly. 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).

If area freedom from *Bactrocera correcta* and/or *Bactrocera dorsalis* can be demonstrated for any areas in India, the likelihood of importation of the pest species with table grapes sourced from these areas would be reduced to at least 'extremely low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Monitoring and trapping of fruit flies in the specific table grape export vineyards and packing houses of India would be required.

Under the area freedom option, the Department of Agriculture and Cooperation, India would be required to notify the Australian Government Department of Agriculture of a 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 DAC of the action to be taken. If fruit flies are detected at offshore pre-shipment inspection or on-arrival inspection, trade would be suspended immediately, pending the outcome of an investigation.

Cold disinfestation treatments

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

Treatment regimes consistent with the *USDA Treatment Manual* (USDA 2015) for *B. dorsalis* on a range of commodities are proposed for the disinfestation of *B. dorsalis and B. correcta* on table grapes. 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 2009). The Australian Government Department of Agriculture proposes the following treatment regimes for *B. dorsalis and B. correcta* on table grapes from India:

- 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 *Daktulosphaira vitifoliae*

Daktulosphaira vitifoliae (grapevine phylloxera) was assessed to have an unrestricted risk estimate that exceeds Australia's ALOP. Measures are required to manage this risk.

The Australian Government Department of Agriculture proposes area freedom or fruit treatment known to be effective against all life stages of *D. vitifoliae* such as sulphur pad treatment.

Area freedom

Area freedom is a measure that might be applied to manage the risk posed by *D. vitifoliae*. 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).

If area freedom from *D. vitifoliae* could be demonstrated for any areas in India, the likelihood of importation of this pest with table grapes sourced from those areas would be reduced to at least 'extremely low'. The restricted risk would then be reduced to 'negligible', which would achieve Australia's ALOP.

Treatment of fruit

Treatment that is known to be effective against all life stages of *D. vitifoliae* is a measure that might be applied to manage the risk posed by *D. vitifoliae* with table grapes sourced from areas infested or affected by this pest.

Treatment options that might be applied to manage the risk posed by *D. vitifoliae* in imports of table grapes include:

Irradiation

Irradiation treatment is considered a suitable measure option for *B. correcta* and *B. dorsalis*. The treatment schedule of 150 Gy minimum absorbed dose as set in ISPM 28 Annex 7: *Irradiation treatment for fruit flies of the family Tephritidae (generic)* (FAO 2009) would reduce the likelihood of importation of infested fruit to at least 'extremely low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Sulphur pads

Commercial sulphur pads with proven efficacy against *D. vitifoliae* packed inside the plastic liner in all cartons of table grapes for export could be used to manage the risk posed by this pest. The sulphur pads must be a registered product containing a minimum of 970 grams per kilogram anhydrous sodium metabisulphite used at the rate specified on the label (PIRSA 2010).

The inclusion of sulphur pads in all cartons of table grapes for export is to reduce the survival of *D. vitifoliae* associated with packed table grapes and packaging and the likelihood of introduction to at least 'very low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Combined SO_2/CO_2 fumigation

The Australian Government Department of Agriculture reviewed the efficacy data in support of a combination treatment of SO_2/CO_2 fumigation (listed below) and considered it suitable to manage the risk of *D. vitifoliae*

- 6 per cent carbon dioxide (CO_2) and 1 per cent sulphur dioxide (SO_2) by volume for 30 minutes, at a pulp temperature of 15.6 degrees Celcius or greater.

Additional post-treatment security measures may be required to limit post-treatment contamination by this pest.

Treatment of table grapes with combined SO_2/CO_2 fumigation would reduce the likelihood of introduction of infested fruit to at least 'extremely low'. The restricted risk would then be reduced to at least 'negligible', which would achieve Australia's ALOP.

Alternate treatments

Other treatments, demonstrated to be effective against all life stages of *D. vitifoliae*, will be considered by the Australian Government Department of Agriculture if proposed by DAC.

Management for *Guignardia bidwellii*, *Monilinia fructigena* and *Phakopsora euvitis*

Guignardia bidwellii (black rot), *Monilinia fructigena* (brown rot), and *Phakopsora euvitis* (grape rust fungus) were assessed to have an unrestricted risk estimate that exceeds Australia's ALOP. Measures are required to manage these risks.

The Australian Government Department of Agriculture proposes area freedom or a systems approach as measures for these pathogens.

Area freedom

Area freedom is a measure that might be applied to manage the risk posed by these pathogens. 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).

If area freedom from these pathogens could be demonstrated for any areas in India, the likelihood of importation of these pathogens with table grapes sourced from those areas would be reduced to at least 'extremely low'. The restricted risk would then be reduced to at least 'very low', which would achieve Australia's ALOP.

Systems approach

A systems approach that uses the integration of different risk management measures, at least two of which act independently, and which cumulatively achieve the required level of phytosanitary protection could be used to reduce the risk of these pathogens being imported to Australia with consignments of table grapes. More information on a systems approach is set out in ISPM 14: *The use of integrated measures in a systems approach for pest risk management* (FAO 2002).

The Australian Government Department of Agriculture considers a systems approach to address the risks posed by these pathogens may be feasible. The approach could be based on area of low pest prevalence, a combination of fruit protection e.g. fruit bagging, vineyard preventative measures and monitoring, and pest control with post-harvest measures. The approach could be used to progressively reduce the risk of infested table grapes being imported to Australia.

Should India wish to use a systems approach as a measure to manage the risk posed by these pathogens, DAC would need to submit a proposal outlining components of the system and how these components will address the risks posed by these pathogens. The Australian Government Department of Agriculture will consider the effectiveness of any system proposed by DAC.

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 DAC, providing that it achieves Australia's ALOP. Evaluation of such measures or treatments will require a technical submission from DAC 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 table grapes from India. This is to ensure that the proposed risk management measures have been met and are maintained.

Details of the operational system, or equivalent, will be determined by agreement between the Australian Government Department of Agriculture and DAC before the commencement of trade.

5.2.1 Provision for traceability

A system of traceability to source vineyards

The objectives of this proposed procedure are to ensure that:

- table grapes are sourced only from vineyards producing commercial quality fruit
- vineyards from which table grapes are sourced can be identified so investigation and corrective action can be targeted rather than applying it to all contributing vineyards in the event that live pests are intercepted.

It is proposed that DAC establish a system to enable traceability back to the vineyards where table grapes for export to Australia are sourced from. The Department of Agriculture and Cooperation, India would be responsible for ensuring that export table grape growers are aware of pests of quarantine concern to Australia and control measures. The records of the pest control programme would need to be made available to the Australian Government Department of Agriculture, if requested.

Registration of packing house and treatment providers and auditing of procedures

The objectives of this proposed procedure are to ensure that:

- table grapes are sourced only from DAC registered packing houses, processing commercial quality fruit
- reference to the packing house and the vineyard source (by name or a number code) are clearly stated on cartons of table grapes 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 DAC before the commencement of harvest each season. The list of registered packing houses and treatment providers must be kept by DAC, and would need to be made available to the Australian Government Department of Agriculture, if requested.

DAC would be required to audit the registered providers at the beginning of each export season to ensure that packing houses and treatment facilities are suitably equipped to carry out the specified phytosanitary activities and treatments. Records of DAC audits would be made available to the Australian Government Department of Agriculture, if requested.

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

Where table grapes undergo fruit treatment prior to export, this process could only be undertaken by the treatment providers that have been registered with and audited by DAC for the purpose.

DAC must immediately suspend exports of table grapes 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 re-instated for processing of table grapes for export to Australia when DAC and the Australian Government Department of Agriculture are satisfied that non-compliance issues have been adequately addressed.

5.2.2 Packaging and labelling

The objectives of this proposed procedure are to ensure that:

- table grapes 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 table grapes. 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, table grapes is defined as table grape bunches or clusters, which include peduncles, rachises, laterals, pedicels and berries (Pratt 1988), 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 table grape bunches) is not imported with the table grapes
- all wood material used in packaging of table grapes 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 table grapes are labelled with the vineyard source (by name or a number code), packing house registration number for the purposes of trace back
- the phytosanitary status of table grapes must be clearly identified.

5.2.3 Specific conditions for storage and movement

The objectives of this proposed procedure are to ensure that:

- table grapes 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-cleared product, product to prevent mixing or cross-contamination
- the quarantine integrity of the commodity during storage and movement is maintained.

5.2.4 Freedom from trash

All table grapes 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 and/or foreign matter should be withdrawn from export unless approved remedial action is available and applied to the export consignments and then re-inspected.

5.2.5 Pre-export phytosanitary inspection and certification by DAC

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, or equivalent, whereby one unit is one bunch of table grapes
- 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 irradiation or pre-shipment/in-transit cold treatment) which include date, temperature, dose, duration, and/or treatment certificate (as appropriate)
- an additional declaration that *'The fruit in this consignment has been produced in India in accordance with the conditions governing entry of fresh table grapes to Australia and inspected and found free of quarantine pests and regulated articles'*
- another statement may be required, where irradiation is used. Additional information about live pests detected in the consignments during NPPO inspection must also be included on the IPC, as the treatment is performed following NPPO inspection on the shipment.

5.2.6 Verification by the Australian Government Department of Agriculture

The objectives of this proposed procedure 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 table grapes from India meets Australia's import conditions, the Australian Government Department of Agriculture complete a verification inspection of all consignments of table grapes.

The inspection will be conducted in accordance with the Australian Government Department of Agriculture standard inspection protocol for table grapes, using optical enhancement where necessary.

The inspection is usually undertaken on-arrival into Australia of table grape consignments. However, DAC has an option to request for the inspection to be undertaken in India prior to export. The offshore pre-shipment inspection arrangement is 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 DAC.

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.

5.2.7 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 Agriculture reserves the right to suspend the export programme and conduct an audit of the risk management systems. The programme will recommence only when the department is satisfied that appropriate corrective action has been taken.

5.3 Responsibility of competent authority

The Department of Agriculture and Cooperation (DAC) of India is the designated NPPO under the International Plant Protection Convention (IPPC).

The NPPO's responsibilities include:

- inspecting plants and plant products moving in international trade

- issuing certificates relating to phytosanitary condition and origin of consignments of plants and plant products
- ensuring that all relevant agencies participating in this programme meet the recommended service and certification standards and recommended work plan procedures
- ensuring that administrative processes are established to meet the requirements of the programme.

5.3.1 Use of accredited personnel

Operational components and the development of risk management procedures may be delegated by DAC to an accredited agent under an agency arrangement as appropriate. This delegation must be approved by the Australian Government Department of Agriculture. DAC is responsible for auditing delegated risk management procedures.

The accrediting authority must provide DAC with the documented criteria upon which accreditation is based and this must be available for audit by DAC. The Australian Government Department of Agriculture may verify the accrediting system before the commencement of trade.

5.4 Uncategorised pests

If an organism, including contaminant pests, is detected on table grapes either in India or on-arrival in Australia that has not been categorised, it will require assessment by the Australian Government Department of Agriculture to 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.

5.5 Review of processes

5.5.1 Verification of protocol

Prior to 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 India that produce table grapes for export to Australia.

5.5.2 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 India has changed.

DAC must inform the Australian Government Department of Agriculture immediately on detection in India of any new pests of table grapes that are of potential quarantine concern to Australia or of a significant change in the application of existing commercial practices considered in this report.

5.6 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 table grapes from India 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 table grapes from India.

Appendix A Initiation and categorisation for pests of table grapes from India

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.

Details of the method used in this risk analysis are given in Section 2: Method for pest risk analysis.

This pest categorisation table does not represent a comprehensive list of all the pests associated with the entire plant of an imported commodity. Reference to 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 table grapes and would be addressed by Australia's current approach to contaminating pests.

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
ARTHROPODS						
Coleoptera						
Adoretus bicolor (Brenske, 1900) [Scarabaeidae] Cockchafer beetle	Yes (Ahmed *et al.* 1977)	No records found	No Although adults can puncture the berries, they mainly feed on the foliage and at night (Ahmed *et al.* 1977). They are not likely to be feeding on grapes at the time of harvest.	Assessment not required	Assessment not required	No
Adoretus versutus Harold, 1869 [Scarabaeidae] Rose beetle	Yes (CABI 2012)	No records found	No Larvae feed underground on roots of vine and surrounding vegetation; adults feed on foliage (CABI 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Carpophilus humeralis (Fabricius, 1758) [Nitidulidae] Pineapple sap beetle	Yes (DPP 2007)	Yes (Hossain and Williams 2003; Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No
Cerosterna scabrator (Fabricius, 1781) [Cerambycidae] Babul-root boring longicorn	Yes (DPP 2007)	No records found	No The adult beetles feed on the outer bark and lay eggs on the trunk of the vine, or stem and the larvae bore directly into the stem (NHB 2009). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Chlorophorus annularis (Fabricius, 1787) [Cerambycidae] Bamboo longhorn beetle	Yes (CABI 2012)	Yes (McKeown 1947) NSW, Qld, Vic (Plant Health Australia 2001b) Not known to be present in WA (Poole 2010).	No Larvae of this species attack roots and stems, while adult beetles feed on flowers (Walker 2008). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Melolontha melolontha (Linnaeus, 1758) [Scarabaeidae] White grub cockchafer	Yes (DPP 2007)	No records found	No Larvae feed underground on roots of vine and surrounding vegetation; adults feed on foliage (CABI 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Phyllophaga spp. [Scarabaeidae] White grubs	Yes (DPP 2007)	No *Phyllophaga* is a very large genus of scarab beetles in the subfamily Melolonthinae. In Australia, the subfamily Melolonthinae is represented by the genera *Dermolepida* and *Lepidiota*, rather than *Phyllophaga* (CABI 2015).	No Larvae feed on roots of its hosts and adults feed on foliage and fruits of orchard trees (CABI 2012). However, no records have been found which associate this genus with grape bunches.	Assessment not required	Assessment not required	No
Scelodonta strigicollis (Motschulsky, 1866) [Eumolphidae] Grape flea beetle	Yes (Bournier 1977)	No records found	No Larvae feed underground on roots of vine and the adults feed on the leaves, specifically the buds (Bournier 1977). They have only been reported to scrape unripe berries (Kulkarni 1971) and would not be expected to be present at time of harvest for mature berries.	Assessment not required	Assessment not required	No
Sinoxylon anale (Lesne, 1897) [Bostrichidae] Auger beetle	Yes (Mathew 1987)	Yes (CSIRO 2005a)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Sthenias grisator (Fabricius, 1784) [Cerambycidae] Grapevine girdler, Long-horned beetle	Yes (NHB 2009)	No records found	No Larvae feed underground on roots of vine and surrounding vegetation, while the adults girdle around the main stem around 15 centimetres above ground level (NHB 2009). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Xylopsocus capucinus (Fabricius, 1781) [Bostrichidae] False powderpost beetle	Yes (Woodruff *et al.* 2011)	NSW, NT (Plant Health Australia 2001b) Not known to be present in WA.	No Larvae feed on roots and adults bore into stems (Woodruff *et al.* 2011). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Xylothrips flavipes (Illiger, 1801) [Bostrichidae] Auger beetle	Yes (Walker 2011)	Yes NSW, Qld, Vic., NT (Plant Health Australia 2001d) Not known to be present in WA.	No Adult and larvae bore into wood, for example trunk of vine (Walker 2011). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Xylosandrus crassiusculus (Motschulsky, 1866) [Bostrichidae] Asian ambrosia beetle	Yes (Keshavareddy *et al.* 2007)	No records found	No Adult and larvae bore into stems and trunks of host plant (CABI 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Xylosandrus compactus (Eichhoff 1875) [Bostrichidae] Shot-hole borer, Black twig borer	Yes (Keshavareddy *et al.* 2007)	No records found	No Adult and larvae bore into stems and trunks of vine (CABI 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Diptera						
Bactrocera correcta (Bezzi 1916) [Tephritidae] Guava fruit fly	Yes (Verghese *et al.* 2002; CABI 2012)	No records found	Yes Has been known to infect grapes (Mani 1992). A survey conducted in India to examine natural pests affecting ripe grape berries identified the emergence of *Bactrocera correcta* in insect cages for rearing purposes (Mani 1992).	Yes Known to be present in Sri Lanka, Pakistan, Nepal and Thailand (White and Elson-Harris 1992). In India it forms part of the *B. dorsalis* complex, which is important in terms of the pest's distribution, diverse host range, rapid population build up and potential economic damage (Satarkar *et al.* 2009).	Yes In India, this potential pest often occurs with serious pest species such as *B. zonata* and *B. dorsalis* (Kapoor 2002). This pest complex is considered one of the most important in world agriculture (Satarkar *et al.* 2009). *Bactrocera correcta* is known to affect citrus, mango, sandalwood, guava, peach (White and Elson-Harris 1992) and grapes (Mani 1992).	Yes (EP)

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Bactrocera dorsalis (Hendel, 1912) [Tephritidae] Oriental fruit fly	Yes (Verghese *et al.* 2002; Verghese *et al.* 2004; CABI 2012)	No records found	Yes Damage caused by *B. dorsalis* consists of punctures of the host tissue by adults during oviposition. They lay their eggs under the skin of fruits, and larvae subsequently feed on the fruit pulp (Chu and Tung 1996; Ye and Liu 2005).	Yes *Bactrocera dorsalis* has significant potential to become established and spread through areas of Australia. This is best shown by an incursion of the closely allied papaya fruit fly (*B. papayae)* (Drew and Hancock, 1994) in north Queensland during the mid-1990s.	Yes *Bactrocera dorsalis* can utilise more than 150 fruit species (Waite 2009). It is considered one of the five most important pests of agriculture in South East Asia (Waterhouse 1993). Females oviposit into the fruit of hosts, eggs hatch inside the fruit and the larvae consume the fruit pulp (CABI 2012).	Yes (EP)
Drosophila melanogaster Meigen, 1830 [Drosophilidae] Common fruit fly, Vinegar fly	Yes (DPP 2007)	Yes (CSIRO 2005a) NSW, Tas., Vic., WA (Plant Health Australia 2001d)	Assessment not required	Assessment not required	Assessment not required	No
Drosophila suzukii Matsumaram 1931 [Drosophilidae] Spotted wing drosophila	Yes (Guruprasad *et al.* 2010)	No records found	A pest risk assessment for *D. suzukii* will not be conducted in this risk analysis report for table grapes from India. There is existing policy for *D. suzukii* for all commodities, including table grapes, from all countries (DAFF Biosecurity 2013). A summary of pest information and previous assessment is presented in Chapter 4 of this report. Further information on existing policy can be found in the 'Final pest risk analysis report for *Drosophila suzukii*', published on 24 April 2013 (DAFF Biosecurity 2013).			

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Hemiptera						
Aleurocanthus spiniferus (Quaintance, 1903) [Aleyrodidae] Citrus blackfly	Yes (DPP 2007)	Yes NT, Qld (Plant Health Australia 2001d; ABRS 2009a; CABI 2015) No records found for WA.	No *Aleurocanthus spiniferus* is mainly associated with leaves (CABI-EPPO 1997a), primarily of citrus (Gyeltshen *et al.* 2008). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Aleurocanthus woglumi Ashby, 1915 [Aleyrodidae] Citrus blackfly	Yes (CABI-EPPO 1997b; CABI 2012)	No records found	No Although grapes are considered a minor host, *A. woglumi* is most commonly found on vegetative material, such as leaves and stems (Plant Health Australia 2009b; CABI 2012). Plant Health Australia (2009b) considered that this pest was not on the pathway. Eggs are laid on leaves and nymphs feed on the underside of leaves (CABI-EPPO 1997b).	Assessment not required	Assessment not required	No
Aleurodicus dispersus Russell, 1965 [Aleyrodidae] Spiralling whitefly	Yes (CABI 2012)	Yes NT, Qld (CSIRO 2005b; ABRS 2009a)	No Adults and nymphs only feed on leaves (CABI 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Aleurolobus taeonabae (Kuwana, 1911) [Aleyrodidae] Whitefly	No. Dubey and Ko (2009) reported *Aleurolobus taeonab e* as being present in India, however no actual records have been found. India has stated that *A. taeonabe* is absent from India (DPP 2012). Note: If the NPPO of India becomes aware of any records of this pest in India, it must inform Australia immediately and this pest categorisation may need to be reviewed accordingly.	No records found	Assessment not required	Assessment not required	Assessment not required	No
Aonidiella citrina (Coquillett, 1891) [Diaspididae] Yellow scale	Yes (EPPO 2011)	Yes NSW, SA, Vic., WA (Plant Health Australia 2001b; CABI 2012)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Aonidiella orientalis (Newstead, 1894) [Diaspididae] Oriental yellow scale, Oriental scale	Yes (DPP 2007; CABI 2012)	Yes (CSIRO 2005a) NT, Qld, WA (Plant Health Australia 2001b). It is present in Northern Australia as far south as 24°S (Gladstone) (Astridge and Elder 2005).	Assessment not required	Assessment not required	Assessment not required	No
Amrasca biguttula biguttula (Ishida, 1912) [Cicadellidae] Leafhopper	Yes (NRC 2013)	No records found	No The leafhopper *Amrasca biguttula biguttula* is associated with grapevine leaves in India (NRC 2013). It is associated with leaves of other hosts (CABI 2013) and no records have been found which associate this species with grape bunches..	Assessment not required	Assessment not required	No
Aphis fabae Scopoli, 1763 [Aphidae] Black bean aphid	Yes (DPP 2007)	No records found	No While this species attacks grapevine (USDA-APHIS 2002), it rests and feeds on leaves (Miles 1987) and is not associated with grape bunches (Ingels *et al.* 1998).	Assessment not required	Assessment not required	No
Aphis gossypii Glover, 1877 [Aphidae] Cotton aphid	Yes (DPP 2007)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Aphis spiraecola Patch, 1914 [Aphidae] Green citrus aphid	Yes (DPP 2007)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Arboridia viniferata Sohi & Sandhu, 1971 [Cicadellidae] Grapevine cicadellid	Yes (Sohi *et al.* 1975)	No records found	No This pest mainly attacks leaves (Sohi *et al.* 1975). While individuals may at times be on grape bunches, they are likely to jump off bunches of grapes during harvesting and grading.	Assessment not required	Assessment not required	No
Aspidiotus destructor Signoret, 1869 [Diaspididae] Coconut scale	Yes (DPP 2007)	Yes NSW, NT, Qld, Vic, WA (Plant Health Australia 2001b) WA (Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No
Ceroplastes rusci (Linnaeus, 1758) [Coccidae] Fig wax scale	Yes (DPP 2007)	Yes NT (Plant Health Australia 2001d; CSIRO 2005a) Permitted into WA (Government of Western Australia 2014)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Chrysomphalus dictyospermi [Diaspididae] Dictyospermum scale	Yes (Butani 1993)	Yes NSW, NT, Qld, SA (Plant Health Australia 2001b) No records found for WA. However, WA does not require mitigation measures for this pest for other hosts (such as citrus, peach or nectarine fruit) from Australian states where this pest is present (DAFWA 2014).	Assessment not required	Assessment not required	Assessment not required	No
Coccus hesperidum Linnaeus, 1758 [Coccidae] Brown soft scale	Yes (CABI 2012)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Daktulosphaira vitifoliae (Fitch, 1855) Synonym: *Viteus vitifoliae (*Fitch, 1855) [Phylloxeridae] Grapevine phylloxera	Yes (DPP 2007; CABI 2012)	Yes Present only in isolated areas of Vic. and NSW. The pest is under official control in these areas and strict quarantine conditions apply (NVHSC 2005; PGIBSA 2009).	Yes The first instar 'crawler' stage is the most dispersive stage and can be found on the soil surface and on the foliage or fruit of vines (Buchanan and Whiting 1991).	Yes *Daktulosphaira vitifoliae* is already established in small areas of Australia, where it is under official control (NVHSC 2008). In Australia, several generations develop in each growing season (NVHSC 2005). *Daktulosphaira vitifoliae* can be spread by human activities, notably movement of grapevine nursery stock and related products including soil associated with infested roots (e.g. carried on footwear or vehicle tyres). Harvesting machinery, other equipment and tools are also implicated with its spread (NVHSC 2005). The potential for spread on harvested table grapes is also a concern (Buchanan and Whiting 1991).	Yes *Daktulosphaira vitifolia e* only causes direct harm to grapevines (*Vitis* spp.). The only reliable control measure for *D. vitifoliae* is the complete removal of infested vines and their replacement with grapevines grown on resistant rootstock (Buchanan and Whiting 1991).	Yes (EP)
Diaspidiotus perniciosus (Comstock, 1881) [Diaspididae] San José scale	Yes (CABI 2012)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b) WA (Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Dysmicoccus brevipes (Cockerell, 1893) [Pseudococcidae] Pineapple mealybug	Yes(Mani and Thontadarya 1987)	Yes NSW, NT, Qld, SA, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Empoasca fabae (Harris, 1841) Synonym: *Empoasca mali* (Baron, 1853) [Cicadellidae] Potato leaf hopper	Yes (Prasad 1960)	No records found	No *Empoasca fabae* can cause significant injury to vineyards, causing leaf cupping, reduced shoot growth, and leaf yellowing (Isaacs 2007; Integrated Pest Management Center 2007; Isaacs and van Timmeren 2009). Adults are very active, jumping or flying when disturbed. The immature forms, or nymphs run forward, backward or sideways when disturbed (Isaacs 2007). This pest is unlikely to remain on the host during harvesting.	Assessment not required	Assessment not required	No
Empoasca vitis (Göthe, 1875) [Cicadellidae] Smaller green leafhopper, Vine leaf hopper	Yes (DPP 2007)	No records found	No Attacks leaves and feeding causes scorching (Pavan *et al.* 1998; CABI 2012). This pest is unlikely to remain on the host during harvesting.	Assessment not required	Assessment not required	No
Eulecanium tiliae (Linnaeus, 1758) [Coccidae] Nut scale, Brown gooseberry scale	Yes (DPP 2007)	Yes (ALA 2013) Tas., WA (Plant Health Australia 2001d)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Ferrisia virgata (Cockerell, 1893) [Pseudococcidae] Striped mealybug	Yes (DPP 2007)	Yes (Poole 2010; CABI 2012) NSW, NT, Qld, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Halyomorpha halys (Stål, 1855) [Pentatomidae] Brown marmorated stink bug	Yes (Nielsen *et al.* 2008)	No records found	No In grapes, *H. halys* adults suck sap from the fruit and the nymphs feed on leaves, stems and fruit (Zhang 2005). Pentatomid bugs are not likely to be carried by fruit because they characteristically drop from their hosts when disturbed, or fly off (Alcock 1971).	Assessment not required	Assessment not required	No
Helopeltis antonii Signoret, 1858 [Miridae] Tea bug	Yes (Devasahayam and Nair 1986)	No records found	No Feeds on tender leaves and developing fruits (Puttarudriah and Appanna 1955). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Hemiberlesia lataniae (Signoret, 1869) Synonyms: *Aspidiotus lataniae* (Signoret, 1869); *Aspidiotus cydoniae* (Comstock, 1881) [Diaspididae] Latania scale, Quince scale	Yes (Miller and Davidson 2005; DPP 2007)	Yes (CSIRO 2005a) NSW, NT, Qld, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Icerya purchasi (Maskell, 1876) [Monophlebidae] Cottony cushion scale	Yes (Kapur 1949; Verma *et al.* 2012)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001a)	Assessment not required	Assessment not required	Assessment not required	No
Icerya seychellarum (Westwood, 1855) [Monophlebidae] Seychelles scale	Yes (DPP 2007)	Yes (DAFWA 2008; ALA 2013) NSW, NT, Qld, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Jacobiasca lybica (Bergevin & Zanon, 1922) Synonym: *Chlorita lybica* (Bergevin & Zanon 1922) [Cicadellidae] Cotton jassid	Yes (DPP 2007)	No records found	No Attacks leaves and feeding causes scorching (INRA 1997b). This species is unlikely to remain on the host during harvesting.	Assessment not required	Assessment not required	No
Maconellicoccus hirsutus (Green, 1908) [Pseudococcidae] Pink hibiscus mealybug	Yes (Mani and Thontadarya 1987; DPP 2007)	Yes NT, Qld, Vic., WA (Plant Health Australia 2001d)	Assessment not required	Assessment not required	Assessment not required	No
Macrosiphum euphorbiae (Thomas, 1878) [Aphididae] Potato aphid	Yes (DPP 2007)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001d)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Myzus persicae (Sulzer, 1776) [Aphididae] Green peach aphid	Yes (CABI-EPPO 1979)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b) *Myzus persicae* can vector *Broad bean wilt virus 2* (BBWV 2)(Zhou 2002), a potential virus of grapevine (Martelli 1999). BBWV 2 is present in India (Mali *et al.* 1977; CABI 2012) and is also present in NSW (Schwinghamer *et al.* 2007) and may be present in Qld (Plant Health Australia 2001b), but is not known to occur in WA. Although *M. persicae* is present in Australia, the potential for *M. persicae* carrying BBWV 2 warrants further assessment for this species. .	No Although reported from grapes in spring, *M. persicae* is likely to be present only as transients (Flaherty *et al.* 1992). Watson (1923) reported *M. persicae* on the leaves and tender stems of grapevine, but did not consider this species to be a berry feeder. *Myzus persicae* has been reported on grapevine flower clusters in California on one occasion (Flaherty *et al.* 1992). It has not been reported feeding on grape bunches but has been reported on the fruit of other hosts (Gildow *et al.* 2004). Also, *M. persicae* can only vector BBWV 2 for a maximum of two hours after feeding (Zhou 2002). No records have been found of virus acquisition from infected berries by *M. persicae.*	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Nipaecoccus nipae (Maskell, 1893b) [Pseudococcidae] Coconut mealybug	Yes (Ben-Dov 2012c)	No records found	No This pest occurs on the foliage of its host plants (Ben-Dov 2012c). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Nipaecoccus viridis (Newstead 1894) [Pseudococcidae] Spherical mealybug	Yes (Mani and Thontadarya 1987; DPP 2007)	Yes NT, Qld, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Nysius niger Baker, 1906 [Lygaeidae] Northern false chinch bug	Yes (DPP 2007)	No records found	No Species of *Nysius* pierce the leaves and buds with toxic saliva, which damages the leaves and buds and causes leaf fall (Bournier 1977). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Parasaissetia nigra (Nietner, 1861) [Coccidae] Pomegranate scale	Yes (DPP 2007)	Yes NSW, NT, Qld, SA, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Parthenolecanium corni (Bouché, 1844) [Coccidae] European fruit lecanium, Plum scale, Peach scale	Yes (Bhagat *et al.* 1991; DPP 2007; CABI 2012)	Yes Tas. (Plant Health Australia 2001b), NSW and Vic. (Snare 2006). Not known to be present in WA (Poole 2010).	Yes This species sucks sap from branches, leaves and fruit of grapevines (Zhang 2005). Due to their small size and habit of feeding in concealed areas on plant material and fruit, they are frequent invasive species (Miller *et al.* 2007).	Yes This pest is widely distributed in temperate and subtropical regions (Ben-Dov 2012a). This pest is highly polyphagous, attacking some 350 plant species placed in 40 families (Ben-Dov 2012a). Many of these host plants are available in Western Australia.	Yes This pest is highly polyphagous, attacking some 350 plant species placed in 40 families (Ben-Dov 2012a). It has been observed to cause heavy infestation and damage to *Vitis vinifera* in the Kasmir Valley (Bhagat *et al.* 1991) and is the most widespread and injurious soft scale in French vineyards (Sforza *et al.* 2003). Trees infested with *P. lecanium* lose leaves and decrease their annual growth while heavy infestations lead to fungal growth on the honeydew secretions (David'yan 2008).This species also transmits viruses (Ben-Dov 2012a).	Yes (EP, WA)
Parthenolecanium persicae (Fabricius, 1776), [Coccidae] Peach scale, Grapevine scale	Yes (CABI 2012)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Perissopneumon ferox Newstead, 1900 [Monophlebidae]	Yes (DPP 2007)	No records found	Yes Infests the fruit stalk, inflorescence and fruit (DPP 2012).	Yes Susceptible hosts (for example mango, citrus and neem) (Ben-Dov 2012b) are present in Australia.	No In an orchard in the Lucknow district, India, *P. ferox* heavily infested mango trees in 1980 (Srivastava and Verghese 1985). *Perissopneumon ferox* has also been reported in the 1980s in India on custard apple and guava (Shukla and Tandon 1984; Tandon and Verghese 1987). Since then, only limited evidence has been published of this species causing economic damage on any host. Therefore, this species is not considered further.	No
Pinnaspis strachani (Cooley, 1899) [Diaspididae] Lesser snow scale	Yes (DPP 2007; CABI 2012)	Yes NSW, NT, Qld, WA (Plant Health Australia 2001b) SA, WA (Brookes 1964)	Assessment not required	Assessment not required	Assessment not required	No
Planococcus citri (Risso, 1813) [Pseudococcidae] Citrus mealybug	Yes (Mani and Thontadarya 1987; DPP 2007)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Planococcus ficus (Signoret, 1875) [Pseudococcidae] Grapevine mealybug	Yes (Ben-Dov 2012c)	No records found	Yes Mealybugs occupy the main stems of the vines, but move to the new growth areas, such as leaves and grape bunches as the season progresses (Walton and Pringle 2004a). They have been known to accumulate in grape clusters (Millar *et al.* 2002).	Yes The grapevine mealybug can have up to four to six generations per year (Millar *et al.* 2002) and is very polyphagous, causing damage to plants in over 11 families (Ben-Dov 2012c). The grapevine mealybug occurs in many countries including Argentina, Brazil, Egypt, France, Mexico, Russia, South Africa and United States of America (Ben-Dov 2012c). Environments with climates similar to these regions exist in various parts of Australia, suggesting that *P. ficus* has the potential to establish and spread in Australia.	Yes *Planococcus ficus* is a key pest in vineyards worldwide (Millar *et al.* 2002; Walton and Pringle 2004b; Ben-Dov 2012c). This pest has the ability to destroy a grape crop, cause progressive weakening of vines through early leaf loss (Walton and Pringle 2004b; Walton *et al.* 2006). In the last decade, economic losses from this pest in Californian vineyards have increased dramatically (Millar *et al.* 2002). The pest is also a major transmitter of numerous viruses and diseases (Millar *et al.* 2002; Walton and Pringle 2004a). It also excretes large amounts of honeydew on grapes (Walton and Pringle 2004b).	Yes (EP)

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Planococcus lilacinus Cockerell, 1905 [Pseudococcidae] Coffee mealybug	Yes (Tandon and Verghese 1987; MacLeod 2006; CABI 2012)	No records found	Yes This mealybug has been commonly recorded on grape bunches in surveys conducted in 1983 in Bangalore, India (Tandon and Verghese 1987).	Yes *Planococcus lilacinus* is extremely polyphagous, and feeds on various tropical, sub-tropical and shade trees and crops including cocoa, guava, mango, citrus, potato, coffee, custard apple, tamarind and grapes (Tandon and Verghese 1987; MacLeod 2006). This species has been reported from tropical regions around the world as well as China and Japan (Ben-Dov 2012c). Environments with climates similar to these regions exist in various parts of Australia, suggesting that *P. lilacinus* has the potential to establish and spread in Australia.	Yes *Planococcus lilacinus* is extremely polyphagous and can feed on plants in over 35 families (MacLeod 2006), including many crops which are commercially grown in Australia. This species has been identified as a serious threat to grape crops in India (Tandon and Verghese 1987).	Yes (EP)

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Planococcus minor (Maskell, 1897) Synonym: *Planococcus pacificus* Cox, 1981 [Pseudococcidae] Pacific mealybug	Yes (DPP 2007)	Yes (Ben-Dov 2012c) NSW, NT, Qld, SA (Plant Health Australia 2001d) Not known to be present in WA (Poole 2010)	Yes This pest has been recorded on grape bunches in India (Batra *et al.* 1987).	Yes *Planococcus minor* is polyphagous attacking many wild and cultivated susceptible species; 250 host species in nearly 80 families are reported as hosts (Sugimoto 1994; Lit *et al.* 1998; Venette and Davis 2004; Ben-Dov 2012c). Susceptible hosts are freely available in Western Australia, suggesting a high probability that a suitable host would be found. Many species of mealybugs are considered invasive, rapidly becoming established when introduced into new areas (Miller *et al.* 2002).	Yes *Planococcus minor* is a pest of many economically important species (Venette and Davis 2004; Ben-Dov 2012c). It has potential to cause economic damage if introduced into Western Australia.	Yes (EP, WA)

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Pseudaulacaspis pentagona (Targioni Tozzetti, 1886) Synonym: *Diaspis pentagona* Targioni-Tozzetti, 1886 [Diaspididae] Mulberry scale	(Miller *et al.* 2012)	Yes NSW, Qld (Plant Health Australia 2001b) No records found for WA. However, WA does not require mitigation measures for this pest for other hosts (such as stonefruit) from Australian states where this pest is present (Poole *et al.* 2011; DAFWA 2014).	Assessment not required	Assessment not required	Assessment not required	No
Pseudococcus longispinus (Targioni Tozzetti, 1867) [Pseudococcidae] Long-tailed mealybug	Yes (DPP 2007; CABI 2012)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Rastrococcus iceryoides (Green, 1908) [Pseudococcidae] Downey snowline mealybug, Mango mealybug	Yes (Williams 1989; DPP 2007; CABI 2012; Ben-Dov 2012c).	No records found	Yes The pest has been recorded on grapevine in India (Williams 1989; Williams 2004). *Rastrococcus iceryoides* can be spread by humans on infested planting material (DPP 2012). Therefore, this mealybug may be present on the stems of grape bunches.	Yes When introduced into new areas, *Rastrococcus* species become particularly injurious to tropical fruit trees and other crop plants (Williams 1989). This is one of the most widespread and polyphagous of all *Rastrococcus* species (Williams 2004).	Yes *Rastrococcus iceryoides* is one of the most polyphagous species of *Rastrococcus*, occurring on plants belonging to diverse botanical families. It has been recorded attacking over 60 genera of plants in 36 families, including *Vitis vinifera* (Williams 2004; Ben-Dov 2012c).	Yes (EP)

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Saissetia coffeae (Walker, 1852) [Coccidae] Hemispherical scale	Yes (DPP 2007)	Yes NSW, NT, Qld, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Saissetia oleae (Olivier, 1791) [Coccidae] Black scale	Yes (Suresh and Mohanasundaram 1996; Ben-Dov 2013)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Singhius hibisci (Kotinsky, 1907) [Aleyrodidae] Hibiscus whitefly	Yes (Dubey *et al.* 2008)	No records found	No There is no information for this pest being on the export pathway (DPP 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Typhlocyba sp. [Cicadellidae] Leaf hopper	Yes (NHB 2009)	Uncertain as not identified to species level	No The nymphs and adults suck sap from the underside of leaves (NHB 2009). This pest is unlikely to remain on the host during harvesting.	Assessment not required	Assessment not required	No

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Hymenoptera						
Polistes dominula (Christ, 1791) Synonym: *Polistes dominulus* (Christ) [Vespidae] Paper wasp	Yes (Buck *et al.* 2008)	Yes WA (Plant Health Australia 2001d; ABRS 2009a)	No Although recorded as a pest of grapevine (Cranshaw *et al.* 2011), it is believed that no stage of the wasp's life cycle would be present on the commodity after harvesting and grading. The larvae feed on insects (Cranshaw 2008) and adults feed on nectar (Cranshaw *et al.* 2011).	Assessment not required	Assessment not required	No
Vespula germanica (Fabricus, 1793) [Vespidae] European wasp	Yes (Das and Gupta 1989)	Yes NSW, NT, SA, Tas., Vic., WA (Plant Health Australia 2001d)	Assessment not required	Assessment not required	Assessment not required	No
Lepidoptera						
Agrotis ipsilon (Hufnagel, 1766) [Noctuidae] Black cutworm	Yes (CABI 2012)	Yes NSW, NT, Qld, SA, Tas., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Agrotis segetum (Denis & Schiffermuller, 1775) [Noctuidae] Turnip moth	Yes (DPP 2007)	No records found	No Highly polyphagous, eggs are typically laid on soil; young larvae feed on foliage of plant; older larvae complete development mostly underground on roots (CABI 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No

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Ampelophaga rubiginosa Bremer & Grey 1853 [Sphingidae] Hawkmoth, grape horn worm	Yes (DPP 2007)	No records found	No Sphingids generally feed only on foliage (Common 1990) and this species has been reported on grapevines (Pittaway and Kitching 2012). The larvae feed only on leaves of grapevine (Zhang 2005).	Assessment not required	Assessment not required	No
Archips machlopis (Meyrick, 1912) Synonyms: *Cacoecia machlopis* Meyrick, 1912) [Tortricidae] Leaf rolling moth, Bell moth	Yes (Puttarudriah *et al.* 1961; Varma 1984; Vanitha *et al.* 2011) *Archips machlopis* has frequently been misidentified in the literature as *Archips micaceana.* Previous reports of *A .micaceana* in India are likely to be misidentifications of *A .machlopis* (Tuck 1990; Robinson *et al.* 1994; Rose and Pooni 2004; Meijerman and Ulenberg 2011)	No records found	Yes Table grapes are a host of *Archips machlopis*(Puttarudriah *et al.* 1961; Zhang 1994). *Archips machlopis* caused damage to grapevines at Bangalore and Mysore in India where the larvae fed under thin webbing on the epidermis of the leaves, the main stalks of the bunch and the berries themselves and pupated within the webbing (Puttarudriah *et al.* 1961).	Yes *Archips machlopis* larvae feed on a wide range of plants including cereals, citrus, coffee, cotton, grapes, ornamental crops, eucalypts, pome fruits, strawberry, mango and tea (Robinson *et al.* 2010). Many of these species are present in Australia. This pest has been reported from India, Burma, Indonesia, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand and Vietnam (Puttarudriah *et al.* 1961; Bharathie 1975; Varma 1984; Tuck 1990). Environments with climates similar to these regions exist in various parts of Australia, suggesting that *A .machlopis* has the potential to establish and spread in Australia.	Yes *Archips machlopis* has caused damage to grapevines at Bangalore and Mysore in India (Puttarudriah *et al.* 1961). This leafroller is polyphagous and causes considerable damage to eucalyptus seedlings (Varma 1984).	Yes

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Autographa gamma (Linnaeus, 1758) [Noctuidae] Silver-Y moth	Yes (DPP 2007)	No records found	No Larvae of this species scrape the skin from grapes and feed on the fruit contents (Abdullagatov and Abdullagatov 1986). However, larvae feed at night and shelter under leaves during the day (Venette *et al.* 2003).	Assessment not required	Assessment not required	No
Conogethes punctiferalis (Guenée, 1854) Synonym: *Dichrocrosis punctiferalis* Guenée, 1854 [Crambidae] Yellow peach moth, Castor capsule borer	Yes (DPP 2007)	Yes (Nielsen *et al.* 1996) NSW, NT, Qld, SA, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Cossus cossus (Linnaeus, 1758) [Cossidae] Goat moth	Yes (CABI 2012)	No records found	No Larvae bore within stems and trunks of grapevine (CABI 2012). Cossid moth larvae feed internally on the woody parts of plants (Grichanov 2009). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No

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Deilephila elpenor (Linnaeus, 1758) [Sphingidae] Large elephant hawkmoth	Yes (DPP 2007)	No records found	No This species has been reported on grapevines (Pittaway and Kitching 2012). However, Sphingids generally feed only on foliage (Common 1990). They oviposit on leaves while larvae feed on leaves, or occasionally stems, and pupate in the soil (Australian Museum 2009).	Assessment not required	Assessment not required	No
Eudocima fullonia (Clerck, 1764) Synonyms: *Ophideres fullonica* Linnaeus, 1758; *Otheris fullonia* (Clerck, 1764) [Noctuidae] Fruit-piercing moth, Fruit sucking moth, Orange piercing moth	Yes (DPP 2007)	Yes (Nielsen *et al.* 1996) NSW, NT, Qld, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

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Eupoecilia ambiguella (Hübner, 1796) Synonym: *Clysia ambiguella* Hübner (1825) [Tortricidae]	No Specimens labelled as *E .ambiguella* in the British Museum of Natural History (dating from 1889, 1890) were re-identified as *E. turbinaris* by JD Bradley in 1957 (CABI-EPPO 1986). India has stated that *E. ambiguella* is absent from India (DPP 2012). No information can be found to associate *E. turbinaris* with grapes.	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Hippotion celerio (Linnaeus 1758) [Sphingidae] Grapevine hawk moth, Silver-striped hawk-moth	Yes (Pittaway and Kitching 2012)	Yes NSW, NT, Tas., Vic., WA (Common 1990; Plant Health Australia 2001d; Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No

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Hyles livornica (Esper, 1779) [Sphingidae]	Yes (Krizek 1991)	No records found	No Feeds on leaves (Alford 2007). In plague proportions, this pest feeds on everything, including fruit (Mijuskovic and Badulovic 1960). However, this pest under those conditions was at the later larval stage, which is about 6 centimetres long, before feeding on grapes (Mijuskovic and Badulovic 1960) and these larvae would be seen and removed during harvesting and packing procedures.	Assessment not required	Assessment not required	No
Hyphantria cunea Drury, 1770 [Actiidae] *Mulberry moth, Fall webworm*	Yes (CABI 2012)	No records found	No *Hyphantria cunea* larvae feed on foliage only (FAO 2007a; Grichanov and Ovsyannikova 2009).	Assessment not required	Assessment not required	No
Mamestra brassicae (Linnaeus, 1758) Synonym: *Barathra brassicae* Linnaeus, 1758 [Noctuidae] Cabbage moth	Yes (DPP 2007)	No records found	No Larvae of this species feed only on foliage of grapevines (Ovsyannikova and Grichanov 2009b) and hide on the ground during the day (Carter 1984).	Assessment not required	Assessment not required	No
Oraesia emarginata (Fabricius, 1794) [Noctuidae] Fruit-piercing moth, Smaller oraesia	Yes (Zaspel and Branham 2008)	Yes (Nielsen *et al.* 1996) Qld (Plant Health Australia 2001b) Not known to be present in WA (Poole 2010).	No Though this species attacks grape berries (JSAE 1987), it feeds only at night and is not associated with grapevine during the day (Hattori 1969; Li 2004; MAFF 2008).	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Orgyia postica Walker, 1855 [Lymantriidae] Cocoa tussock moth	Yes (DPP 2007; CABI 2012)	No records found	No Larvae feed on leaves and pupate on leaves and stems (MAF Biosecurity New Zealand 2009). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Pergesa acteus (Cramer, 1779) [Sphingidae] Hawk moth	Yes (Pittaway and Kitching 2012)	No records found	No This species feeds on grapevines (JSAE 1987; Pittaway and Kitching 2012). However, Sphingids oviposit on leaves while larvae feed on leaves or occasionally stems and pupate in the soil (Common 1990; Australian Museum 2009).	Assessment not required	Assessment not required	No
Platyptilia ignifera Meyrick, 1908 [Pterophoridae] Large grape plume moth	Yes (Sidhu *et al.* 2010)	No records found	Yes Larvae bore into grape berries and feed internally on the fruit (Zhang 1994; MAFF 2008).	Yes Hosts, *Vitis* spp. are present in Australia. This species has 2–3 generations per year (MAFF 2008). *Platyptilia ignifera* is recorded from Japan, Taiwan (Zhang 1994) and India (Sidhu *et al.* 2010). Environments with climates similar to these regions exist in various parts of Australia, suggesting that *P .ignifera* has the potential to establish and spread in Australia.	Yes Infestation by larvae destroys grape berries (MAFF 2008). This species is considered an economic pest in its native range (Yano 1963; MAFF 2008).	Yes

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Spirama retorta (Clerck, 1764) [Noctuidae] Owlet moth, Fruit-sucking moth	Yes (Roychoudhury and Joshi 2011)	No records found	No Adults feed on fruit at night; they are not associated with grape during the day (Li 2004).	Assessment not required	Assessment not required	No
Spodoptera exigua (Hübner) [Noctuidae] Beet army worm	Yes (Phadke *et al.* 1978)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Spodoptera litura Fabricius, 1775 [Noctuidae] Taro caterpillar	Yes (DPP 2007)	Yes NSW, NT, Qld, Tas., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Stathmopoda auriferella (Walker, 1864) Synonym: *Stathmopoda crocophanes* Meyrick, 1897 [Oecophoridae] Apple heliodinid	Yes (Robinson *et al.* 2010)	Yes This species is synonymous with *S. crocophanes* (Kasy 1973), which is present in Qld, NSW, Tas., SA, WA (Meyrick 1897; Plant Health Australia 2001d; CSIRO 2005c).	Assessment not required	Assessment not required	Assessment not required	No
Sylepta lunalis (Guenee 1854) [Pyralidae]	Yes (Odak and Dhamdhere 1970)	No records found	No It is a leafroller and only affects the foliage (Odak and Dhamdhere 1970; Hill 1987).	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Theretra clotho (Drury, 1773) Synonym: *Sphinx clotho* (Drury, 1773) [Sphingidae] Hawk moth	Yes (DPP 2007)	Yes One record from Qld (Plant Health Australia 2001d) No records found for WA	No This species feeds on grapevine (Zhang 1994; Pittaway and Kitching 2006). However, Sphingids oviposit on leaves while larvae feed on leaves or occasionally stems and pupate in the soil (Australian Museum 2009). Adults feed on nectar (Common 1990).	Assessment not required	Assessment not required	No
Theretra latreillii lucasii (Walker, 1856) [Sphingidae]	Yes (Pittaway and Kitching 2012)	Yes One record of *Theretra latreillii* from Qld and eight from WA (Plant Health Australia 2001d). However, it is unclear whether the few records for Australia are the same species/subspecies as the one reported for India.	No This species feeds on grapevine (Zhang 1994; Pittaway and Kitching 2006). However, Sphingids oviposit on leaves while larvae feed on leaves or occasionally stems and pupate in the soil (Australian Museum 2009). Adults feed on nectar (Common 1990).	Assessment not required	Assessment not required	No
Theretra oldenlandiae Fabricius,1775 [Sphingidae] Impatiens hawkmoth, Vine hawkmoth	Yes (DPP 2007)	Yes NSW, NT, Qld, SA, Vic, WA (Plant Health Australia 2001d; CSIRO 2005a)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	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) [Arctiidae] Spotted cutworm	Yes (DPP 2007; CABI 2012)	No records found	No Larvae feed on foliage close to ground level at night and shelter in litter on the ground during the day (Washington State University 2008; Pfeiffer 2009). They are unlikely to be associated with the fruit at harvest (day-time) (Washington State University 2008; MAF Biosecurity New Zealand 2009).	Assessment not required	Assessment not required	No
Zeuzera coffeae Nietner, 1861 [Cossidae] Coffee carpenter	Yes (DPP 2007)	No records found	No Larvae bore into stems and trunks of grapevine (CABI 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Orthoptera						
Anacridium rubrispinum Bei-Bienko, 1948 [Acrididae] Red-spined tree locust	Yes (DPP 2007)	No records found	No Herbivore which attacks vegetative and flowering parts of trees and bushes including grapevines (CABI 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Schistocerca gregaria (Forskål, 1775) [Acrididae] Desert locust	Yes (CABI 2012)	No records found	No A general herbivore, attacking all soft parts of food plants (CABI 2012). This pest is 4–5 centimetres long (Davey 1954) and likely to be easily seen by pickers at harvest.	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Thysanoptera						
Haplothrips tenuipennis Bagnall, 1918 [Phlaeothripidae]	Yes (Verghese and Harish 2010)	Yes One record from 1980 in NSW on lucernce (Plant Health Australia 2001d). No records found for WA	No This species feeds on buds, inflorescences and leaves of mango (Srivastava 1997) and pollinates sapodilla feeding on pollen, nectar and stigmatic exudations (Mickelbart 1996). On grapevine in India, it is mainly associated with tender leaves and flowers (Verghese and Harish 2010).	Assessment not required	Assessment not required	No
Karnyothrips flavipes Jones, 1912 [Phlaeothripidae]	Yes (Verghese and Harish 2010)	Yes. Qld (Plant Health Australia 2001d) No records found for WA	No On grapevine in India, this species is mainly associated with tender leaves and flowers (Verghese and Harish 2010). It is a predatory thrips feeding on other arthropods on a wide variety of plants (Pitkin 1976; Jaramillo *et al.* 2010).	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Retithrips syriacus (Mayet 1890) [Thripidae] Black vine thrips	Yes (Lal and Pillai 1981; DPP 2007; CABI 2012)	No records found	Yes This species is principally a pest of grapevine (Medina-Gaud and Franqui 2001). It has been recorded causing serious levels of berry scarring and heavy yield losses in India (Reddy 2006).	Yes Grapes are considered a major host for this species and it occurs in large numbers in Southern India (Mound 2005). It affects various crops such as cotton, roses and cassava, and has been observed breeding on *Ricinus sp*. and *Diospyros kaki* (Lal and Pillai 1981). Some of these hosts are present in Australia. *Retithrips syriacus* is found in Brazil, India, Iraq, Israel, Tunisia and USA (CABI 2012). Environments with climates similar to these regions exist in various parts of Australia, suggesting that *R. syriacus* has the potential to establish and spread in Australia.	Yes It has been listed as an insect species which is responsible for heavy losses in grapevines, affecting both the yield and aesthetic look of the grapes (Reddy 2006). *Retithrips syriacus* affects its hosts by defoliating and shrivelling the leaves, marring the fruit with scars and staining the fruit by abdomen droplets which contain faeces (Medina-Gaud and Franqui 2001).	Yes (EP)

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Rhipiphorothrips cruentatus Hood, 1919 [Thripidae] Grapevine thrips, Rose thrips	Yes (Bournier 1977; Bindra and Varma 1979; Lakra and Dahiya 2000; DPP 2007; CABI 2012)	No records found	Yes *Rhipiphorothrips cruentatus* is a polyphagous species feeding on the fruit, stems and leaves of various crops such as grape, guava, mango and jamun (Dahiya and Lakra 2001). The grape berries develop a corky layer and become brown (Kulkarni *et al.* 2007).	Yes *Rhipiphorothrips cruentatus* is a polyphagous species attacking a number of commercial host plants (Dahiya and Lakra 2001) including cashew nut, sugarapple, mango, pomegranate and guava (CABI 2012), some of which are present in Australia. *Rhipiphorothrips cruentatus* is found in Afghanistan, Bangladesh, China, India, Oman, Myanmar, Pakistan, Sri Lanka and Thailand (CABI 2012). Environments with climates similar to these regions exist in various parts of Australia, suggesting that *R. cruentatus* has the potential to establish and spread in Australia.	Yes *Rhipiphorothrips cruentatus* is a serious pest of grapevine in the Punjab, sucking the sap from the lower surface of the leaves and causing russetting and scarring of grapes (Batra *et al.* 1980).	Yes (EP)
Scirtothrips dorsalis Hood, 1919 [Thripidae] Chilli thrips, Oriental tea thrips, Castor thrips, Strawberry thrips	Yes (CABI 2012)	Yes NSW, NT, Qld (Plant Health Australia 2001b), WA (Government of Western Australia 2013)	Assessment not required	Assessment not required	Assessment not required	No
Selenothrips rubrocinctus (Giard 1901) [Thripidae] Red-banded thrips	Yes (CABI 2012)	Yes NSW, NT, Qld, SA, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Streothrips arorai Bhatti [Aeolothripidae]	Yes (Verghese and Harish 2010)	No records found	No This family of thrips feeds on floral tissues and insects (Mound 2009).	Assessment not required	Assessment not required	No
Scirtothrips citri (Moulton, 1909) [Thripidae] Citrus thrips, California citrus thrips	Yes (Dadmal *et al.* 2001; CABI 2012), on citrus (Dadmal *et al.* 2001)	No records found	No *Scirtothrips citri* has only been recorded on citrus in India. The records of *S. citri* on grapevine appear to be limited to the southern part of North America where it is considered a minor pest of grapevine (Cline 1986).	Assessment not required	Assessment not required	No
Thrips hawaiiensis (Morgan, 1913) [Thripidae] Banana flower thrips, Hawaiian flower thrips	(DPP 2007)	Yes NSW, NT, Qld, SA, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Thrips tabaci Lindeman 1889 [Thripidae] Potato thrips, Onion thrips	Yes (DPP 2007)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b; Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No

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Xylaplothrips sp. [Phlaeothripidae]	Yes (Verghese and Harish 2010)	Uncertain as not identified to species level. Some species of *Xylaplothrips* are present in Australia-ACT, NSW, WA (ABRS 2009a), Qld, (Plant Health Australia 2001d; ABRS 2009a).	No Species of *Xylaplothrips* feed on fungi, other insects and grain seeds (Collyer 1976; ICRISAT 1985; Singh *et al.* 2010). On grapevine in India, this species is mainly associated with tender leaves and flowers (Verghese and Harish 2010). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Trombidiformes						
Brevipalpus californicus (Banks, 1904) [Tenuipalpidae] Citrus flat mite	Yes (DPP 2007)	Yes NSW, NT, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Brevipalpus lewisi McGregor, 1949 [Tenuipalpidae] Citrus flat mite, Grape bunch mite	Yes (Dhooria *et al.* 2005)	Yes NSW, SA, Vic., WA (Plant Health Australia 2001b; Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No
Brevipalpus phoenicis (Geijskes, 1930) [Tenuipalpidae] False spider mite	Yes (Rather 1999)	Yes NT, NSW, SA (Plant Health Australia 2001b) WA (Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No
Calepitrimerus vitis (Nalepa, 1905) [Eriophyidae] Grape leaf rust mite	Yes (DPP 2007)	Yes NSW, SA, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Colomerus vitis (Pagenstecher, 1857) [Eriophyidae] Grape gall mite	Yes (Rather 1999)	Yes NSW, SA, Vic., WA (Plant Health Australia 2001b) Qld, Tas. (CSIRO 2005a)	Assessment not required	Assessment not required	Assessment not required	No
Eotetranychus truncatus Estebanes and Baker 1968 [Tetranychidae] Spider mite	Yes (Rather 1999)	No records found	No This mite is known to mainly feed on leaves, which lead to leaf yellowing and premature leaf fall (Gupta and Dhooria 1972; Rather 1999). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Eutetranychus orientalis (Klein, 1936) [Tetranychidae] Oriental spider mite	Yes (Rather 1999)	Yes NSW, NT, Qld, WA (Plant Health Australia 2001b) Qld (Walter *et al.* 1995)	Assessment not required	Assessment not required	Assessment not required	No
Oligonychus coffeae (Nietner, 1861) [Tetranychidae] Tea red spider mite	Yes (Dhooria 2003; DPP 2007)	Yes NSW, NT, Qld (Plant Health Australia 2001b) WA (Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No
Oligonychus mangiferus (Rahman & Sapra, 1940) [Tetranychidae] Mango red spider mite	Yes (Nassar and Ghai 1981)	Yes Qld (Plant Health Australia 2001d) WA (Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Oligonychus vitis (Zaher & Shehata, 1965) [Tetranychidae] Grape spider mite	Yes (Rather 1999)	No records found	No Primarily feeds on foliage and lays eggs on the bases of leaf buds or in scars in wood. Larvae move towards leaves and are found on upper and lower surfaces of leaves and shoots (Gonzalez 1983). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Panonychus citri (McGregor 1916) [Tetranychidae] Citrus red mite	Yes (DPP 2007; CABI 2012)	Yes NSW (Plant Health Australia 2001d) NSW, SA (CSIRO 2005b) Not known to be present in WA (Poole 2010).	No Though this species attacks grapevine (Wu and Lo 1989; Migeon and Dorkeld 2012), feeding occurs on leaves (Jeppson *et al.* 1975). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Panonychus ulmi (Koch, 1836) [Tetranychidae] European red spider mite	Yes (DPP 2007)	Yes NSW, SA, Tas., Vic., WA (Plant Health Australia 2001b) WA (Botha and Learmonth 2005; Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No
Polyphagotarsonemus latus (Banks, 1904) [Tarsonemidae] Broad mite	Yes (DPP 2007)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Tetranychus cinnabarinus (Boisduval, 1867) [Tetranychidae] Carmine spider mite	Yes (DPP 2007)	Yes (Halliday 1998) all states and territories (CSIRO 2005a) WA (Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No
Tetranychus kanzawai Kishida, 1927 Synonym: *Tetranychus hydrangea* [Tetranychidae] Kanzawa spider mite	Yes (DPP 2007)	Yes Qld, NSW (Gutierrez and Schicha 1983; Navajas *et al.* 2001; CSIRO 2005a). Not known to be present in WA (Poole 2010).	Yes *Tetranychus kanzawai* mites and webbing are often found on the under surfaces of the leaves, but can occasionally attack and breed on grape berries (Ho and Chen 1994; Ashihara 1996; CABI 2012).	Yes Major hosts are groundnut, tea, pawpaw, citrus, soybean, peach, apple, cherry, aubergine, watermelon and grapevine (Moon *et al.* 2008; Migeon and Dorkeld 2012; CABI 2012), which are present in Western Australia. This species is recorded from China, Greece, India, Japan, Korea and Mexico (Migeon and Dorkeld 2006). It has also been introduced to, and has successfully established in, Queensland and NSW (Gutierrez and Schicha 1983). Environments with climates similar to these regions exist in various parts of Western Australia, suggesting that *T. kanzawai* has the potential to establish and spread in WA.	Yes *Tetranychus kanzawai* is a significant polyphagous pest subject to quarantine measures in many parts of the world (Navajas *et al.* 2001).	Yes (EP, WA)

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Tetranychus neocaledonicus (Andre, 1933) [Tetranychidae] Vegetable spider mite	Yes (Rather 1999)	Yes NSW, NT, Qld, WA (Plant Health Australia 2001b) WA (Poole 2010)	Assessment not required	Assessment not required	Assessment not required	No
Tetranychus urticae Koch, 1836 [Tetranychidae] Two-spotted spider mite	Yes (DPP 2007)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
BACTERIA						
Candidatus Phytoplasma asteris [16SrI Aster yellows group] Aster yellows phytoplasma Note: Phytoplasmas classified in subgroups 16SrI-A, 16SrI-B and 16SrI-C ('*Candidatus* Phytoplasma asteris'-related strains) are associated with grapevine yellows in several countries (Bianco *et al.* 1994; Alma *et al.* 1996; Davis *et al.* 1998). The strains related to 'Ca. Phytoplasma asteris' comprises of a large number of related phytoplasmas worldwide, representing the most diverse and widespread phytoplasma group (Lee *et al.* 2004). Although there is relatively high similarity in the 16S rDNA sequence, the strains in this group occupy diverse ecological niches and show substantial genetic variation (Firrao *et al.* 2005).	Yes (DPP 2007)	No records found Australia has *Candidatus* Phytoplasma australiense (Australian grapevine yellows) and *Candidatus* Phytoplasma asteris-related (Buckland Valley grapevine yellows) (Streten and Gibb 2006).	Yes Infects the phloem, causing grapevine yellows (Weintraub and Jones(eds) 2010). Several molecularly distinct phytoplasma groups that cause grapevine yellows have been identified (Hren *et al.* 2009).	No The Aster yellows group are not seed transmissible (Lee *et al.* 2000; CABI 2012). The Aster yellows group is graft transmissible, long-distance dissemination may occur through propagative material (Belli *et al.* 2010; CABI 2012). Aster yellows are also vector transmissible, the primary vectors are not found in Australia and are unlikely to be transmitted from the fruit bunch to a suitable host plant (Plant Health Australia 2001b; Weintraub and Beanland 2006; ABRS 2009b; Wilson and Turner 2010; Krüger *et al.* 2011; CABI 2012).	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Candidatus Phytoplasma asteris subgroup C [16SrI-C Aster yellows group] Clover phyllody phytoplasma	Yes (Singh *et al.* 1983; DPP 2007)	No records found Australia has *Candidatus* Phytoplasma australiense (Australian grapevine yellows) and *Candidatus* Phytoplasma asteris-related (Buckland Valley grapevine yellows) (Streten and Gibb 2006).	Yes Infects the phloem, causing grapevine yellows (Weintraub and Jones(eds) 2010). Several molecularly distinct phytoplasma groups that cause grapevine yellows have been identified (Hren *et al.* 2009).	No The Aster yellows group are not seed transmissible (Lee *et al.* 2000; CABI 2012). The Aster yellows group are graft transmissible, long-distance dissemination may occur through propagative material (Lee *et al.* 2000; CABI 2012). The Aster yellows group are also vector transmissible, the primary vectors are not found in Australia and are unlikely to be transmitted from the fruit bunch to a suitable host plant (Plant Health Australia 2001b; Weintraub and Beanland 2006; ABRS 2009b; Wilson and Turner 2010; CABI 2012).	Assessment not required	No
Pantoea agglomerans (Beijerinck 1888) Gavini *et al.* 1989 Synonym: *Erwinia herbicola* (Lohnis 1911) Dye 1964 [Enterobacteriales: Enterobacteriaceae] Bacterial grapevine blight	Yes (Pathak and Verma 2009)	Yes NSW, Vic., WA (Wilkinson *et al.* 1994; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

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Pseudomonas syringae pv. *syringae* van Hall 1902 [Pseudomonadales: Pseudomonoadaceae] Bacterial canker	Yes (CABI 2012)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Bradbury 1986; McCormick and Hollaway 1999; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Pseudomonas viridiflava (Burkholder 1930) Dowson 1939 [Pseudomonadales: Pseudomonoadaceae] Bacterial leaf blight of tomato	Yes (Shekhawat *et al.* 1999)	Yes NSW, Qld, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Rhizobium radiobacter (Beijerinck & van Delden 1902) Young *et al.* 2001 Synonym: *Agrobacterium tumefaciens* (Smith and Townsend 1907) Conn1942 [Rhizobiales: Rhizoboeaceae] Crown gall	Yes (CABI 2012)	Yes NSW, Qld, SA, Tas., Vic. (Plant Health Australia 2001b). WA (Shivas 1989).	Assessment not required	Assessment not required	Assessment not required	No
Rhizobium vitis (Ophel & Kerr 1990) Young *et al.* 2001 Synonym: *Agrobacterium vitis* (Ophel & Kerr 1990) [Rhizobiales: Rhizoboeaceae] Crown gall of grapevine	Yes (CABI 2012)	Yes NSW, SA, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Xanthomonas campestris pv. *viticola* (Nayudu 1972) Dye 1978 [Xanthomondales: Xanthomonadaceae] Grapevine bacterial canker disease, Leaf spot	Yes (Chand *et al.* 1999; Trindade *et al.* 2005; Jambenal 2008)	No records found	Yes Infects leaves, shoots and berries. Berries can develop brown and black lesions; infected berries are small and shrivelled (Chand and Kishun 1990).	Yes Host plants include mango (Trindade *et al.* 2005) and grapevine (Chand *et al.* 1999) which are both widely grown in Australia. This pathogen has spread and established in Brazil where it has become the most important bacterial disease of grapevines in the Sao Francisco region (Nascimento and Mariano 2004).	Yes The first incidence of this disease in India was in 1969. However, it became a major problem when it caused yield losses of up to 80% in 1986–87 (Chand *et al.* 1999). It is now a regular problem in the major grape growing regions of India (Chand *et al.* 1999; Jambenal 2008).	Yes

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Xylella fastidiosa Wells *et al.* (1987) Synonyms: *Xylella fastidiosa* subsp. *fastidiosa* Wells *et al.* (1987) [Xanthomondales: Xanthomonadaceae] Pierce's disease	Yes An isolated record from almonds in India in 1985 exists (Jindal and Sharma 1987). However, the phony peach chemical test the authors used to confirm the identity of the pathogen was based on a 1970s method. It is recommended that this record be confirmed by more modern methods (CABI 2012). No other records from India exist. India stated in their supplementary submission that *X. fastidiosa* is not present on table grapes in India (DPP 2012).	No records found	Yes It spreads systemically through xylem vessels and can be present where ever these tissues occur (Pearson and Goheen 1988).	No *Xylella fastidiosa* has been subject to rigorous assessment in context with the review of policy for the glassy winged sharpshooter, a vector of *X. fastidiosa*, in 2002 (Biosecurity Australia 2002) and with significant trade of table grapes into eastern Australian states since that time. Should new information suggest there is a change in the risk profile of this disease and/or its vectors, this would initiate a further review process to ensure appropriate measures are in place to reduce the risks posed to meet Australia's appropriate level of protection.	Assessment not required	No
CHROMALVEOLATA						
Phytophthora drechsleri Tucker [Peronosporales: Pythiaceae] Fruit rot	Yes (Farr and Rossman 2012)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Shepherd and Pratt 1973; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Plasmopara viticola (Berk. & M. A. Curtis) Berl. & De Toni [Peronosporales: Peronosporaceae] Grapevine downy mildew	Yes (DPP 2007; CABI 2012)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
FUNGI						
Alternaria alternata (Fr.) Keissl. [Pleosporales: Pleosporaceae] Alternaria leaf spot	Yes (DPP 2007; CABI 2012)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Alternaria tenuissima (Nees) Wiltshire [Pleosporales: Pleosporaceae] Alternaria leaf spot	Yes (Farr and Rossman 2012)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b; Pethybridge *et al.* 2003)	Assessment not required	Assessment not required	Assessment not required	No
Alternaria vitis Cavara [Pleosporales: Pleosporaceae] Grapevine alternariosis	Yes (Suhag *et al.* 1982; Farr and Rossman 2012)	No records found	No *Alternaria vitis* only infects leaves (Suhag *et al.* 1982).	Assessment not required	Assessment not required	No
Aplosporella beaumontiana S. Ahmad [Botryosphaeriales: Botryosphaeriaceae] Sooty mould	Yes (Rajak and Pandey 1985; Prakash and Raoof 1985)	No records found	No *Aplosporella beaumontiana* only infects dry stems and leaves (Sutton 1980; Rajak and Pandey 1985; Prakash and Raoof 1985; Damm *et al.* 2007). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Aspergillus fumigatus Fresen. Synonym: *Neosartorya fumigata* O'Gorman, H.T. Fuller & P.S. Dyer [Eurotiales: Trichocomaceae]	Yes (Farr and Rossman 2012)	Yes NSW, NT, Qld, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Aspergillus niger Tiegh. [Eurotiales: Trichocomaceae] Aspergillus ear rot, Black mould	Yes (Singh and Chohan 1974; DPP 2007; CABI 2012)	Yes ACT, NSW, NT, Qld, SA, Vic., WA (Shivas 1989; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Aspergillus terreus Thom [Eurotiales: Trichocomaceae]	Yes (Singh and Chohan 1974; Farr and Rossman 2012)	Yes NSW, Qld (Plant Health Australia 2001b) WA (Kelly *et al.* 1995) Cosmopolitan distribution (Farr and Rossman 2012)	Assessment not required	Assessment not required	Assessment not required	No
Aureobasidium pullulans (de Bary) G. Arnaud [Dothideales: Dothioraceae]	Yes (Sarbhoy *et al.* 1975; Farr and Rossman 2012)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Botryosphaeria dothidea (Moug.: Fr.) Ces. & De Not. Synonym*: Fusicoccum aesculi* Corda [Botryosphaeriales: Botryosphaeriaceae] Macrophoma rot	Yes (CABI 2012)	Yes NSW, Qld, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Botryosphaeria obtusa (Schwein.) Shoemaker [Botryosphaeriales: Botryosphaeriaceae] Dead arm, Canker	Yes (Rajak and Pandey 1985; Farr and Rossman 2012)	Yes ACT, NSW, Qld, SA, Vic., WA (Plant Health Australia 2001b; Cunnington *et al.* 2007)	Assessment not required	Assessment not required	Assessment not required	No
Botryosphaeria ribis Grossenb. & Duggar [Botryosphaeriales: Botryosphaeriaceae]	Yes (Farr and Rossman 2012)	Yes ACT, NSW, Qld, Vic., WA (Plant Health Australia 2001b; Sakalidis *et al.* 2011; Farr and Rossman 2012)	Assessment not required	Assessment not required	Assessment not required	No
Botryosphaeria stevensii Shoemaker Synonym: *Diplodia mutila* (Fr.: Fr.) Mont. [Botryosphaeriales: Botryosphaeriaceae]	Yes (Sharma and Bhardwaj 1999)	Yes ACT, NSW, Vic., WA (Plant Health Australia 2001b; Taylor *et al.* 2005; Farr and Rossman 2012)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Botrytis cinerea Pers.: Fr. Synonym: *Botryotinia fuckeliana* (de Bary) Whetzel [Helotiales: Sclerotiniaceae] Grey mould rot	Yes (DPP 2007; CABI 2012)	Yes ACT, NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Cercospora truncata Ellis & Everh. [Capnodiales: Mycosphaerellaceae]	Yes (Farr and Rossman 2012)	No records found	No *Cercospora truncata* only infects leaves (Robert *et al.* 2009; Farr and Rossman 2012). No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Cladosporium cladosporioides (Fresen.) G.A. de Vries 1952 [Capnodiales: Davidiellaceae]	Yes (Chakraborty *et al.* 2001)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b; Bensch *et al.* 2010)	Assessment not required	Assessment not required	Assessment not required	No
Cladosporium herbarum (Pers.: Fr.) Link Synonym: *Mycosphaerella tassiana* (De Not.) Johanson [Capnodiales: Davidiellaceae] Cladosporium rot	Yes (Farr and Rossman 2012)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b; Maxwell and Scott 2008)	Assessment not required	Assessment not required	Assessment not required	No
Colletotrichum acutatum J.H. Simmonds [Phyllachorales: Phyllachoraceae] Strawberry black spot	Yes (Kaur and Singh 1990; DPP 2007)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Cylindrocarpon destructans var. *destructans* (Zinssm.) Scholten Synonym: *Cylindrocarpon destructans* (Zinssm.) Scholten [Hypocreales: Nectriaceae]	Yes (Farr and Rossman 2012)	Yes ACT, NSW, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Elsinoë ampelina Shear Synonym: *Sphaceloma ampelinum* de Bary [Myriangiales: Elsinoaceae] Grape anthracnose, Berry rot, Black spot, Bird's eye spot	Yes (DPP 2007; CABI 2012)	Yes NSW, NT, Qld, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Epicoccum nigrum Link [Dothideales: Dothioraceae] Cereal leaf spot	Yes (Farr and Rossman 2012)	Yes ACT, NSW, Qld, Vic., WA (Nair 1985; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Erysiphe necator var. *necator* Schwein. Synonyms: *Erysiphe necator* Schwein., *Oidium tuckeri* Berk. [Erysiphales: Erysiphaceae] Grapevine powdery mildew	Yes (DPP 2007; CABI 2012)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Fusarium oxysporum Schltdl. [Hypocreales: Nectriaceae] Fusarium wilt	Yes (DPP 2007; CABI 2012)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Elmer *et al.* 1997; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Fusarium sacchari (E.J. Butler) W. Gams Synonym: *Gibberella sacchari* Summerell & J.F. Leslie [Hypocreales: Nectriaceae] Fusarium wilt	Yes (Leslie *et al.* 2005; DPP 2007)	Yes (Summerell *et al.* 2011) NSW (CABI 2015) NT (Summerell *et al.* 2011; Petrovic *et al.* 2013) Qld (Summerell *et al.* 2011) The distribution of *F. sacchari* in Australia is not well understood. No records were found for WA.	No Although *F. sacchari* has been reported on grapevine in India (DPP 2007), specific details on plant parts affected were not provided. No records have been found which associate this species with grape bunches.	Assessment not required	Assessment not required	No
Fusarium solani (Mart.) Sacc. Synonym: *Haematonectria haematococca* (Berk. & Broome) Samuels & Rossman [Hypocreales: Nectriaceae] Dry rot	Yes (Sharma *et al.* 1997; Farr and Rossman 2012)	Yes NSW, Qld, SA, Tas., Vic., WA (Elmer *et al.* 1997; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Fusarium subglutinans (Wollenw. & Reinking) P.E. Nelson, Toussoun & Marasas [Hypocreales: Nectriaceae] Damping off, Pitch canker	Yes (Rawal 1998; Farr and Rossman 2012)	Yes NSW, NT, Qld, Vic., WA (Elmer *et al.* 1997; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Fuscoporia gilva (Schwein.) T. Wagner & M. Fisch. Synonym: *Phellinus gilvus* (Schwein.) Pat. [Hymenochaetales: Hymenochaetaceae]	Yes (Farr and Rossman 2012)	Yes Known as *Phellinus gilvus* in NSW, NT, Qld, Vic., WA (Plant Health Australia 2001b).	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	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] Fruit rot	Yes (Badyal and Sumbali 1990; Farr and Rossman 2012)	Yes NSW, NT, Qld, Tas., Vic., WA (Wade and Morris 1982; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Glomerella cingulata (Stoneman.) Spauld. & H. Schrenk Synonym: *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. [Phyllachorales: Glomerellaceae] Anthracnose	Yes (Kaur and Singh 1990; Farr and Rossman 2012)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b). Tas. (Sampson and Walker 1982)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Greeneria uvicola (Berkley & M.A. Curtis) Punithalingam [Diaporthales: Gnomoniaceae] Bitter rot	Yes (Reddy and Reddy 1983)	Yes NSW, Qld (Plant Health Australia 2001b) Not known to be present in WA.	Yes Bitter rot can affect young shoots, stems of fruit bunches, pedicels and berries. *Greeneria uvicola* usually attacks berries via the pedicel. Within a few days of infection, berries soften and are bitter to taste; some are easily detached while others shrivel and mummify (McGrew 1988; Momol *et al.* 2007).	Yes In Australia, *G. uvicola* has been reported from north eastern New South Wales and Queensland (Sergeeva *et al.* 2001; Plant Health Australia 2001b; Steel *et al.* 2007). *Greeneria uvicola* has also been reported from Brazil, Costa Rica, Greece, India, Japan, New Zealand, South Africa and the USA (Sutton and Gibson 1977; Ullasa and Rawal 1986; McGrew 1988; Kummuang *et al.* 1996b; Steel 2007). Environments with climates similar to these regions exist in various parts of Western Australia suggesting that *G. uvicola* has the potential to establish and spread in Western Australia. Hosts are *Vitis* spp (Sutton and Gibson 1977; Farr *et al.* 2001), which are widely grown in Australia.	Yes *Greeneria uvicola* attacks many species of grape, including *Vitis vinifera* (European grape), *V. labrusca* (fox grape) and *V. rotundifolia* (muscadine grape) (Sutton and Gibson 1977; Farr *et al.* 2001). Affected berries shrivel and rot or become soft, bitter-tasting and are easily detached (McGrew 1988). *Greeneria uvicola* can also cause girdling of the shoots of *V. vinifera* cultivars (McGrew 1988). *Greeneria uvicola* has also been reported to cause rot on mature fruit of apple, cherry, strawberry, peach and banana under experimental conditions (Ridings and Clayton 1970).	Yes (EP, WA)

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Guignardia bidwellii (Ellis) Viala & Ravez Synonym: *Phyllosticta ampelicida* (Engelm.) Van der Aa [Botryosphaeriales: Botryosphaeriaceae] Black rot	Yes (Singh *et al.* 1999; DPP 2007; CABI 2012; Farr and Rossman 2012)	No records found	Yes Affects grape leaf, stem, peduncle and fruit (Ramsdell and Milholland 1988; NPQS 2007; CABI 2012). The pathogen attacks all parts of the vine, particularly the berry clusters (Singh *et al.* 1999).	Yes *Guignardia bidwelli* overwinters in mummified berries, either in the vine or on the ground. Ascospores are airborne and disperse moderate distances and conidia are splash dispersed only short distances (Wilcox 2003). *Guignardia bidwellii* has a range of hosts, including *Ampelopsis* spp., *Cissus* spp., *Citrus* spp., *Vitis* spp., *Arachis hypogaea* (peanut) and *Asplenium nidus* (bird's nest fern), which are widely distributed in home gardens, nurseries and orchards in Australia (Eyres *et al.* 2006; Farr and Rossman 2012).	Yes Black rot is an important fungal disease of grapes that originated in eastern North America, but now occurs in parts of Europe, South America and Asia (Wilcox 2003). Crop losses can range from 5 to 80% (Ramsdell and Milholland 1988) and are depending on weather, inoculum levels and cultivar susceptibility.	Yes (EP)
Lasiodiplodia theobromae (Pat.) Griffon & Maubl. Synonyms: *Botryodiplodia theobromae* Pat., *Botryosphaeria rhodina* (Berk. & Curtis) Arx [Botryosphaeriales: Botryosphaeriaceae] Lasiodiplodia cane dieback	Yes (DPP 2007; CABI 2012; Farr and Rossman 2012)	Yes NSW, NT, Qld, SA, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Macrophomina phaseolina (Tassi) Goid. [Sphaeropsidales: Sphaeropsidaceae] Charcoal rot	Yes (CABI 2012; Farr and Rossman 2012)	Yes ACT, NSW, NT, Qld, SA, Vic., WA (Plant Health Australia 2001b; Sergeeva *et al.* 2005b)	Assessment not required	Assessment not required	Assessment not required	No
Monilinia fructicola (G. Winter) Honey Synonym: *Monilia fructicola* L. R. Batra [Helotiales: Sclerotiniaceae] Brown rot	Yes (CABI 2012)	Yes ACT, NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Monilinia fructigena (Aderh. & Ruhland) Honey Synonym: *Monilia fructigena* (Pers.) Pers. [Helotiales: Sclerotiniaceae] Brown rot	Yes (Sharma and Kaul 1989; DPP 2007; CABI 2012)	No records found	Yes Causes raised light brown pustules on the fruit that often expand enclosing the fruit to form a dark, wrinkled, hard mummified fruit (USDA-APHIS 2004). Grape is not a primary host. The original record of *M. fructigena* on grape was in China (Qi *et al.* 1966 in Tai (1979)), which provided evidence of the anamorphic stage (*Monilia fructigena*) being associated with *Vitis vinifera*. This pathogen has also been reported to cause a soft brown rot of grape berries in both Italy and Japan (Ogata *et al.* 1999; Nanni *et al.* 2003).	Yes Brown rot disease caused by *M. fructigena* is a common and widespread disease of pome and stone fruit (Mackie *et al.* 2005), which are grown widely in Australia. The spores of this fungus can be spread from one orchard to another through wind and water (Jones 1990), as well as potentially being transported by various insects (CABI 2012).	Yes *Monilinia fructigena* produces raised light brown pustules that enclose the fruit to form a wrinkled and mummified fruit (USDA-APHIS 2004). *Monilinia fructigena* causes brown rot disease in pome and stone fruit which is the soft decay of fruit flesh and blighting of spurs and blossoms (Mackie *et al.* 2005). This results in significant pre- and post-harvest fruit losses and causes considerable economic losses worldwide (Jones 1990; Mackie *et al.* 2005). Brown rot is responsible for great losses to apple after harvest in Himachal Pradesh (Sharma and Kaul 1989). Extensive surveys between 1982–1985 revealed cumulative incidences of the disease varied from 2.0–14% (Sharma and Kaul 1989).	Yes (EP)

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Mucor circinelloides Tiegh. [Mucorales: Mucoraceae]	Yes (DPP 2007)	Yes NSW, Qld, Vic., WA (Plant Health Australia 2001d; Kew Royal Botanic Gardens 2014)	Assessment not required	Assessment not required	Assessment not required	No
Mucor racemosus Fresen. Synonym: *Mucor varians* Povah [Mucorales: Mucoraceae] Spongy storage rot	Yes (Farr and Rossman 2012)	Yes ACT, NSW, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Neofusicoccum mangiferae (Syd. & P. Syd.) Crous Synonyms: *Nattrassia mangiferae* (Syd. & P. Syd.) B. Sutton & Dyko; *Fusicoccum mangiferae* (Syd. & P. Syd.) G.I. Johnson, Slippers & M.J. Wingf. [as '*mangiferum*'] [Botryosphaeriales: Botryosphaeriaceae] Leaf spot, Stem end rot	Yes (DPP 2007; Farr and Rossman 2012)	Yes Qld (Plant Health Australia 2001b) In WA as *Nattrassia mangiferae* or *Fusicoccum mangiferum* and in Qld as *Fusicoccum mangiferum* (Plant Health Australia 2001b).	Assessment not required	Assessment not required	Assessment not required	No
Neoscytalidium dimidiatum (Penz.) Crous & Slippers Synonyms: *Hendersonula toruloidea* Nattrass; *Scytalidium dimidiatum* (Penz.) B. Sutton & Dyko [Botryosphaeriales: Botryosphaeriaceae]	Yes (Wangikar *et al.* 1969; Farr and Rossman 2012)	Yes NT, WA (Plant Health Australia 2001b) Qld as *Torula dimidiata* (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Passalora dissiliens (Duby) U. Braun & Crous Synonym: *Phaeoramularia dissiliens* (Duby) Deighton [Capnodiales: Mycosphaerellaceae]	Yes (Farr and Rossman 2012)	No records found	No *Passalora dissiliens* causes variable leaf spot symptoms (Deighton 1976). No report of association with grape bunches was found.	Assessment not required	Assessment not required	No
Penicillium aurantiogriseum Dierckx [Eurotiales: Trichocomaceae] Blue mould rot	Yes (Palejwala *et al.* 1988)	Yes NSW, Qld, Vic., WA (Plant Health Australia 2001b; Kew Royal Botanic Gardens 2014)	Assessment not required	Assessment not required	Assessment not required	No
Penicillium chrysogenum Thom [Eurotiales: Trichocomaceae]	Yes (DPP 2007; Farr and Rossman 2012)	Yes ACT, NSW, Qld, Tas., Vic. (Plant Health Australia 2001b) WA (Kew Royal Botanic Gardens 2014)	Assessment not required	Assessment not required	Assessment not required	No
Penicillium digitatum (Pers.) Sacc. [Eurotiales: Trichocomaceae] Green mould	Yes (CABI 2012)	Yes NSW, Qld, SA, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Penicillium expansum Link [Eurotiales: Trichocomaceae] Blue mould of stored apple	Yes (DPP 2007; CABI 2012)	Yes NSW, Qld, SA, Vic., WA (Plant Health Australia 2001b; CABI 2012)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Penicillium italicum Wehmer [Eurotiales: Trichocomaceae] Blue mould	Yes (CABI 2012)	Yes ACT, NSW, Qld, SA, Vic., WA (Plant Health Australia 2001b; CABI 2012)	Assessment not required	Assessment not required	Assessment not required	No
Pestalotiopsis funerea (Desm.) Steyaert [Xylariales: Amphisphaeriaceae] Leaf spot	Yes (Farr and Rossman 2012)	Yes NSW, Qld, Vic. (Plant Health Australia 2001b). Not known to be present in WA	No Affects leaves, stems and roots of its hosts (Mordue 1976). No report of association with grape bunches was found.	Assessment not required	Assessment not required	No
Pestalotiopsis mangiferae (Henn.) Steyaert [Xylariales: Amphisphaeriaceae] Grey leaf spot of mango	Yes (Verma *et al.* 1991; DPP 2007)	Yes NT, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Pestalotiopsis menezesiana (Bres. & Torr.) Bissett [Xylariales: Amphisphaeriaceae] Fruit rot	Yes (Mishra *et al.* 1974)	Yes NSW (Plant Health Australia 2001b; Sergeeva *et al.* 2005a) Not known to be present in WA	Yes Infects fruit (Mishra *et al.* 1974; Xu *et al.* 1999).	Yes *Pestalotiopsis menezesiana* infects *Cissus rhombifolia* (Bissett 1982), grapevine (Mishra *et al.* 1974; Xu *et al.* 1999), kiwifruit (Park *et al.* 1997) and plantain (Huang *et al.* 2007), which are present in Western Australia. *Pestalotiopsis menezesiana* is present in Australia (NSW), China, India, Japan and Korea (Mishra *et al.* 1974; Park *et al.* 1997; Xu *et al.* 1999; Plant Health Australia 2001b; Huang *et al.* 2007). Environments with climates similar to these regions exist in various parts of Western Australia.	Yes Grapevine, kiwifruit and plantain are commercially grown in Western Australia. This pathogen causes rot of grape berries (Mishra *et al.* 1974; Xu *et al.* 1999), leaf spot of kiwifruit (Park *et al.* 1997) and leaf spot of plantain (Huang *et al.* 2007).	Yes (EP, WA)

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Pestalotiopsis uvicola (Speg.) Bissett [Xylariales: Amphisphaeriaceae] Fruit rot, Berry rot, Leaf spot	Yes (Mohanan *et al.* 2005)	Yes NSW, Qld (Plant Health Australia 2001b) NSW (Sergeeva *et al.* 2005a) Not regulated for Tas. (DPIPWE 2011). Not known to be present in WA.	Yes Affects grape berries (Guba 1961; Xu *et al.* 1999; Sergeeva *et al.* 2005a).	Yes In Australia, *P. uvicola* has been reported from NSW and Qld (Plant Health Australia 2001a). This pathogen has also been reported from Brazil, France, Italy and the US (Guba 1961). Environments with climates similar to these regions exist in various parts of WA suggesting that *P. uvicola* has the potential to establish and spread in WA. Hosts include *Vitis vinifera*, *Laurus nobilis* and *Mangifera indica* (Xu *et al.* 1999; Vitale and Polizzi 2005; Ismail *et al.* 2013), which are grown in WA.	Yes Has been reported to cause post-harvest disease of grapes (Xu *et al.* 1999), leaf spot and stem blight of bay laurel (*Laurus nobilis*) (Vitale and Polizzi 2005) and leaf spot of mango (Ismail *et al.* 2013).	Yes (EP, WA)
Phakopsora ampelopsidis Diet. & P. Syd. [Pucciniales: Phakopsoraceae] Ampelopsis rust fungus	Yes (Punithalingam 1968)	No records found	No Revised distribution by Ono (2000) did not place this disease in India. This species does not infect *Vitis* spp. (Ono 2000).	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Phakopsora euvitis Y. Ono [Pucciniales: Phakopsoraceae] Grapevine leaf rust, grapevine rust, grapevine rust fungus	Yes (Leu 1988; DPP 2007; Persley and Magarey 2009; CABI 2012).	No Recorded in NT (Weinert *et al.* 2003) but has since been eradicated (EPPO 2007; IPPC 2008; Persley and Magarey 2009).	Yes Infects leaves of *Vitis vinifera* (CABI 2012)and young shoots (Li 2004). Occasionally infects rachises (Leu 1988).	Yes *Phakopsora euvitis* established in the Northern Territory before eradication (Weinert *et al.* 2003). Rust fungi spores are wind dispersed (Deacon 2005), and are produced abundantly in warm and humid weather (Persley and Magarey 2009). Hosts are *Vitis* spp. (Weinert *et al.* 2003), which are widely grown in Australia.	Yes Rust disease caused by *P. euvitis* is very destructive (Leu 1988). Heavy infection causes early senescence of the leaves and premature leaf fall. The disease can cause poor shoot growth, reduction of fruit quality and yield loss (CABI 2012).	Yes (EP)
Phoma betae A.B. Frank Synonym: *Pleospora betae* (Berl.) Nevod. F [Pleosporales: Pleosporaceae]	Yes (Farr and Rossman 2012)	Yes NSW, Qld, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Phoma glomerata (Corda) Wollenw. & Hochapfel [Pleosporales: Pleosporaceae] Phoma blight	Yes (Pandotra 1976; Farr and Rossman 2012)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Phomopsis viticola (Sacc.) Sacc. Synonyms: *Cryptosporella viticola* (Reddick) Shear; *Fusicoccum viticola* Reddick [Diaporthales: Valsaceae] Phomopsis cane and leaf spot, Excoriose (Europe), Dead arm (USA)	Yes (Lal and Arya 1982; DPP 2007; CABI 2012; Farr and Rossman 2012)	Yes (Merrin *et al.* 1995) NSW, Qld, SA, Vic. (Plant Health Australia 2001b). Tas. (Mostert *et al.* 2001). Plant Health Australia (2001) also shows records for WA, but these have been shown to be *Diaporthe australafricana* or other species of *Phomopsis* other than *P. viticola* by sequencing of the ITS region.	Yes Infects all parts of the grape bunch including rachis, pedicels and berries (Hewitt and Pearson 1988; Persley and Magarey 2009).	Yes *Phomopsis viticola* is established in temperate climatic regions throughout the viticultural world and has been reported in Africa, Asia, Australia (except WA), Europe and North America (Hewitt and Pearson 1988). Spores of *P. viticola* are dispersed by rain splash and insects within the vineyard. Long distance dispersal occurs by movement of infected/contaminated propagation material, pruning equipment and agricultural machinery (Burges *et al.* 2005).	Yes *Phomopsis viticola* is a serious pathogen of grapes in several viticultural regions of the world (Hewitt and Pearson 1988). It can cause vine stunting and reduced fruit yield (Burges *et al.* 2005), as well as lower the quality of fruit and kill grafted and other nursery stock (Hewitt and Pearson 1988).	Yes (EP, WA)

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Pilidiella castaneicola (Ellis & Everh.) B. Sutton Synonyms: *Coniella castaneicola* (Ellis & Everh.) B. Sutton, *Schizoparme straminea* Shear [Diaporthales: Schizoparmaceae] White rot	Yes (Nag Raj 1993)	Yes NSW, NT, Qld, Vic., but not on grape (Plant Health Australia 2001b) On leaf of *Eucalyptus pellita* in Qld (Langrell *et al.* 2008) Not regulated for Tas. (DPIPWE 2011). Not known to be present in WA.	Yes Causes white rot of table grapes. It affects rachis, pedicel and berries (Yamato 1995; Kishi 1998).	Yes This fungus has a variety of hosts (Farr and Rossman 2012). Hosts, including grapevine, are widely grown in Western Australia. In Australia, *P. castaneicola* has been reported from NSW, NT, Qld, Vic., (Plant Health Australia 2001b). *Pilidiella castaneicola* has also been reported from Brazil, Canada, China, Cuba, India, Indonesia, Japan, Korea, Pakistan, South Africa, Switzerland, the US and the West Indies (Farr and Rossman 2012). Environments with climates similar to these regions exist in various parts of WA suggesting that *P. castaneicola* has the potential to establish and spread in WA.	Yes Causes white rot of grapevine berries, (Yamato 1995; Kishi 1998) reducing marketability. Causes fruit rot of strawberries and is found on foliage of broadleafed trees (Farr and Rossman 2012). Is commonly found on leaves of *Eucalyptus*, but is of minor importance as a leaf pathogen (Van Niekerk *et al.* 2004).	Yes (EP, WA)

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Pilidiella diplodiella (Speg.) Crous & Van Niekerk Synonym: *Coniella diplodiella* (Speg.) Petr. & Syd [Diaporthales: Melanconidaceae] White rot, grapevine white rot	Yes (DPP 2007; CABI 2012)	Yes (Van Niekerk *et al.* 2004) NSW and WA-as *Coniella diplodiella* (Plant Health Australia 2001b) WA (Shivas 1989). However, the WA isolates were recently re-identified as *Coniella fragariae*.	Yes Infects young and mature fruit, causing purple-brown spots, yellowing and then browning and drying out of the fruit (Lauber and Schuepp 1968).	Yes Hosts of *P. diplodiella*, *Vitis* spp. (Farr and Rossman 2012), are cultivated in Western Australia.	Yes *Pilidiella diplodiella* causes white rot of grapevine berries, reducing marketability (Bisiach 1988; Van Niekerk *et al.* 2004). It can also cause cankers in nonlignified shoots of grapevine (Bisiach 1988).	Yes (EP, WA)
Pseudocercospora vitis (Lév.) Speg. Synonym: *Mycosphaerella personata* B.B. Higgins [Capnodiales: Mycosphaerellaceae] Grapevine leaf spot, Leaf blight	Yes (Pons and Sutton 1988)	Yes Qld, NSW, Vic. (Plant Health Australia 2001d) Not known to be present in WA.	No Infects leaves (McGrew and Pollack 1988). No report of association with grape bunches was found.	Assessment not required	Assessment not required	No
Rhizoctonia solani J.G. Kühn Synonym: *Thanatephorus cucumeris* (A.B. Frank) Donk [Ceratobasidiales: Ceratobasidiaceae] Damping off	Yes (CABI 2012)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Rhizopus arrhizus A. Fischer [Mucorales: Mucoraceae] Fruit rot	Yes (Farr and Rossman 2012)	Yes NSW, Vic. (Plant Health Australia 2001b) WA (Kew Royal Botanic Gardens 2014)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Rhizopus stolonifer (Ehrenb.) Vuill. [Mucorales: Mucoraceae] Rhizopus rot	Yes (DPP 2007)	Yes NSW, NT, Qld, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Rosellinia necatrix Prill. Synonym: *Dematophora necatrix* R. Hartig [Xylariales: Xylariaceae] White root rot	Yes (CABI 2012)	Yes NSW, Qld, WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Schizophyllum commune Fr. [Agaricales: Agaricomycetidaeae] Schizophyllum rot	Yes (Swapna *et al.* 2008)	Yes NSW, NT, Qld, SA, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Sclerotinia sclerotiorum (Lib.) de Bary Synonym: *Sclerotium varium* Pers. [Helotiales: Sclerotiniaceae] White mould	Yes (Farr and Rossman 2012)	Yes ACT, NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b; Hall *et al.* 2002)	Assessment not required	Assessment not required	Assessment not required	No
Sclerotium rolfsii Sacc. Synonym: *Corticium rolfsii* Curzi, *Athelia rolfsii* (Curzi) C.C. Tu & Kimbr. [Poriales: Atheliaceae] Sclerotium stem rot	Yes (CABI 2012; Farr and Rossman 2012)	Yes ACT, NSW, NT, Qld, SA, Tas., Vic., WA (Vawdrey and Peterson 1990; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Stemphylium botryosum Wallr. Synonym: *Pleospora tarda* E. G. Simmons [Pleosporales: Pleosporaceae] Stemphylium rot	Yes (Ihsanul Huq and Nowsher Ali Khan 2008)	Yes NSW, SA, Tas., Vic., WA (Plant Health Australia 2001b; Barbetti *et al.* 2006)	Assessment not required	Assessment not required	Assessment not required	No
Trichoderma harzianum Rifai Synonym: *Hypocrea lixii* Pat. [Hypocreales: Hypocreaceae]	Yes (DPP 2007)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Penrose *et al.* 1984; Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Trichothecium roseum (Pers.) Link [Hypocreales: Not Assigned] Pink mould rot	Yes (Sharma and Agarwal 1997; DPP 2007)	Yes ACT, NSW, Qld, SA, Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Verticillium dahliae Kleb. [Not Assigned: Plectosphaerellaceae] Verticillium wilt	Yes (DPP 2007)	Yes ACT, NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b; Harding and Wicks 2007)	Assessment not required	Assessment not required	Assessment not required	No
VIRUSES						
Alfalfa mosaic virus [Bromoviridae: Alfamovirus]	Yes (Nain *et al.* 1994; CABI 2012)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b; CABI 2012)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Broad bean wilt virus 2 (BBWV 2) [Comoviridae: Fabavirus]	Yes (Mali *et al.* 1977; CABI 2012)	Yes NSW (Schwinghamer *et al.* 2007). May be present in Qld (Plant Health Australia 2001b) but the records could be of *Broad bean wilt virus 1*. Not known to be present in WA.	Yes Recorded in grapevine (CIHEAM 2006). Probably infects systemically.	No At least one strain is transmitted in seed of *Vicia faba*, broad bean (Zhou 2002), but no record of seed transmission in *Vitis* spp. was found. Transmitted in a non-persistent manner by aphids, including *Myzus persicae*, *Aphis craccivora* and *Acyrthosiphon pisum* (Zhou 2002). No records of acquisition of the virus from infected berries.	Assessment not required	No
Cucumber mosaic virus [Bromoviridae: Cucumovirus]	Yes (Samad *et al.* 2008; Rishi 2009)	Yes NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b)	Assessment not required	Assessment not required	Assessment not required	No
Peach rosette mosaic virus [Comoviridae: Nepovirus]	No Only one record from India in 1986 exists (CABI 2012). This record is considered unreliable (EPPO 2011). DPP (2012) states that this virus is not present in India.	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Tobacco necrosis viruses (TNV) [Tombusviridae: Necrovirus]	Yes TNV-D (cb isolate) (Ramachandraiah *et al.* 1979; CABI 2012; DPP 2012)	Yes TNVs have been recorded in Vic. and Qld (Finlay and Teakle 1969; Teakle 1988), but not on grapevine. It is not known if the species or strain that infects grapevine is present in Australia. Not known to be present in WA.	Yes The strain of *Tobacco necrosis virus* found in grapevine in South Africa spreads systemically (Cesati and Van Regenmortel 1969); probably present in grape bunches.	Yes TNV strains are established in Australia (Teakle 1988). TNV strains typically have a wide host range (Uyemoto 1981), including grapevine (Zitikaite and Staniulis 2009) and many of these hosts occur in Australia. TNVs are transmitted by *Olpidium* spp. (Rochon *et al.* 2004) and at least one of these vectors occurs in Australia (Maccarone *et al.* 2008).	Yes TNVs cause rusty root disease of carrot, Augusta disease of tulip, stipple streak disease of common bean, necrosis disease 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)
Tobacco ringspot virus [Comoviridae: Nepovirus]	Yes (Madhusudan and Govindu 1985; CABI 2012)	Qld, SA (CABI-EPPO 1997c). Not considered to be present in WA (DAFWA 2013).	Yes This virus is associated with embryonic tissue of the seed of its host plants. Some seed transmission probably occurs in most hosts (Stace-Smith 1985).	Assessment not required This virus was not assessed, as it may be seedborne in capsicum seed (Stace-Smith 1985) for planting that is permitted entry into Western Australia.	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Tomato black ring virus (TBRV) [Comoviridae: Nepovirus]	Yes (Madhusudan and Govindu 1985; DPP 2007; CABI 2012)	No records found	Yes *Vitis* spp. is a principal host (Card *et al.* 2007). Many plant species infected with TBRV are symptomless, and are difficult to detect (Murant 1983; CABI 2012). However, some symptoms include necrotic rings and malformation (Harrison 1996). It has also been demonstrated to transmit through seed in at least 25 plant families (Murant 1983).	Yes TBRV has been recorded throughout Europe, Africa, Asia and the Americas (Harrison 1996). It is known to infect over 76 experimental plant species, including horticultural, agricultural and many weed and endemic species (Harrison 1996; CABI 2012), causing various levels of disease. Many of these plants are present in Australia. It is transmitted in nature by *Longidorus* spp. of nematodes (Brown *et al.* 1989; Harrison 1996). *Longidorus* spp. have been reported throughout Australia (Harris 1983; Plant Health Australia 2001b). The virus can also be transmitted through sap extracts (Madhusudan and Govindu 1985). It is believed that nearly all of the nematode borne viruses, such as TBRV, can be transmitted and distributed through the seed of their principal hosts (Murant 1983).	Yes TBRV causes necrotic rings, spots and flecks, mottle stunting and leaf malformation (Harrison 1996). The experimental host range is >9 families susceptible to the virus, many of which include important commodities such as onion, lettuce, tomato, potato, tulip, cucumber, strawberry and grapevines (Harrison 1996; CABI 2012).	Yes

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
Tomato ringspot virus [Comoviridae: Nepovirus]	Yes (Verma *et al.* 2003; Rana *et al.* 2011)	No Recorded in SA (Chu *et al.* 1983; Cook and Dubé 1989), but there are no further records, the infected plants no longer exist, and the virus is believed to be absent from Australia.	Yes Infects systemically; present in fruit and seed (Uyemoto 1975; Gonsalves 1988).	No Seed transmitted in grapevine occasionally (Uyemoto 1975). Also transmitted by nematodes (*Xiphinema* spp.) and by grafting (Stace-Smith 1984). Transmission via nematode from fruit for human consumption is unlikely. Infected grapevine seedlings are unlikely to establish. The chance that infected grape seeds from fruit waste will germinate is small. If germination does occur, seedlings are unlikely to survive.	Assessment not required	No
Tomato spotted wilt virus [Bunyaviridae: Tospovirus]	Yes (CABI 2012)	Yes NSW, NT, Qld, SA, Tas., Vic., WA (Plant Health Australia 2001b; Persley *et al.* 2006)	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessmen t required
VIROIDS						
Citrus exocortis viroid (CEVd) [Pospiviroidae: Pospiviroid]	Yes (Ramachandran *et al.* 1993)	Yes Only known to be present in NSW, Qld and SA (Barkley and Büchen-Osmond 1988). Not known to be present in WA.	Yes Grapevine is a host of CEVd (Garcia-Arenal *et al.* 1987) and transmission of the viroid via grape seed has been observed (Wan Chow Wah and Symons 1997).	No The viroid may be transmitted by grafting, abrasion and through seed (Wan Chow Wah and Symons 1997; Little and Rezaian 2003; Singh *et al.* 2003). Mechanical transmission from fruit for human consumption is unlikely. Infected grapevine seedlings are unlikely to establish. The chance that infected grape seeds from fruit waste will germinate is small. If germination does occur, seedlings are unlikely to survive.	Assessment not required	No

Pest	Present in India	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Hop stunt viroid (HSVd) [Pospiviroidae: Hostuviroid]	Yes (Ramachandran *et al.* 2005)	Yes Only known to be present in SA and Vic. (Koltunow *et al.* 1988). Not known to be present in WA.	Yes HSVd has been demonstrated to be seed transmitted in grapevines (Wan Chow Wah and Symons 1999), but not in any other species. Wan Chow Wah and Symons (1999) confirmed that, in grapevines, HSVd can be transmitted by seed to seedlings. (This authority is cited in Little and Rezaian (2003) which is then cited in Albrechtsen (2006)). HSVd infects systemically and is present in all parts of the plant (Yaguchi and Takahashi 1984; Li *et al.* 2006).	No The viroid may be transmitted via mechanical means (Sano 2003), through cuttings and grafting (European Food Safety Authority 2008) or via grape seed (Wan Chow Wah and Symons 1999). Mechanical transmission from fruit for human consumption is unlikely. Infected grapevine seedlings are unlikely to establish. The chance that infected grape seeds from fruit waste will germinate is small. If germination does occur, seedlings are unlikely to survive.	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 Agriculture may 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 Agriculture may, 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 Australian Government Department of the Environment directly for further information.

When undertaking risk analyses, the Australian Government Department of Agriculture consults with the Australian Government Department of the Environment about environmental issues and may use or refer to the Australian Government 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

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 probability 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 Australian Government 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 Agriculture will 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 Australian Government 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 Australian Government 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 Australian Government 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.
Cane (grapevine)	A cane is a ripened shoot of a grapevine that has grown from a new bud located on the cordon. A shoot is called a cane when it changes colour from green to brown during veraison. Shoots give rise to leaves, tendrils and grape clusters.
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.
Host	An organism that harbours a parasite, mutual partner, or commensal partner, typically providing nourishment and shelter.

Term or abbreviation	Definition
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 etc., 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 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).
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 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).

Term or abbreviation	Definition
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 probability 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).
Phloem	In vascular plants, the tissue that carries organic nutrients to all parts of the plant where needed.
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 table grape 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).
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.

Term or abbreviation	Definition
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.
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.

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