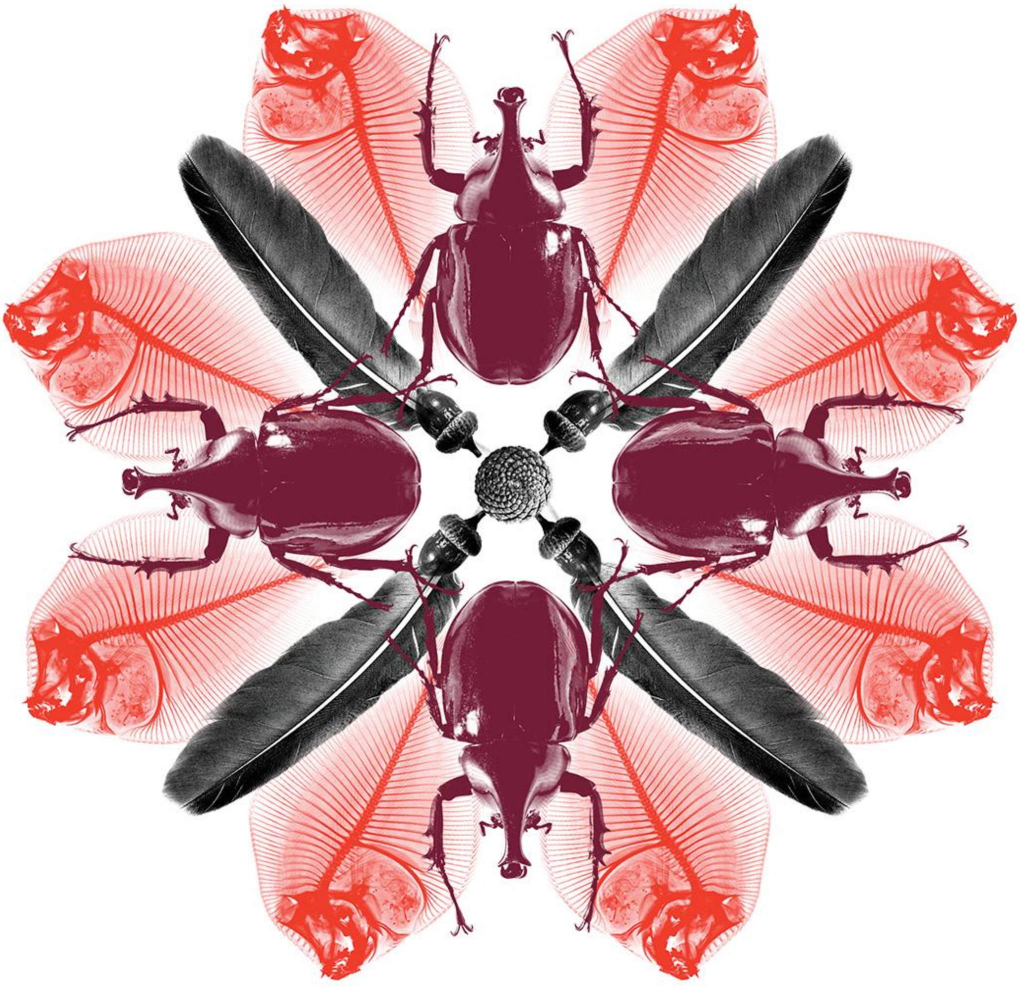
Australian Government

Department of Agriculture and Water Resources

Final review of policy: importation of *Zantedeschia* dormant tubers into Australia

July 2016



Cataloguing data

Australian Government Department of Agriculture and Water Resources 2016, *Final review of policy: importation of* Zantedeschia *dormant tubers into Australia*, Department of Agriculture and Water Resources, Canberra.

This publication is available at agriculture.gov.au.

Australian Government Department of Agriculture and Water Resources
GPO Box 858 Canberra ACT 2601

Switchboard: +61 2 6272 3933 or 1800 900 090

Facsimile: +61 2 6272 3307

Email: plant@agriculture.gov.au

Contents

Tables

Acronyms and abbreviations

Term or abbreviation	Definition
ACT	Australian Capital Territory
ALOP	Appropriate level of protection
BA	Biosecurity Advice
BICON	The Australian Department of Agriculture and Water Resources biosecurity import conditions database (BICON)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FAO	Food and Agriculture Organization of the United Nations
IPC	International Phytosanitary Certificate
IPPC	International Plant Protection Convention
BIRA	Biosecurity Import risk analysis
ISPM	International Standard for Phytosanitary Measures
MPI	Ministry for Primary Industries (New Zealand)
NPPO	National Plant Protection Organisation
NSW	New South Wales
NT	Northern Territory
PEPICC	Post Entry Plant Industry Consultative Committee
PEQ	Post-entry quarantine
PRA	Pest risk assessment
Qld	Queensland
SA	South Australia
SPS	Sanitary and Phytosanitary
Tas.	Tasmania
Vic.	Victoria
WA	Western Australia
WTO	World Trade Organization

Summary

The Australian Government Department of Agriculture and Water Resources (the department) initiated this review in response to a market improvement request from the Ministry for Primary Industries (MPI) New Zealand, for dormant Calla lily (*Zantedeschia* species) tubers. Specifically, the MPI requested that the department reconsider the requirement for dormant *Zantedeschia* tubers to undergo methyl bromide fumigation and provide an option for post-entry quarantine (PEQ) to occur in open quarantine in Australia. Additionally, Australian importers requested the department consider alternative risk management measures for dormant *Zantedeschia* tubers from the United States.

This review evaluates the biosecurity risks associated with *Zantedeschia* dormant tubers from all sources and the appropriateness of the existing management measures for the identified risks. This review recommends two different sets of import conditions for *Zantedeschia* tubers to manage the biosecurity risks. The import conditions are based on where the tubers have originated and what is known about that source in terms of biosecurity risk. The import conditions are separated into the following categories:

Dormant tubers (non-approved sources)

- mandatory on-arrival inspection;
- mandatory treatment, including either methyl bromide fumigation or hot water treatment or insecticidal dip; and
- growth in a closed PEQ facility for a minimum of six weeks for pathogen screening, or until sufficient new growth has occurred (where the plant has developed multiple, open and green leaves).

Dormant tubers (produced under a systems approach)

The recommended components of the systems approach include:

- dormant tubers sourced from high health mother stock (pathogen-tested mother stock or mother stock established from seeds);
- in-field monitoring and management for quarantine pests and pathogens, as well as thrips vectors;
- mandatory off-shore or on-shore treatment (methyl bromide fumigation or hot water treatment or insecticidal dip);
- mandatory pre-export inspection; and
- mandatory on-arrival inspection.

Dormant tubers meeting all the components of the systems approach are recommended to be released and will not require growth in a PEQ facility.

The ultimate goal of phytosanitary measures is to protect Australia from exotic pests and diseases through maintaining plant health and preventing the introduction of identified quarantine pests associated with *Zantedeschia* dormant tubers. The department considers that

the risk management measures recommended in this final review of policy will be adequate to mitigate the risks posed by the identified pests of quarantine concern.

The department has made several minor changes to the final policy review, following careful consideration of stakeholder comments on the *Draft review of policy: importation of* Zantedeschia *dormant tubers into Australia*. Changes of note include:

- the removal of *Zantedeschia mild mosaic virus* from the quarantine pest list as this virus was reported to occur in Australia in April 2016 and is not under official control. Therefore, this virus no longer meets the International Plant Protection Convention (IPPC) definition of a quarantine pest.
- the inclusion of an operational system for the maintenance and verification of the phytosanitary status of *Zantedeschia* dormant tubers produced under a systems approach.

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 recommended to reduce the risks to an acceptable level. However, 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 and Water Resources (the department) using technical and scientific experts in relevant fields, and involve consultation with stakeholders at various stages during the process.

Further information about Australia's biosecurity framework is provided in the *Biosecurity Import Risk Analysis Guidelines 2016* located on the Australian Government Department of Agriculture and Water Resources website.

1.2 This review of existing phytosanitary policy

Australia has an existing phytosanitary policy to import *Zantedeschia* propagative material in the form of dormant tubers from all countries. The existing phytosanitary policy for imported dormant tubers includes mandatory on-arrival fumigation and growth in a closed post-entry quarantine facility for disease screening.

1.2.1 Background

This review of existing phytosanitary policy review was initiated in response to a request from the Ministry for Primary Industries (MPI) New Zealand, to improve the import conditions for dormant *Zantedeschia* tubers. Additionally, Australian importers have requested that the department considers alternative risk management measures for *Zantedeschia* dormant tubers from the United States. Specifically, both MPI and Australian importers have requested that the department reconsiders the requirement for dormant *Zantedeschia* tubers to undergo methyl bromide fumigation and to consider alternative requirements to growth in closed post-entry quarantine facilities.

1.2.2 Scope

The scope of this review of existing phytosanitary policy is limited to:

- the identification of biosecurity risks associated with *Zantedeschia* dormant tubers from all countries; and
- the recommendation of phytosanitary measures for the identified risks.

This policy review recommends appropriate phytosanitary measures to address the risk of introducing quarantine pests of *Zantedeschia* propagative material into Australia. It is the importer's responsibility to ensure compliance with the requirements of all other regulatory and advisory bodies associated with importing commodities to Australia. Among others, these could include the Department of Immigration and Border Protection, Department of Health, Therapeutic Goods Administration, Australian Pesticides and Veterinary Medicines Authority, Department of the Environment and state and territory departments of agriculture.

1.2.3 Existing phytosanitary policy to import dormant tubers

The existing phytosanitary policy to import dormant tubers of *Zantedeschia* species include:

- an import permit and a Phytosanitary Certificate;
- mandatory on-arrival inspection to verify freedom from live insects, live snails, soil, disease symptoms and any other extraneous contamination of quarantine concern;
- mandatory fumigation; and
- mandatory growth under closed quarantine, at a government post-entry quarantine facility or at a Quarantine Approved Premises (Class 6.1) for a minimum of three months (and until sufficient new growth has occurred) for passive screening.

There are a number of *Zantedeschia* species permitted entry into Australia. The list of permitted species is available on the Biosecurity import conditions database (BICON) at http://www.agriculture.gov.au/bicon and provided in Table 1 below.

Table 1 List of *Zantedeschia* species permitted entry into Australia from all sources

Scientific name	Synonyms
*Zantedeschia aethiopica** (L.) Spreng	*Calla aethiopica* L; *Zantedeschia aethiopica* var. *minor* Engl., *Richardia africana* Kunth
Zantedeschia albomaculata (Hook.) Baill.	
Zantedeschia albomaculata (Hook.) Baill. subspecies *albomaculata*	*Calla oculata* Lindl.; *Richardia albomaculata* Hook.; *Zantedeschia oculata* (Lindl.) Engl.
Zantedeschia albomaculata (Hook.) Baill. subspecies *macrocarpa* (Engl.) Letty	*Zantedeschia macrocarpa* (Engl.) Letty
Zantedeschia albomaculata (Hook.) Baill. var. *macrocarpa* (Engl.) Letty	
Zantedeschia elliottiana (W. Watson) Engl.	*Calla elliottiana* (W. Watson) W. Watson; *Richardia elliottiana* W. Watson
Zantedeschia elliottiana x *pentlandii*	
Zantedeschia pentlandii (W. Watson) Wittm.	*Richardia pentlandii* W. Watson; *Zantedeschia sprengeri* (Comes) Burtt Davy
Zantedeschia jucunda Letty	
Zantedeschia rehmannii Engl.	*Richardia rehmannii* (Engl.) N. E. Br. ex W. Harrow

Zantedeschia rehmannii x *elliottiana*
Zantedeschia rehmannii x *pentlandii*

**Zantedeschia aethiopica* is prohibited entry into certain states, including South Australia and Western Australia.

1.2.4 Consultation

The department consults stakeholders through the public release of a draft report for comment. The Draft review of policy: importation of *Zantedeschia* dormant tubers into Australia was released for a 30 day stakeholder consultation period on 29 July 2015. All submissions were carefully considered and, where relevant, changes were made to the final report. A summary of major stakeholder comments and how they were considered is contained in Appendix C.

The department has regularly consulted with New Zealand's MPI and Australian state and territory government departments during the preparation of this final report. There has also been formal consultation with industry representatives at regular Post-Entry Plant Industry Consultative Committee (PEPICC) meetings.

2 Pest risk analysis

The Department of Agriculture and Water Resources has conducted this PRA in accordance with the International Standards for Phytosanitary Measures (ISPMs), including ISPM 2: *Framework for pest risk analysis* (FAO 2016a) and ISPM 11: *Pest risk analysis for quarantine pests* (FAO 2016b) that have been developed under the SPS Agreement (WTO 1995). These standards provide a broad rationale for the analysis of the scientific evidence to be taken into consideration when identifying and assessing the risk posed by quarantine pests.

Phytosanitary terms used in this PRA are defined in ISPM 5: *Glossary of phytosanitary terms* (FAO 2016c). 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

The initiation of a risk analysis identifies pest(s) and pathway(s) that should be considered for risk analysis in relation to the identified PRA area.

The department initiated this review in response to requests from the MPI New Zealand and Australian importers to review pathway specific conditions for *Zantedeschia* dormant tubers from New Zealand and the United States. Given the small number of additional pests from all countries, the department made the decision to review conditions for *Zantedeschia* dormant tubers from all sources.

The pests associated with *Zantedeschia* from all sources were tabulated from information provided by the MPI and published scientific literature, such as reference books, journals and database searches. This information is set out in Appendix A and forms the basis of the pest categorisation. Synonyms are provided where the current scientific name differs from that provided by the exporting countries National Plant Protection Organisation (NPPO) or where the cited literature uses a different scientific name.

In the context of this assessment, *Zantedeschia* dormant tubers are a potential import 'pathway' by which a pest can enter Australia.

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

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 the magnitude of the associated potential economic consequences' (FAO 2016c). The pest risk assessment provides technical justification for identifying quarantine pests and for establishing phytosanitary import requirements.

This is a commodity-initiated pest risk analysis and risk is estimated through a standard set of factors that contribute to entry, establishment, spread or potential economic impact of pests. The following three, consecutive steps were used in the pest risk assessment:

- pest categorisation
- assessment of probability of entry, establishment and spread
- assessment of potential consequences.

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 2016c).

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.

Pests were categorised according to their association with the pathway, their presence or absence or regulatory status, their potential to establish or spread, and their potential for economic consequences. Pests associated with *Zantedeschia* listed in Appendix A were used to develop a pathway-specific pest list for dormant tubers. This list identifies the pathway association of pests recorded on *Zantedeschia* species and their status in Australia, their potential to establish or spread, and their potential for economic consequences. Pests likely to be associated with *Zantedeschia* dormant tubers, and absent or under official control in Australia, may be capable of establishment and spread within Australia if suitable ecological and climatic conditions exist.

The quarantine pests of *Zantedeschia* dormant tubers from all sources identified in the pest categorisation (Appendix A) are listed in Table 2. These pests fulfil the International Plant Protection Convention (IPPC) criteria for a quarantine pest, specifically:

- these pests are economically important (as they cause a variety of direct and indirect economic impacts, such as reduced yield, reduced commodity value, loss of foreign or domestic markets)
- these pests are not present in Australia, or present in Australia but have a limited distribution and are official control.

Table 2 Quarantine pests for *Zantedeschia* dormant tubers from all sources

Pest type	Common name
DIPTERA (flies)	
Eumerus strigatus (Fallen) [Diptera: Syrphidae]	Lesser bulb fly
HEMIPTERA (Mealybugs)	
Pseudococcus maritimus Ehrhorn [Hemiptera: Pseudococcidae]	Grape mealybug
BACTERIA	
Pseudomonas veronii Elomari et al. 1996 [Pseudomonadales: Pseudomonadaceae]	Bacterial soft rot
FUNGI	
Phytophthora meadii McRae [Peronosporales: Peronosporaceae]	Rubber secondary leaf fall
Phytophthora richardiae Buisman [Peronosporales: Peronosporaceae]	Tuber rot of Calla lily
VIRUSES	
Calla lily chlorotic spot virus (CCSV) [Bunyaviridae: *Tospovirus*]	Calla lily chlorotic spot
Impatiens necrotic spot virus (INSV) [Bunyaviridae: *Tospovirus*]	Necrotic spot
Konjac mosaic virus (KoMV) [Potyviridae: *Potyvirus*]	Konjac mosaic
Lisianthus necrosis virus (LNV) [Tombusviridae: *Necrovirus*]	Lisianthus necrosis
Watermelon silver mottle virus (WSMoV) [Bunyaviridae: *Tospovirus*]	Watermelon silver mottle disease

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 2016b). A summary of this process is given below, followed by a description of the qualitative methodology used in this PRA.

In the case of pests associated with propagative material imports, the concepts of entry, establishment and spread take into account pathway specific factors. Firstly, the primary conditions for the survival of pests are fulfilled by the presence of live propagative material. Propagative material is expected to be shipped at moderate temperatures and humidity, which is unlikely to adversely affect any pest that is present during shipment. Secondly, propagative material is deliberately introduced, distributed and aided to establish. The material will enter Australia and then be maintained in a suitable habitat, potentially in substantial numbers, and for an indeterminate period. Significant resources are utilised to ensure the continued health and survival of imported propagative material, thus facilitating the survival and establishment of associated pests. Pests associated with propagative material may not need to leave the host to complete their life cycles and produce subsequent generations. Thirdly, propagative material will be multiplied and spread throughout the PRA area through the nursery trade. Human-mediated spread is a high risk for the continued spread of pests post-border in Australia.

Therefore, the introduction, establishment and spread of plants from imported propagative material in essence introduces, establishes and spreads those pests associated with the propagative material.

As a result of these pathway specific factors, it is highly likely that the quarantine pests associated with *Zantedeschia* dormant tubers identified in Table 2 will enter Australia, be distributed in a viable state to susceptible hosts, establish in that area and subsequently spread within Australia.

Probability of entry

Quarantine pests associated with *Zantedeschia* dormant tubers identified in Table 2 are likely to arrive in Australia and be distributed within Australia in a viable state.

- Association with the host commodity provides the opportunity for a pest to enter Australia. The pest's ability to survive on, or in, propagative material acts to ensure their viability on route to, and during distribution across, Australia.
- The primary conditions for the survival of pests are fulfilled by the presence of the live propagative material and the associated favourable environmental conditions.
- Pathogens associated with propagative material may be systemic or associated with the vascular system (occur internally within the plant) and cannot be dislodged during standard harvesting, handling and shipping operations. Therefore, these pests are more likely to escape detection and survive during transport to Australia.
- Transport and storage of dormant *Zantedeschia* tubers is expected to be at moderate temperatures to ensure the survival of the propagative material. These conditions are not expected to affect viability of the associated pests. Therefore these pests are likely to survive transport and storage.
- Infected/infested propagative material is one of the main pathways for the introduction of the pests into new areas. This mode of introduction is greatly enhanced by latency periods for pathogens or cryptic behaviour of arthropods, as conspicuous symptoms may not develop immediately. Careful handling of propagative material to maintain plant health would assist the pests in surviving within the host plant.
- Distribution of the imported dormant *Zantedeschia* tubers in Australia would be for retail sale to multiple destinations. Following retail sale, the infected imported dormant *Zantedeschia* tubers will be widely grown in Australia.
- Pests arriving in Australia with imported dormant *Zantedeschia* tubers are already in a suitable host for planting.
- Infested/infected imported dormant *Zantedeschia* tubers may be distributed to nurseries or retail shops and for backyard and amenity plantings where these pests may continue multiplying within the host. Infected nursery stock is unlikely to be grown in isolation, providing greater opportunity for these pests to move to a suitable host.

Probability of establishment

Quarantine pests associated with *Zantedeschia* dormant tubers identified in Table 2, having entered on imported propagative material, are likely to establish within Australia.

- Association with the host will facilitate the establishment of pests associated with it, as they are already established with, or within, a suitable host. As host plant material is likely to be maintained in places with similar climates to the area of production, climatic conditions are expected to favour the pest's establishment.
    - Some pest specific factors are likely to impact upon a pest's ability to establish in Australia. For example, the likelihood of establishment will vary if an alternative host is

required for the pest to complete its life cycle or if multiple individuals are required to form a founder population.

- Propagative material intended for ongoing propagation or horticultural purposes is deliberately introduced, distributed and aided to establish. This material will enter and then be maintained in a suitable habitat, potentially in substantial numbers and for an indeterminate period. Therefore, the introduction and establishment of plants from imported propagative material in essence establishes the pests and pathogens associated with the propagative material.
- Latency periods of infection may result in the non-detection of some pathogens; therefore, the pathogens are more likely to establish into new areas.
- The identified pests are established in areas with a wide range of climatic conditions. There are similar climatic regions in parts of Australia that would be suitable for the establishment of these pests.
- A latent or cryptic period of infection/infestation before visible symptoms appear may result in non-detection of pests; therefore, the pests are more likely to establish in new areas. Pests that overwinter may remain undetected in the host plant until environmental conditions are suitable to complete their life cycle.

Probability of spread

Quarantine pests associated with *Zantedeschia* dormant tubers identified in Table 2, having entered on propagative material and established, are likely to spread in Australia.

- Propagative material will be multiplied and spread throughout the PRA area through the nursery trade. Human-mediated spread is a high risk for the continued spread of associated pests post-border in Australia
- Pest related factors that would aid the spread of a pest once it has established in Australia (such as wind, water or mechanical transmission) will increase a pest's ability to spread from an already high baseline.
- The systemic nature of some of the pests associated with propagative material is likely to assist in their dispersal. Accordingly, local and long-distance spread of these pathogens has been associated with the movement of infected propagative material.
- Vectors present in Australia may help spread pathogens from infected plants to healthy plants.
  - Although the pathogens may differ in morphologies, disease symptoms induced, and means of natural spread (for example, insect or nematode vectors), each pathogen is readily carried and dispersed in nursery stock.
  - In some instances, pathogens may be introduced via infected propagative material into a region where native vector species reside, resulting in secondary spread to a neighbouring host or to surrounding host plants.
  - Pathogens that are spread by vectors, where the vectors are absent from Australia, will have a lower likelihood of spread. However, pathogens present in infected dormant *Zantedeschia* tubers may have the ability to spread from resultant plants, potentially through multiple generations, in the absence of a vector.

- Natural barriers, such as arid areas, mountain ranges, climatic differentials and possible long distances between suitable hosts in parts of Australia, may prevent long-range natural spread of identified pests. However, tuber-associated pests can be quickly disseminated by human activities; for instance, they can hitchhike with tubers as they travel long distances by car, ship or aeroplane. This makes them capable of easily crossing natural barriers like oceans and mountains, and artificial barriers such as state borders.
- In the absence of statutory control there is a high probability that pests will spread quickly in Australia through the trade of propagative material. Planting of infected propagative material is likely to bring pathogens into the environment.

As a result of these pathway specific factors, it is highly likely that the quarantine pests associated with *Zantedeschia* dormant tubers identified in Table 2 will enter Australia, be distributed in a viable state to susceptible hosts, establish in that area and subsequently spread within Australia.

2.2.3 Assessment of potential consequences

The purpose of the assessment of potential consequences in the PRA process is to identify and qualify, as much as possible, the potential impacts that could be expected to result from a pest's introduction and spread. The basic requirements for the assessment of consequences are described in the SPS Agreement (WTO 1995), in particular Article 5.3 and Annex A. Further detail on assessing consequences is given in the 'potential economic consequences' section of ISPM 11 (FAO 2016b). ISPM 11 separates the consequences into 'direct' and 'indirect' and provides examples of factors to consider within each.

Direct impacts of the introduction and spread of multi-host pests in Australia will not only affect the imported host but also other hosts. Introduction and establishment of quarantine pests in Australia would result in phytosanitary regulations imposed by foreign or domestic trading partners, and increased costs of production, including pest control costs. Introduction and establishment of quarantine pests would also likely result in industry adjustment. The potential economic impact for the nursery trade is high. The introduction of pests which meet the criteria of a quarantine pest will have unacceptable economic consequences in Australia as these pests will cause a variety of direct and indirect economic impacts. Quarantine pests that are identified in the PRA process are of economic concern and do not occur in Australia. A summary of these pests and justification is provided below:

- *Eumerus strigatus* (lesser bulb fly) is considered an economically important pest of ornamentals and some root vegetables, particularly onions (Perry 2007). The larvae of this species tunnel into tuberous plant parts and can cause up to 30 percent crop loss in onion, up to 25 percent crop loss of some varieties of narcissus and approximately 10 percent crop loss in hyacinths (Gherasim 1973; Mulin 1990; Perry 2007).
- *Pseudococcus maritimus* causes considerable losses in table grapes through direct feeding (McKenzie 1967; Daane et al. 2003) and is a recognised pest of apricots and pears (Ben-Dov 2013b). In addition, *P. maritimus* vectors grapevine leafroll viruses (Skinkis et al. 2009; Daane et al. 2011) and *Little cherry virus* 2 (Mekuria et al. 2013).
- Soft rot is an important disease of *Zantedeschia* production in various countries (Mikiciński et al. 2010b) and *Pseudomonas veronii* is part of the bacterial complex that causes this disease (Mikiciński et al. 2010a). Globally, soft rot results in substantial losses in *Zantedeschia*

production. For example, in New Zealand (the biggest producer of *Zantedeschia* tubers and flowers), losses from soft rot accounts for 20 percent of the total income of *Zantedeschia* production (Vanneste 1996; Wright et al. 2005).

- *Phytophthora meadii* and *P. richardiae* cause rots to underground plant parts of *Zantedeschia* species as well as economically important crops such as tomato, cassava, asparagus and carrot. *Phytophthora meadii* is the causal agent of numerous diseases, such as rubber black thread, rubber stripe canker, rubber secondary leaf fall, rubber bark and pod rot and pineapple top rot (Erwin & Ribeiro 1996). In wet tropical areas, rubber leaf fall is very common and can cause 40 percent yield loss (Drenth & Guest 2004). *Phytophthora richardiae* causes the destructive disease *Zantedeschia* root rot (Erwin & Ribeiro 1996). Symptoms of this disease include leaf necrosis, flower malformation, root rot and eventual plant death (Erwin & Ribeiro 1996).
- Identified viruses of quarantine concern for *Zantedeschia* dormant tubers (*Calla lily chlorotic spot virus, Impatiens necrotic spot virus, Konjac mosaic virus*, *Lisianthus necrosis virus* and *Watermelon silver mottle virus*) cause a variety of direct and indirect economic impacts (CABI/EPPO 1997; Chang et al*.* 2001; Chen et al. 2005; Chen et al*.* 2006c; 2006d; Daughtrey et al*.* 1997; EPPO 1997; Wick 2009). Many of these viruses affect the marketability of *Zantedeschia* plants and plant products. For example, *Zantedeschia* species are a popular cut flower and nursery stock commodity that is valued for its ornamental appeal. Therefore, any loss of aesthetic value—such as through yellowing, mosaic, green or discoloured spots on the leaves or flowers of *Zantedeschia*—will render nursery stock unsaleable, and result in production losses through the destruction of infected material.

2.3 Stage 3: Pest risk management

Pest risk management evaluates and selects risk management options to reduce the risk of entry, establishment and spread of identified pests for the identified import pathways. To effectively prevent the introduction of pests associated with an identified pathway, a series of important safeguards, conditions or phytosanitary measures must be in place.

2.3.1 Identification and selection of appropriate risk management options

Phytosanitary measures to prevent the establishment and spread of quarantine pests may include any combination of measures, including pre- or post-harvest treatments, inspection at various points between production and final distribution, surveillance, official control, documentation or certification. A measure or combination of measures may be applied at any one or more points along the continuum between the point of origin and the final destination. Pest risk management explores options that can be implemented (i) in the exporting country, (ii) at the point of entry or (iii) within the importing country. The ultimate goal is to protect plants and prevent the introduction of identified quarantine pests.

Examples of phytosanitary measures that may be applied to propagative material consignments include:

- **Import from pest free areas only** (**ISPM 4, 10**)—the establishment and use of a pest free area by a NPPO provides for the export of plants from the exporting country to the importing country without the need for application of additional phytosanitary measures when certain requirements are met.

- **Inspections or testing for freedom from regulated pests**—this is a practical measure for visible pests or for pests which produce visible symptoms on plants.
- **Inspection and certification** (**ISPM 7, 12, 23**)—the exporting country may be asked to inspect the shipment and certify that the shipment is free from regulated pests before export.
- **Specified conditions for preparation of the consignment**—the importing country may specify steps that must be followed in order to prepare the consignment for shipment. These conditions can include the requirement for plants to be produced from appropriately tested parent material.
- **Pre- or post-entry quarantine**—the importing country may define certain control conditions, inspection and possible treatment of shipments upon their entry into the country. Post-entry quarantine for dormant tubers, seed and even *in vitro* plantlets can help avoid the introduction of new viruses or allied pathogens into the importing countries.
- **Removal of the pest from the consignment by treatment or other methods**—the importing country may specify chemical or physical treatments that must be applied to the consignment before it may be imported.

Measures can range from total prohibition to permitting the import of nursery stock subject to visual inspection. In some cases, more than one phytosanitary measure may be required in order to reduce the pest risk to an acceptable level.

3 Pest risk management

The International Plant Protection Convention (IPPC) and the World Trade Organisation (WTO) recognise the phytosanitary concerns associated with expanding world trade in plant propagative material. Consequently, international standards have been developed for the safe movement of plants and plant products. The aim of these standards is to reduce the likelihood of the accidental introduction of pests associated with plants and plant products into new areas through the application of phytosanitary measures. Measures may be applied only where necessary to prevent the introduction and/or spread of quarantine pests. Phytosanitary measures should be applied in a transparent and non-discriminatory manner, and phytosanitary restrictions used only where technically justified and not in lieu of barriers to protect an industry from competition.

The pest risk assessment stage identified several pests that may require pest risk management measures as they meet the IPPC criteria for a quarantine pest. These include: *Calla lily chlorotic spot virus* (CCSV), *Eumerus strigatus, Impatiens necrotic spot virus* (INSV), *Lisianthus necrosis virus* (LNV), *Konjac mosaic virus* (KoMV), *Phytophthora meadii*, *Phytophthora richardiae*, *Pseudococcus maritimus*, *Pseudomonas veronii* and *Watermelon silver mottle virus* (WSMoV). Consequently, phytosanitary measures are justified to reduce the risk of these quarantine pathogens to achieve Australia's appropriate level of protection.

Risk management options can consist of existing measures or they can be new measures that have been developed specifically to address the risk from the pest or pathway under consideration. To effectively prevent the introduction of pests associated with nursery stock, a series of important safeguards, conditions or phytosanitary measures must be in place. The ultimate goal of the recommended phytosanitary measures is to prevent the introduction of identified quarantine pests into Australia.

Further to Australia's quarantine pests for *Zantedeschia* dormant tubers listed above, state and territory governments may regulate the import of additional pests into their jurisdictions. It is the importer's responsibility to ensure compliance with regional requirements. Importers are advised to contact state and territory agriculture departments where necessary to ensure that regional requirements are met.

3.1 Recommended risk mitigation measures

This review recommends two different sets of import conditions for *Zantedeschia* tubers to manage the biosecurity risks. The import conditions are based on where the tubers have originated and what is known about that source in terms of biosecurity risk. The import conditions are separated into the following categories:

- Dormant tubers from non-approved sources.
- Dormant tubers produced under a systems approach.

3.1.1 Dormant tubers (non-approved sources)

The recommended requirements for *Zantedeschia* dormant tubers from non-approved sources are detailed below.

Mandatory on-arrival inspection

Mandatory on-arrival inspection of dormant tubers to verify freedom from disease symptoms, live insects, soil and other extraneous contaminants of quarantine concern.

Mandatory on-arrival treatment

All dormant tubers must undergo one of the following treatments on-arrival to manage the risk posed by insect pests of quarantine concern:

- Mandatory on-arrival methyl bromide fumigation at the rate recommended to control Narcissus fly; or
- Mandatory hot water treatment (minimum of 44 degrees Celsius for one hour); or
- Mandatory insecticidal dip (Imidacloprid 100 milligrams per litre and one percent eco-oil® for a minimum of 30 seconds).

Mandatory growth in closed PEQ

Mandatory growth in a closed government PEQ facility or at an Approved Arrangment site for visual screening for a minimum period of six weeks, or until sufficient new growth has occurred (where the plant has developed multiple, open and green leaves), to manage the risk posed by pathogens of quarantine concern to Australia identified in Table 2.

If disease symptoms appear during the PEQ period, further testing to identify the causal agent will be necessary and the appropriate remedial actions undertaken, if required.

3.1.2 Dormant tubers (produced under a systems approach)

Consistent with the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) Article 4 *Equivalence,* the department is recommending the following systems approach to manage quarantine pests:

- dormant tubers sourced from high health mother stock (that is, pathogen-tested mother stock or mother stock established from seeds);
- in-field monitoring and management for quarantine pests and pathogens, as well as thrips vectors;
- mandatory off-shore or on-shore treatment (methyl bromide fumigation or hot water treatment or insecticidal dip);
- pre-export inspection; and
- mandatory on-arrival inspection.

Dormant tubers meeting all the components of the recommended systems approach may be released on-arrival and will not require growth in a PEQ facility.

The main components of the recommended systems approach are detailed below and summarised in Table 2.

Dormant tubers sourced from high health mother stock

Dormant tubers for export to Australia should be sourced from high health mother stock that has been virus tested or has been established from seeds.

- Mother stock raised from nursery stock (tissue cultures or tubers) must be tested using Polymerase Chain Reaction (PCR) based methodologies to verify freedom from viruses of quarantine concern to Australia identified in Table 2. The prior inspection and testing of mother stock ensures that only virus-free plant material is used for the production of *Zantedeschia* tubers*.*
- Mother stock raised from true seeds does not require testing as none of the viruses of quarantine concern to Australia identified in Table 2 are seed-borne; therefore, mother plants grown from seed will be free of these quarantine pathogens.

In-field monitoring and management of pests

Zantedeschia species are susceptible to a number of fungal, bacterial and viral pathogens, including the quarantine pathogens *Phytophthora meadii, P. richardiae* and *Pseudomonas veronii*, which express above ground symptoms. These pathogens should be managed using a combination of visual crop inspections, pre-planting fungicides and in-field spray regimes as the dormant tubers are produced for export to Australia.

The mother crop must be monitored by a National Plant Protection Organisation (NPPO) or a NPPO authorised officer. This will allow the inspectors to pick up any infected plants or signs of pest infestation. Removing unhealthy plants is permitted; however, records are to be kept and made available upon request regarding why and how many plants have been affected and removed. At least two field inspections of the crop during the growing season should be undertaken, with at least one inspection at flowering time.

In addition to monitoring for signs or symptoms of infection or infestation, thrips in particular should be managed through monitoring programs and insecticidal spray regimes. Thrips should be targeted as they may transmit quarantine viruses to *Zantedeschia* plants during field production (for instance, Western flower thrips is a known vector of *Impatiens necrotic spot virus* (INSV) and *Thrips palmi* is a known vector of *Calla lily chlorotic spot virus* (CCSV) and *Watermelon silver mottle virus* (WSMoV)).

Mandatory treatment

All dormant tubers must undergo one of the following treatments (off-shore or on-shore) to manage the risk posed by insect pests of quarantine concern:

- Mandatory on-arrival methyl bromide fumigation at the rate recommended to control Narcissus fly; or
- Mandatory hot water treatment (minimum of 44 degrees Celsius for one hour); or
- Mandatory insecticidal dip (Imidacloprid 100 milligrams per litre and one percent eco-oil® for a minimum of 30 seconds).

Pre-export inspection

Dormant tubers for export to Australia must be inspected by NPPO authorised officers immediately prior to export and certified as meeting Australia’s import requirements.

On-arrival inspection

A documentation compliance examination for consignment verification purposes is undertaken by the department, at the port of entry in Australia, prior to inspection and discharge of the imported dormant tubers.

Table 3 Recommended systems approach for *Zantedeschia* dormant tubers

Component of systems approach	Effect of the recommended measure
Dormant tubers sourced from high health mother stock, including: • using PCR-tested mother stock to produce dormant tubers for Australia; or • using mother stock that has been established from true seeds to produce dormant tubers for Australia.	Sourcing dormant tubers from high health sources will reduce risk of introducing pests of quarantine concern into the production chain.
In-field monitoring and management, including: • regular monitoring of *Zantedeschia* tuber crops for fungal, bacterial and viral pathogens as well as thrips; and • fungicidal spray regimes and insecticidal spray regimes to control pests, pathogens and their vectors during growth to produce dormant tubers for Australia.	Regular monitoring allows the inspectors to detect infected plants or signs of pest infestation and will reduce the introduction of pests of quarantine concern to Australia in the supply chain.
Treatment (off-shore or on-shore), including: • methyl bromide fumigation; or • insecticidal dip; or • hot water treatment of dormant tubers.	These treatments will ensure that only pest-free dormant tubers are supplied to Australia.
Pre-export inspection, including: • pre-export inspection by NPPO officers immediately prior to export for evidence of plant pests or diseases.	Inspections will ensure that only pest-free dormant tubers are supplied to Australia.
On-arrival inspection, including: • on-arrival inspection by departmental officers for document compliance and consignment verification purposes.	Inspections will verify the declared phytosanitary health of the dormant tubers.

3.2 Operational system for the maintenance and verification of the phytosanitary status of dormant tubers (produced under a systems approach)

It is necessary to have a system of operational procedures in place to ensure that the phytosanitary status of *Zantedeschia* dormant tubers produced under a systems approach is maintained and verified during the export process to Australia.

3.2.1 Registration of export propagation nurseries

Zantedeschia dormant tubers for export to Australia must be sourced from nurseries registered with the National Plant Protection Organization (NPPO) or other relevant agency nominated by the NPPO. Copies of the registration records must be made available to the department, if requested.

All registered nurseries are expected to produce *Zantedeschia* dormant tubers under standard commercial cultivation, harvesting and packing activities; for example, sourcing tubers from high health mother stock, surveillance for quarantine pathogens, in-field hygiene and management of pests and cleaning and hygiene during packing.

The objectives of this recommended procedure are to ensure that:

- *Zantedeschia* dormant tubers are sourced from the NPPO, or other relevant agency nominated by the NPPO, registered export propagation nurseries producing export quality nursery stock; and
- export propagation nurseries, from which *Zantedeschia* dormant tubers are sourced, can be identified so investigation and corrective action can be targeted rather than applying it to all contributing export propagation nurseries in the event that live pests are intercepted during inspection.

It is recommended that the NPPO, or other relevant agency nominated by the NPPO, registers export propagation nurseries before the harvest season commences.

3.2.2 Dormant tubers sourced from high health mother stock

Dormant tubers for export to Australia should be sourced from high health mother stock that has been established from seeds or virus tested by the NPPO, or an NPPO approved laboratory.

- Mother stock raised from nursery stock (tissue cultures or tubers) must be tested using PCR to verify freedom from viruses of quarantine concern to Australia identified in Table 2. The prior inspection and testing of mother stock ensures that only virus-free plant material is used for the production of *Zantedeschia* tubers.
- Mother stock raised from true seed[*] does not require testing as none of the viruses of quarantine concern to Australia identified in Table 2 are seed-borne; therefore, mother plants grown from seed will be free of quarantine pathogens.

If requested, the details of the virus testing will need to be submitted to the Department of Agriculture and Water Resources, through the NPPO.

3.2.3 Pathogen surveillance program

The registered propagation nurseries will be subject to an official pathogen surveillance program. The NPPO officers, or NPPO authorised officers, will be responsible for undertaking crop surveillance activities to certify freedom from the quarantine pathogens identified in Table 2. The NPPO must keep records of surveillance activities, in accordance with ISPM No. 6 (FAO 2016d). At least two field inspections of the crop during the growing season should be undertaken, with at least one inspection at flowering time. Removing unhealthy plants is permitted; however, records are to be kept and made available upon request regarding why and how many plants have been affected and removed. If required, the details of the surveillance program will need to be submitted to the Department of Agriculture and Water Resources, through the NPPO.

3.2.4 Pest control program

The registered propagation nurseries will have a pest control program approved by the NPPO or other relevant agency nominated by the NPPO. The NPPO will be responsible for ensuring registered propagation nurseries are subject to sanitation and control measures against pests of quarantine concern to Australia, and vectors of pests. Registered propagation nurseries must

[*] A true seed is defined as a fertilised mature ovule that possesses embryonic plant, stored material, and a protective coat or coats.

keep records of control measures for auditing purposes. If required, the details of the pest control program will need to be submitted to the Department of Agriculture and Water Resources, through the NPPO.

3.2.5 Cleaning of bulbs before export

Imported bulbs are currently required to be free of soil (a restricted import). Freedom from soil greatly reduces the risk of the presence of weed seeds and other unwanted propagules (for example, root fragments), and soil-borne pests. Cleaning also reduces the risk from 'hitch-hikers' and incidental pests being inadvertently transported, including organisms such as slugs and snails.

Clean bulbs free of soil and other unwanted material are both easier to inspect and to disinfest by fumigation or hot water treatment.

3.2.6 Off-shore treatment

In addition to the routine control of pests in the registered propagation nurseries, the application of a treatment (fumigation, hot water treatment or insecticidal dip) will be required to ensure the identified quarantine pests are controlled.

Zantedeschia dormant tubers for export to Australia require a pre-export treatment at a registered treatment facility. All dormant tubers must undergo one of the following treatments (off-shore or on-shore) to manage the risk posed by insect pests of quarantine concern:

- Mandatory on-arrival methyl bromide fumigation at the rate recommended to control Narcissus fly; or
- Mandatory hot water treatment (minimum of 44 degrees Celsius for one hour); or
- Mandatory insecticidal dip (Imidacloprid 100 milligrams per litre and one percent eco-oil® for a minimum of 30 seconds).

3.2.7 Registration of packing houses, treatment facilities and auditing of procedures

The department requires that all packing houses must:

- be registered by the NPPO or other relevant agency nominated by the NPPO;
- have systems in place to ensure traceability of *Zantedeschia* dormant tubers to the NPPO registered production nurseries (where packing houses are separate from treatment facilities, traceability to the production nursery must be continuous via the respective treatment facility);
- be designed to prevent the entry of pests into areas where unpacked treated *Zantedeschia* dormant tubers are held;
- ensure all areas of the facility are hygienically maintained;
- maintain complete isolation of treated propagative material from untreated propagative material; and
- maintain records of treatments for all lots of *Zantedeschia* dormant tubers for the NPPO auditing and the departments monitoring purposes.

The objectives of these recommended procedures are to ensure that:

- *Zantedeschia* dormant tubers are processed and packaged at the NPPO, or other relevant agency nominated by the NPPO, registered packing houses, processing export quality *Zantedeschia* dormant tubers; and
- reference to the registered packing house and the registered nursery, by name or a number code, are clearly stated on the packaging of *Zantedeschia* dormant tubers destined for export to Australia for trace back and auditing purposes.

3.2.8 Packaging and labelling

Clean, new and secure packaging material must be used. The consignment must be clearly labelled with the plant species name along with the identification numbers of the NPPO registered export propagation nursery, the registered treatment facility and the registered packing house. The objectives of these recommended procedures are to ensure that:

- *Zantedeschia* dormant tubers for export to Australia are not contaminated by quarantine pests or regulated articles (e.g. trash, soil and weed seeds);
- unprocessed packing material (which may vector pests not identified as being on the pathway) is not imported with *Zantedeschia* dormant tubers;
- secure packaging is used if consignments are not transported in sealed containers directly to Australia; and
- the packaged *Zantedeschia* dormant tubers are labelled with the identification numbers for the NPPO registered propagation nursery, treatment facility and packing house for the purposes of trace back.

3.2.9 Pre-export phytosanitary inspection and certification by NPPO

The NPPO will issue a Phytosanitary Certificate for each consignment after completion of the pre-export phytosanitary inspection. The objective of this recommended procedure is to provide formal documentation to the department verifying that the relevant measures have been undertaken offshore.

Each Phytosanitary Certificate is to contain the following information that is consistent with ISPM 7: *Phytosanitary certification system* (FAO 2016e).

Description of consignment

The packing house registration number, treatment facility registration number, propagation nurseries registration number, number of boxes per consignment weight, and container and seal numbers (as appropriate, for sea freight only) should be included on the Phytosanitary Certificate.

Treatments

Details of disinfestation treatments, including date of treatment, dose rate and treatment facility number should be included on the Phytosanitary Certificate.

Additional declarations

The Phytosanitary Certificate should include the following additional declaration:

'*The Zantedeschia dormant tubers in this consignment have been produced in [insert countries name] in accordance with the conditions governing entry of Zantedeschia dormant tubers to Australia and inspected and found free of quarantine pests*'.

3.2.10 On-arrival phytosanitary inspection

The department will undertake a documentation compliance examination for consignment verification purposes, followed by on-arrival inspection. The following conditions will apply:

- The consignment must have a Phytosanitary Certificate that identifies registered packing houses and bears the required additional declaration.
- Any consignment with incomplete documentation or certification that does not conform to the import conditions may be refused entry, or be subject to additional quarantine measures, consistent with the quarantine risk. The department would notify the NPPO immediately of any such proposed action, and request that they investigate the incident.

All *Zantedeschia* dormant tubers will be subject to on-arrival inspection by departmental officers. The detection of live insects, disease symptoms and/or regulated articles will result in the failure of the consignment and remedial action, including methyl bromide fumigation if live insects are detected.

3.2.11 Remedial action(s) for non-compliance detected on-arrival in Australia

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

3.3 Review of policy

Australia reserves the right to review and amend the import policy if circumstances change. Australia may review the policy after a substantial volume of trade has occurred.

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

3.4 Uncategorised pests

If an organism is detected on *Zantedeschia* dormant tubers prior to export or on-arrival in Australia that has not been categorised, it will require assessment by the department to determine its quarantine status and if phytosanitary action is required. The detection of any pests of quarantine concern not already identified in the analysis may result in remedial action 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

3.5 Consideration of alternative measures

Consistent with the principle of equivalence detailed in ISPM 1 (FAO 2016f), the department will consider any alternative measure proposed by a NPPO, providing that it achieves Australia's ALOP. Evaluation of such measures or treatments will require a technical submission from the NPPO that details the proposed treatment, including data from suitable treatment trials to demonstrate efficacy.

There are a number of risk mitigation measures that can be adopted to protect and minimise the risks of exotic pests under the International Plant Protection Convention (IPPC) standards.

3.5.1 Sourcing *Zantedeschia* tubers from pest free areas

The establishment and use of a pest free area (PFA) by a NPPO provides assurance that specific pests are not present in the production area for plant products being exported. This facilitates the commodity's entry into the importing country, without the need for the application of additional phytosanitary measures, when certain requirements are met.

Area freedom is a measure that might be applied to manage the risk posed by *Eumerus strigatus*, *Pseudococcus maritimus*, *Pseudomonas veronii*, *Phytophthora meadii*, *Phytophthora richardiae*, *Calla lily chlorotic spot virus*, *Impatiens necrotic spot virus*, *Konjac mosaic virus*, *Lisianthus necrosis virus* and *Watermelon silver mottle virus* with dormant *Zantedeschia* tubers imported into Australia. The requirements for establishing pest free areas or pest free places of production are set out in ISPM No. 4: *Establishment of pest free areas* (FAO 2016g) and ISPM No. 10: *Requirements for the establishment of pest free places of production and pest free production sites* (FAO 2016h).

The establishment and use of a PFA by a NPPO allows for the export of plants and other regulated articles from the exporting country to the importing country without the need for the application of additional phytosanitary measures, when certain requirements are met. The exporting country may also inspect the crop to certify freedom from the pests. The requirements for the establishment, and subsequent maintenance, of a PFA include:

- systems to establish freedom (general surveillance, specific surveys);
- phytosanitary measures to maintain freedom (regulatory actions, routine monitoring, extension advice to producers); and
- checks to verify freedom has been maintained.

Should a NPPO wish to use area freedom as a measure to manage the risk posed the identified quarantine pests associated with dormant *Zantedeschia* tubers, they would need to provide Australia with a submission demonstrating area freedom for consideration by the Australian Government Department of Agriculture and Water Resources.

4 Conclusion

The findings of this final review of phytosanitary policy are based on a comprehensive analysis of the scientific literature. This review has identified several pests of quarantine concern that are associated with *Zantedeschia* dormant tubers from all sources.

The ultimate goal of Australia's phytosanitary measures is to protect plant health and prevent the introduction of identified quarantine pests associated with *Zantedeschia* dormant tubers. The department considers that the risk management measures recommended in this final review of policy are adequate to mitigate the risks posed by the identified pests of quarantine concern.

The recommended risk management measures for *Zantedeschia* dormant tubers are summarised as follows:

Dormant tubers (non-approved sources)

- mandatory on-arrival inspection;
- mandatory treatment (methyl bromide fumigation, hot water treatment or insecticidal dip); and
- growth in a closed PEQ facility for a minimum of six weeks for pathogen screening, or until sufficient new growth has occurred (where the plant has developed multiple, open and green leaves).

Dormant tubers (produced under a systems approach)

The recommended components of the systems approach include:

- dormant tubers sourced from high health mother stock (pathogen-tested mother stock or mother stock established from seeds);
- in-field monitoring and management for quarantine pests and pathogens, as well as thrips vectors;
- mandatory off-shore or on-shore treatment (methyl bromide fumigation or hot water treatment or insecticidal dip);
- mandatory pre-export inspection; and
- mandatory on-arrival inspection.

Dormant tubers meeting all the components of the systems approach are recommended to be released on-arrival and will not require growth in a PEQ facility.

Appendix A: Initiation and categorisation for pests of *Zantedeschia* dormant tubers from all countries

Initiation identifies the pests that occur on *Zantedeschia* species, their status in Australia and their pathway association. Some pests that are present in Australia may be prohibited entry into certain states and territories. The regional status of some pests are noted in this pest categorisation table; however, this is not a comprehensive list of regional pests and it is the importer's responsibility to ensure compliance with regional requirements.

In this assessment, **pathway** is defined as *Zantedeschia* dormant tubers. Dormant tubers are free of roots and leaves, and consequently pests associated with roots and leaves are not considered to be on the dormant tuber pathway. Please note that the 'introduction potential' column usually specifies the association of pests with propagative material.

Pest categorisation identifies the potential for pests associated with *Zantedeschia* propagative material to enter, establish, spread and cause economic consequences in Australia, and to determine if they qualify as quarantine pests for Australia.

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
ARTHROPODS					
ACARI (mites)					
Brevipalpus obovatus Donnadieu 1875 [Acari: Tenuipalpidae]	Yes (O'Dowd 1994)	Assessment not required			
Bryobia neopraetiosa Meyer 1974 [Acari: Tetranychidae]	Not known to occur	No: This polyphagous mite has been recorded on *Zantedeschia aethiopica* (Scott & Neser 1996), but affected plant parts are not mentioned. *Bryobia* species generally feed on the leaves and sometimes flower buds of host plants (Gutierrez & Schichta 1983). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Bryobia praetiosa Koch [Acari: Tetranychidae]	Yes (Arthur et al. 2011)	Assessment not required			
Calacarus citrifolii Keifer 1955 [Acari: Eriophyidae]	Not known to occur	No: This species occurs on *Zantedeschia* (Ryke & Meyer 1960; Xue et al. 2009). Although affected plant parts are not mentioned, eriophyid mites generally damage leaves, but may also attack twigs and fruit (Lindquist et al. 1996). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Rhizoglyphus echinopus (Fumouze & Robin 1868) [Acari: Acaridae]	Yes (Fan & Zhang 2003)	Assessment not required			
Tetranychus amicus Meyer & Rodrigues 1965 [Acari: Tetranychidae]	Not known to occur	No: This species occurs on *Zantedeschia aethiopica* (Bolland et al. 1998). Generally, spider mites feed on most plant parts, including the upper and lower surfaces of leaves and the stems and sheaths of some grasses (Flechtmann & Knihinicki 2002). This species is not reported to be associated with tubers. Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Tetranychus cinnabarinus (Boisduval 1832) [Acari: Tetranychidae]	Yes (Halliday 1998)	Assessment not required			
Tetranychus desertorum Banks 1900 [Acari: Tetranychidae]	Yes (Flechtmann & Knihinicki 2002)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Tetranychus ludeni Zacher 1913 [Acari: Tetranychidae]	Yes (Flechtmann & Knihinicki 2002)	Assessment not required			
Tetranychus shanghaiensis Ma & Yuan 1975 [Acari: Tetranychidae]	Not known to occur	No: This species occurs on *Zantedeschia aethiopica* (Scott 1997). Generally, spider mites feed on most plant parts, including the upper and lower leaf surfaces and the stems and sheaths of some grasses (Flechtmann & Knihinicki 2002). Therefore, foliage-free dormant tubers do not provide a pathway for this species.			
Tetranychus urticae (Koch 1836) [Acari: Tetranychidae]	Yes (Halliday 1998)	Assessment not required			
Tyrophagus neiswanderi Johnston & Bruce 1965 [Acari: Acaridae]	Yes (Fan & Zhang 2007). This pest has been identified as a regional pest for one or more Australian states or territories.	Assessment not required			
COLLEMBOLA (Springtails)					
Bourletiella hortensis (Fitch 1863) [Collembola: Sminthuridae]	Yes (Greenslade 2007)	Assessment not required			
Smithurus viridus (Linnaeus 1758) [Collembola: Sminthuridae]	Yes (Greenslade 2007)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
COLEOPTERA (beetles, weevils)					
Acrocrypta convexa Gressitt & Kimoto 1963 [Coleoptera: Chrysomelidae]	Not known to occur	No: This beetle occurs on *Zantedeschia* (Aston 2009). Generally, larvae of chrysomelid beetles feed on roots while adults feed on the leaves of host plants (Beenan & Roques 2010). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Adelium brevicorne Blessig [Coleoptera: Tenebrionidae]	Yes (Gu et al. 2007)	Assessment not required			
Adoretus tenuimaculatus Waterhouse [Coleoptera: Scarabaeidae] (Synonym: *Adoretus sinicus* Burmeister)	Not known to occur	No: This species is a polyphagous scarab beetle; adults are foliage feeders and larvae are root feeders (Lee et al. 2002). Therefore, foliage-free dormant tubers do not provide a pathway for this beetle.	Assessment not required		
Agriotes lineatus (Linnaeus 1767) [Coleoptera: Elateridae]	Not known to occur	No: This click beetle has been recorded on *Zantedeschia* plants (Sacoto Bravo 2010). Eggs are laid in the upper soil layers in damp areas (Frolov 2009). Larvae feed on roots, while adults mostly feed on the pollen of host plants (Borg-Karlson et al. 1988). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Conoderus exsul (Sharp 1877) [Coleoptera: Elateridae]	Yes (Clunie 2004). This pest has been identified as a regional pest for one or more Australian states or territories.	Assessment not required			
Costelytra zealandica (White 1846) [Coleoptera: Scarabaeidae]	Not known to occur	No: This beetle has been recorded on *Zantedeschia* (Dymock & Holder 1996). Eggs are laid in the soil and developing larvae feed on the roots while adults are foliage feeders (Fennemore 1984). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Euphoria basalis Gory & Percheron 1833 [Coleoptera: Scarabaeidae]	Not known to occur	No: This species feeds on the pollen and petals of *Zantedeschia* flowers (García 2012). Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		
Hoplia callipyge Le Conte 1856 [Coleoptera: Scarabaeidae]	Not known to occur	No: Adult hoplia beetles chew on the blossoms and young leaves, while larvae chew on the roots of *Zantedeschia* (Dreistadt 2001). Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Popillia japonica Newman 1841 [Coleoptera: Scarabaeidae]	Not known to occur	No: Adults of this polyphagous species have been reported to feed on the flowers of *Zantedeschia* (Cranshaw 2004). Eggs are laid in the soil and larvae develop on the roots of grasses. Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		
Phlyctinus callosus (Boheman 1834) [Coleoptera: Curculionidae]	Yes (Walker 1980)	Assessment not required			
DIPTERA (Flies)					
Cerodontha australis (Malloch 1925) [Diptera: Agromyzidae]	Yes (Sasakawa 2010)	Assessment not required			
Coboldia fuscipes (Meigen 1830) [Diptera: Scatopsidae]	Yes (Smithers 1998; Cook 2007)	Assessment not required			
Delia platura (Meigen 1826) [Diptera: Anthomyiidae]	Yes (Colless 1982)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Eumerus strigatus (Fallen 1817) [Diptera: Syrphidae]	Not known to occur (There is an unconfirmed report of this species occurring in Australia (Thompson 2008). However, there are no confirmed records of this species occurring in Australia)	**Yes**: Eggs are laid on the skin covering or neck of the bulb (Barbour et al. 2008). The larvae hatch and then burrow and overwinter in the bulb (Barbour et al. 2008). This fly has been introduced into many countries by imported bulbs and vegetables (Rojo et al. 1997). Therefore, dormant tubers provide a pathway for this fly.	**Yes**: Bulb flies are established in areas with a wide range of climatic conditions similar to Australia; and may spread naturally in bulbs carrying overwintering larvae (Barbour et al. 2008). In addition, adults and larvae are mobile (Hodson 1927) and therefore are able to disperse naturally. Therefore, this species has the potential to establish and spread in Australia.	**Yes**: Bulb flies are considered economically important pests of ornamentals and some root vegetables, particularly onions (Perry 2007). There are records of up to 30 percent losses in onions; up to 25 percent losses in some varieties of *Narcissus* and 10 percent infestation of hyacinths in some countries (Perry 2007). Therefore, this species has the potential for economic consequences in Australia.	**Yes**
Gaurax flavoapicalis (Malloch 1931) [Diptera: Chloropidae] (Listed as *Gaurex flavoapicalis*, which is not an accepted name)	Yes (Sabrosky 2014)	Assessment not required			
Gaurax mesopleuralis (Becker 1911) [Diptera: Chloropidae]	Yes (Sabrosky 2014)	Assessment not required			
Hippelates insignificans (Malloch 1931) [Diptera: Chloropidae]	Not known to occur	No: This fly has been recorded on *Zantedeschia* (Dymock & Holder 1996). The larvae are not reported to be associated with *Zantedeschia* tubers. Adults of this fly are common in summer on grasses, sedges, and other low vegetation (Sabrosky 1987). Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Neurochaeta inversa McAlpine 1978 [Diptera: Neurochaetidae]	Yes (McAlpine 1993)	Assessment not required			
HEMIPTERA (Aphids, mealybugs, scales)					
Acyrthosiphon malvae (Mosley 1841) [Hemiptera: Aphididae]	Yes (Starý & Carver 1979)	Assessment not required			
Aphis craccivora Koch 1854 [Hemiptera: Aphididae]	Yes (Gutierrez et al. 1974)	Assessment not required			
Aphis fabae Scopoli 1763 [Hemiptera: Aphididae]	Not known to occur	No: This aphid is reported to occur on *Zantedeschia* (Blackman 2013). It overwinters as eggs on its primary hosts (Cammell 1981), including *Euonymus europaeus*, *Viburnum opulus* and *Philadelphus coronarius* (Tosh et al. 2004; Sandrock et al. 2011). Adults move to secondary hosts where they attack the foliage, flowers and twigs (Mackenzie 1996; Liburd et al. 2004). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Aphis gossypii Glover 1877 [Hemiptera: Aphididae]	Yes (Herron et al. 2001)	Assessment not required			
Aulacorthum solani (Kaltenbach 1843) [Hemiptera: Aphididae]	Yes (Berlandier 1997)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Aulacorthum circumflexum (Buckton 1876) [Hemiptera: Aphididae]	Yes (Fletcher & Eastop 2005). This pest has been identified as a regional pest for one or more Australian states or territories.	Assessment not required			
Bemisia tabaci (Gennadius 1889) [Hemiptera: Aleyrodidae]	Yes (De Barro & Hart 2000)	Assessment not required			
Brachycaudis helichrysi (Kaltenbach 1843) [Hemiptera: Aphididae]	Yes (Martyn & Miller 1963)	Assessment not required			
Calocoris norvegicus (Gmelin 1790) [Hemiptera: Miridiae]	Yes (Haye et al. 2006). This pest has been identified as a regional pest for one or more Australian states or territories.	Assessment not required			
Cavariella aegopodii (Scopoli 1763) [Hemiptera: Aphididae]	Yes (Jones et al. 2006)	Assessment not required			
Cenaeus carnifex (Fabricius 1775) [Hemiptera: Pyrrhocoridae]	Not known to occur	No: This species feeds on the foliage of *Zantedeschia* (Scott & Neser 1996). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Ceroplastes rubens Maskell 1893 [Hemiptera: Coccidae]	Yes (Loch 1997)	Assessment not required			
Coccus hesperidum Linnaeus 1758 [Hemiptera: Coccidae]	Yes (Ben-Dov 2013a)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Crenidorsum aroidephagus Martin & Aguiar 2001 [Hemiptera: Aleyrodidae]	Not known to occur	No: This foliage feeding whitefly (Martin et al. 2001; FERA 2008) has been reported on *Zantedeschia* (FERA 2008). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Ctenarytaina eucalypti (Maskell 1890) [Hemiptera: Psyllidae]	Yes (Withers 2001)	Assessment not required			
Dictyotus caenosus (Westwood 1837) [Hemiptera: Pentatomidae]	Yes (Larivière 1995)	Assessment not required			
Dieuches notatus (Dallas 1852) [Hemiptera: Lygaeidae]	Yes (Piper 1985)	Assessment not required			
Dysaphis tulipae Boyer de Fonscolombe 1841 [Hemiptera: Aphididae]	Yes (Hughes et al. 1964)	Assessment not required			
Heterogaster urticae (Fabricius 1775) [Hemiptera: Heterogastridae]	Not known to occur	No: This ground bug is reported on or in close proximity to *Zantedeschia* (Scudder & Eyles 2003). Eggs are laid in the ground at the base of the host plant and sometimes on the stem or leaves (Scudder & Eyles 2003). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Homalodisca vitripennis Germar 1821 [Hemiptera: Cicadellidae] (Synonym: *Homalodisca coagulata* (Say 1832))	Not known to occur	No: *Zantedeschia* is listed as an oviposition host for this sharpshooter (Walker 2005). However, sharpshooters lay eggs in the tissue on the underside of leaves (Grandgirard et al. 2006). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Kilifia acuminata (Signoret 1873) [Hemiptera: Coccidae]	Not known to occur	No: This species is reported to occur on *Zantedeschia* species (Nakahara 1981). This species is normally found on the leaves of host plants (Williams & Watson 1990) and is not reported to be associated with *Zantedeschia* tubers. Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Macrosiphum euphorbiae (Thomas 1878) [Hemiptera: Aphididae]	Yes (Berlandier 1997)	Assessment not required			
Myzus ascalonicus Doncaster 1946 [Hemiptera: Aphididae]	Yes (Eastop 1966)	Assessment not required			
Myzus persicae (Sulzer 1776) [Hemiptera: Aphididae]	Yes (Berlandier 1997)	Assessment not required			
Nezara viridula (Linnaeus 1758) [Hemiptera: Pentatomidae]	Yes (Knight & Gurr 2007)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Nysius huttoni (White 1878) [Hemiptera: Lygaeidae]	Not known to occur	No: *Nysius huttoni* has been recorded on *Zantedeschia* (Dymock & Holder 1996). Eggs are laid in cracks in the soil (Reid & Eyre 2010) and nymphs and adults of *Nysius* species attack the leaves and stems of host plants (Reid & Eyre 2010). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Parafurius discifer (Stäl 1860) [Hemiptera: Miridae]	Not known to occur	No: This plant bug is associated with *Zantedeschia* foliage (Carvalho et al. 2011; 2012). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Parasaissetia nigra (Nietner 1861) [Hemiptera: Coccidae]	Yes (Ben-Dov 2013a)	Assessment not required			
Pentalonia nigronervosa Coq. 1859 [Hemiptera: Aphididae]	Yes (Hughes et al. 1964)	Assessment not required			
Phenacoccus gossypii Townsend & Cockerell 1898 [Hemiptera: Pseudococcidae]	Not known to occur	**Yes:** This mealybug is reported to occur on *Zantedeschia* (McKenzie 1967). It normally occurs above ground on the leaves and stems of host plants, but is occasionally found feeding on the crowns and roots (McKenzie 1967). Therefore, dormant tubers may provide a pathway for this species.	**Yes**: This mealybug is polyphagous and has established in areas with a wide range of climatic conditions similar to Australia (McKenzie 1967). *Phenacoccus gossypii* can spread naturally in infested propagative material and has the potential for establishment and spread in Australia.	No: Information on the economic consequences of this mealybug on *Zantedeschia* is almost non-existent. *Phenacoccus gossypii* is a common pest of ornamentals and has been reported as a minor pest of lima beans (McKenzie 1967); however, there is no evidence to suggest this species has the potential for economic consequences.	

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Philaenus spumarius (Linnaeus 1758) [Hemiptera: Cercopidae]	Yes (Memmott et al. 2000)	Assessment not required			
Planococcus citri (Risso 1813) [Hemiptera: Pseudococcidae]	Yes (Gullan 2000)	Assessment not required			
Pseudococcus calceolariae (Maskell 1879) [Hemiptera: Pseudococcidae]	Yes (Gullan 2000). This pest has been identified as a regional pest for one or more Australian states or territories.	Assessment not required			
Pseudococcus maritimus (Ehrhorn 1900) [Hemiptera: Pseudococcidae]	Not known to occur. Ben-Dov (2013b) reports that there are some erroneous records of this species in Australia, but clarifies that this species is not known to occur in Australia.	**Yes**: This species is reported to occur on *Zantedeschia* (McKenzie 1967; Maddison). It has been recorded on *Zantedeschia* roots (Maddison 1993). *Pseudococcus* species can attack *Zantedeschia* plants in the latter stages of crop growth and leave eggs that can hatch post-storage, as the bulbs are warmed up (Warren 2012). Therefore, dormant tubers may provide a pathway for this mealybug.	**Yes**: This mealybug is polyphagous and has established in areas with a wide range of climatic conditions (Ben-Dov 2013b) similar to Australia. *Pseudococcus maritimus* can spread naturally in infested propagative material by the movement of crawlers and winged males (Grasswitz & James 2008).Therefore, this mealybug has the potential for establishment and spread in Australia.	**Yes**: This mealybug causes considerable losses in table grapes (McKenzie 1967; Daane et al. 2003) and is a recognised pest of apricots and pears (Ben-Dov 2013b). This mealybug not only vectors grapevine leafroll viruses (Skinkis et al*.* 2009; Daane et al. 2011) but also *Little cherry virus 2* (Mekuria et al. 2013). Therefore, this mealybug has the potential for economic consequences in Australia.	**Yes**
Pseudococcus longispinus (Targioni 1867) [Hemiptera: Pseudococcidae]	Yes (Gullan 2000)	Assessment not required			
Pseudococcus viburni (Signoret 1875) [Hemiptera: Pseudococcidae] (Synonym: *Pseudococcus affinis* (Maskell 1867))	Yes (Gullan 2000)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Pulvinaria psidii Maskell 1893 [Hemiptera: Coccidae]	Yes (Qin & Gullan 1992)	Assessment not required			
Rhizoecus falcifer Kunckel d'Herculais 1878 [Hemiptera: Rhizoecidae]	Yes (Ben-Dov et al. 2013)	Assessment not required			
Rhopalosiphoninus latysiphon (Davidson 1912) [Hemiptera: Aphididae]	Yes (Eastop 1966)	Assessment not required			
Rhypodes clavicornis (Fabricius 1794) [Heteroptera: Lygaeidae]	Not known to occur	No: This bug is reported to naturally occur on *Zantedeschia* (Dymock and Holder 1996). There is no evidence that it is associated with *Zantedeschia* tubers. Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		
Scolypopa australis (Walker 1851) [Hemiptera: Ricaniidae]	Yes (Liefting et al. 1997)	Assessment not required			
Sidnia kinbergi (Stål 1859) [Hemiptera: Miridae]	Yes (Pearson 1991)	Assessment not required			
HYMENOPTERA (ants, bees, wasps)					
Trigona spinipes (Jurine 1807) [Hymenoptera: Apidae]	Not known to occur	No: This pollen collector bee (Cortopassi-Laurino & Ramalho 1988) has been reported on *Zantedeschia aethiopica* (Carvalho et al. 2012) but is not reported to be associated with tubers. Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
LEPIDOPTERA (moths, butterflies)					
Alabama argillacea (Hübner 1823) [Lepidoptera: Noctuidae]	Not known to occur	No: This moth has been recorded on *Zantedeschia* (Dymock & Holder 1996). Larvae of this moth are generally foliage feeders (Silva et al. 2011). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Cnephasia longana (Haworth 1811) [Lepidoptera: Tortricidae]	Not known to occur	No: The larvae of this species chew, mine and produce webbing on the buds, flowers and leaves of *Zantedeschia* (Dreistadt 2001). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Coleophora versurella (Zeller 1849) [Lepidoptera: Coleophoridae]	Not known to occur	No: The larvae of this moth have been recorded on *Zantedeschia*. Larvae of this moth are generally foliage feeders (Kimber 2012). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Helicoverpa armigera (Hübner 1805) [Lepidoptera: Noctuidae]	Yes (Fitt et al. 1995)	Assessment not required			
Hippotion celerio (Linnaeus 1758) [Lepidoptera: Sphingidae]	Yes (Nielsen et al. 1996)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Hippotion eson (Cramer 1779) [Lepidoptera: Sphingidae]	Not known to occur	No: The larvae of this moth feed on *Zantedeschia* (Scott & Neser 1996). The larvae of this moth are foliage feeders (Gerlach 2011). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Hippotion osiris (Dalman 1823) [Lepidoptera: Sphingidae]	Not known to occur	No: This moth has been recorded on *Zantedeschia* (Robinson et al. 2010). The larvae of this moth are foliage feeders (Golding 1927). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Macroglossum stellatarum Linnaeus 1758 [Lepidoptera: Sphingidae]	Not known to occur	No: *Zantedeschia* is listed as a larval host of this moth (Plantbook 2013). Larvae of this species feed on above-ground material (Vieira 2002). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Nyctemera annulata (Boisduval 1832) [Lepidoptera: Arctiidae]	Not known to occur	No: The adults and larvae of this moth are reported to naturally occur on *Zantedeschia* (Dymock and Holder 1996). There is no evidence that it is associated with *Zantedeschia* tubers. Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Opogona omoscopa (Meyrick 1893) [Lepidoptera: Tineidae]	Yes (Nielson et al. 1996; Brockerhoff et al. 2010)	Assessment not required			
Pieris rapae (Linnaeus 1758) [Lepidoptera: Pieridae]	Yes (Nielson et al. 1996)	Assessment not required			
Pyrrharctia isabella (Smith 1797) [Lepidoptera: Erebidae]	Not known to occur	No: This moth has been recorded on *Zantedeschia* (Robinson et al. 2010). Larvae of this moth are generally foliage feeders (Cranshaw & Kondratieff 2006). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Spilosoma virginica Fabricius 1798 [Lepidoptera: Erebidae]	Not known to occur	No: This polyphagous moth has been recorded on *Zantedeschia* (Robinson et al. 2010). Larvae of this moth are generally foliage feeders (Peterson et al. 1993). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Theretra cajus (Cramer 1777) [Lepidoptera: Sphingidae]	Not known to occur	No: These hawk moths have been recorded on *Zantedeschia* (Scott & Neser 1996). Larvae of these moths are foliage feeders (Van den Berg et al. 1975) and adults feed on nectar (Queensland Museum 2013). Therefore, foliage-free dormant tubers do not provide a pathway for these species.	Assessment not required		
Theretra monteironis Butler 1882 [Lepidoptera: Sphingidae]	Not known to occur		Assessment not required		
Theretra oldenlandiae (Fabricius 1775) [Lepidoptera: Sphingidae]	Yes (Nielsen et al. 1996)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Theretra tryoni (Miskin 1891) [Lepidoptera: Sphingidae]	Yes (Nielsen et al. 1996)	Assessment not required			
Thysanoplusia orichalcea (Fabricius 1775) [Lepidoptera: Noctuidae]	Yes (Nielson et al. 1996)	Assessment not required			
Xanthopastis timais (Cramer 1780) [Lepidoptera: Noctuidae]	Not known to occur	No: *Zantedeschia* is listed as a rare alternate host (Heppner et al. 2002). Females lay eggs on the leaves of host plants and pupation occurs in the soil (Heppner et al. 2002). Larvae cause damage by chewing leaves, bulbs, and rhizomes of the host plants (Heppner 2000; Heppner et al. 2002). There is no evidence to suggest that this species feeds internally on *Zantedeschia* tubers and is therefore not considered to be on the pathway.	Assessment not required		
ORTHOPTERA (Grasshoppers, locusts)					
Teleogryllus commodus (Walker 1869) [Orthoptera: Gryllidae]	Yes (Bussière et al. 2006)	Assessment not required			
THYSANOPTERA (thrips)					
Apterothrips secticornis (Trybom 1896) [Thysanoptera: Thripidae]	Yes (Nakahara 1988)	Assessment not required			
Ceratothrips frici (Uzel 1895) [Thysanoptera: Thripidae]	Yes (Houston et al. 1991)	Assessment not required			
Echinothrips americanus Morgan 1913 [Thysanoptera: Thripidae]	Not known to occur	No: This thrips infests the leaves of *Zantedeschia* (Varga et al. 2010). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Frankliniella intonsa (Trybom 1895) [Thysanoptera: Thripidae]	Not known to occur	No: This thrips has been recorded on flowers and leaves of *Zantedeschia* (Azidah 2011). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Frankliniella occidentalis (Pergande 1895) [Thysanoptera: Thripidae]	Yes (Mound 2004)	Assessment not required			
Haplothrips niger (Osbourne 1883) [Thysanoptera: Phlaeothripidae]	Yes (Mound & Minaei 2007)	Assessment not required			
Heliothrips haemorrhoidalis (Bouché 1883) [Thysanoptera: Thripidae]	Yes (Mound & Gillespie 1997)	Assessment not required			
Hercinothrips femoralis (Reuter) 1891 [Thysanoptera: Thripidae]	Yes (Houston et al. 1991)	Assessment not required			
Limothrips cerealium (Halliday 1836) [Thysanoptera: Thripidae]	Yes (Mound & Gillespie 1997)	Assessment not required			
Pezothrips kellyanus (Bagnall 1916) [Thysanoptera: Thripidae] (Basionym: *Megalurothrips kellyanus* (Bagnall) Bhatti 1969)	Yes (Webster et al. 2006)	Assessment not required			
Teuchothrips disjunctus (Hood 1918) [Thysanoptera: Phlaeothripidae]	Yes (Mound & Gillespie 1997)	Assessment not required			
Thrips flavus Shrank 1776 [Thysanoptera: Thripidae]	Not known to occur	No: This thrips causes scarring, browning and discolouration of flowers (Tillekaratne et al. 2011). Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		
Thrips hawaiiensis (Morgan 1913) [Thysanoptera: Thripidae]	Yes (Williams et al. 2001)	Assessment not required			
Thrips nigropilosus Uzel 1895 [Thysanoptera: Thripidae]	Yes (Hoddle et al. 2006)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Thrips obscuratus (Crawford 1941) [Thysanoptera: Thripidae]	Not known to occur	No: These thrips species have been recorded on flowers and foliage of a variety of host plants including *Zantedeschia* (Dymock & Holder 1996; McLaren et al. 2010; Tillekaratne et al. 2011). These species lay eggs in the leaves and growing points (CRC 2012) and adults are found mainly on the flowers of plants (McLaren & Walker 2012). Therefore, foliage-free dormant tubers do not provide a pathway for these species.	Assessment not required		
Thrips palmi (Karny 1925) [Thysanoptera: Thripidae]	Yes (Mound & Gillespie 1997), but under official control in Australia.		Assessment not required		
Thrips physapus (Linnaeus 1758) [Thysanoptera: Thripidae]	Not known to occur		Assessment not required		
Thrips simplex (Morison 1930) [Thysanoptera: Thripidae]	Yes (Mound & Gillespie 1997)	Assessment not required			
Thrips tabaci (Lindeman 1889) [Thysanoptera: Thripidae]	Yes (Mound 2004)	Assessment not required			
GASTROPODS (snails, slugs, molluscs)					
Cochlicopa lubrica (Müller 1774) [Orthurethra: Cochlicopidae]	Yes (CSIRO 2004)	Assessment not required			
Helix aspersa (Müller 1774) [Sigmurethra: Helicidae]	Yes (Healy & Jamieson 1989)	Assessment not required			
PATHOGENS					
BACTERIA					

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Burkholderia cepacia (ex Burkholder 1950) Yabuuchi et al. 1993 [Burkholderiales: Burkholderiaceae] (Synonym: *Pseudomonas cepacia* Burkholder 1950)	Yes (Huang & Wong 1998)	Assessment not required			
Chryseobacterium indologenes (Yabuuchi et al. 1983) [Flavobacteriales: Flavobacteriaceae]	Yes (Burešová et al. 2006)	Assessment not required			
Erwinia chrysanthemi Burkholder et al. 1953 [Enterobacteriales: Enterobacteriaceae]	Yes (Stirling 2002)	Assessment not required			
Paenibacillus polymyxa (Prazmowski 1880) [Bacillales: Paenibacillaceae] (Synonym: *Bacillus polymyxa* (Prazmowski) Mace 1889)	Yes (Berge et al. 2002)	Assessment not required			
Pectobacterium carotovorum subspecies *atrosepticum* (van Hall 1902) [Enterobacteriales: Enterobacteriaceae] (Synonym: *Erwinia carotovorum* subspecies *atroseptica* (van Hall 1902) Dye 1969).	Yes (Toth et al. 2001)	Assessment not required			
Pectobacterium carotovorum subspecies *carotovorum* (Jones 1901) [Enterobacteriales: Enterobacteriaceae] (Synonym: *Erwinia carotovora* subspecies *carotovora* (Jones 1901) Dye 1969)	Yes (Peltzer & Sivasithamparam 1985)	Assessment not required			
Pseudomonas fluorescens (Migula 1895) [Pseudomonadales: Pseudomonadaceae]	Yes (Padaga et al. 2000)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Pseudomonas marginalis (Brown 1918) [Pseudomonadales: Pseudomonadaceae]	Yes (Wimalajeewa et al. 1985)	Assessment not required			
Pseudomonas putida (Trevisan 1889) [Pseudomonadales: Pseudomonadaceae]	Yes (Cother et al. 2009)	Assessment not required			
Pseudomonas veronii Elomari et al. 1996 [Pseudomonadales: Pseudomonadaceae]	Not known to occur	**Yes**: This bacterium is associated with *Zantedeschia* tubers causing soft rot (Mikiciński et al. 2010a). The main points of entry for soft rot bacteria are the base of the petiole (Vanneste 1996). Therefore, dormant tubers may provide a pathway for this bacterium.	**Yes**: This bacterium has established in areas with a wide range of climatic conditions (Mikiciński et al. 2010a) similar to Australia. This bacterium is present in soil (Nam et al. 2003) and water (Elomari et al. 1996), and can spread naturally in infected tubers. Therefore, this bacterium has the potential for establishment and spread in Australia.	**Yes:** This species is a part of the bacterial complex associated with soft rot (Mikiciński et al. 2010a), which causes significant crop losses. The first symptoms are a loss of turgidity for the whole plant (Mikiciński et al. 2010a), leaves turning yellow and the tuber rotting (Vanneste 1996). Soft rot is considered one the most important diseases of *Zantedeschia* worldwide (Mikiciński et al. 2010a). Therefore, this bacterium has the potential for economic consequences in Australia.	**Yes**
Xanthomonas campestris pv. *zantedeschiae* (Joubert & Truter 1972) [Pseudomonadales: Pseudomonadaceae]	Not known to occur	No: This bacterium is associated with leaves and causes leaf blight (Lee et al. 2005). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
FUNGI					
Alternaria alternata (Fr.) Keissl. [Pleosporales: Pleosporaceae]	Yes (Webley et al. 1997)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Alternaria tenuissima (Kunze) Wiltshire [Pleosporales: Pleosporaceae]	Yes (Brown & Ferreira 2000)	Assessment not required			
Armillaria gallica Marxmüller & Romagni [Agaricales: Physalacriaceae]	Not known to occur	No: Members of the genus *Armillaria* occur in the bark and roots of the host plant (Farr et al. 1989; Keane 2000; Van der Kamp & Hood 2002). Therefore, dormant tubers do not provide a pathway for these fungi.	Assessment not required		
Armillaria heimii Pegler [Agaricales: Physalacriaceae]	Not known to occur		Assessment not required		
Armillaria limonea (G. Stev.) Boesew. [Agaricales: Physalacriaceae]	Not known to occur		Assessment not required		
Armillaria luteobubalina Watling & Kile [Agaricales: Physalacriaceae]	Yes (Cook & Dubé 1989)	Assessment not required			
Armillaria tabescens (Scop.) Emel [Agaricales: Physalacriaceae]	Not known to occur	No: Members of the genus *Armillaria* occur in the bark and roots of the host plant (Farr et al. 1989; Keane 2000; Kamp & Hood 2002). Therefore, dormant tubers do not provide a pathway for this fungus.	Assessment not required		
Aspergillus niger Tiegh. [Eurotiales: Trichocomaceae]	Yes (Leong et al. 2007)	Assessment not required			
Athelia rolfsii (Curzi) C.C. Tu & Kimbr. [Atheliales: Atheliaceae] (Synonym: *Sclerotium rolfsii* Sacc.)	Yes (Maxwell & Scott 2004)	Assessment not required			
Bionectria ochroleuca (Schwein.) Schroers & Samuels [Hypocreales: Bionectriaceae]	Yes (PHA 2001)	Assessment not required			
Botrytis cinerea Pers.:Fr. [Heliotiales: Sclerotiniaceae] (Synonym: *Botryotinia fuckeliana* (de Bary) Whetzel)	Yes (Salam et al. 2011)	Assessment not required			
Calonectria kyotensis Terash. [Hypocreales: Nectriaceae]	Yes (PHA 2001)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Cercospora apii Fresen [Capnodiales: Mycosphaerellaceae]	Yes (Liberato & Stephens 2006)	Assessment not required			
Cercospora callae Peck & Clinton [Capnodiales: Mycosphaerellaceae]	Not known to occur	No: This fungus is associated with foliage causing leaf spot on *Zantedeschia* (Scott 1997; Farr & Rossman 2014). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Cercospora callae f. *aethiopica* Gonz. Frag. [Capnodiales: Mycosphaerellaceae]	Not known to occur	No: *Zantedeschia* is reported as a host for this fungus (Farr & Rossman 2014). *Cercospora* species are associated with foliage causing leaf spot (Scott 1997). Therefore, foliage-free dormant tubers do not provide a pathway for this fungus.	Assessment not required		
Cercospora richardiicola G.F. Atk. [Capnodiales: Mycosphaerellaceae]	Not known to occur	No: *Zantedeschia* is reported as a host for this fungus (Farr & Rossman 2014). *Cercospora* species are associated with foliage causing leaf spot (Scott 1997). Therefore, foliage-free dormant tubers do not provide a pathway for this fungus.	Assessment not required		
Cladosporium elatum (Harz) Nannf [Capnodiales: Cladosporiaceae] (Synonym: *Ochrocladosporium elatum* (Harz) Crous & U. Braun)	Yes (Upsher & Upsher 1995)	Assessment not required			
Cladosporium herbarum (Pers.) Link [Capnodiales: Cladosporiaceae]	Yes (PHA 2001)	Assessment not required			
Cladosporium sphaerospermum Penz. [Capnodiales: Cladosporiaceae]	Yes (Benyon et al. 1999)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Clonostachys rosea f. *rosea* (Link) Schroers et al. [Hypocreales: Bionectriaceae] (Synonym: *Gliocladium roseum* Bainier)	Yes (Burgess at al. 1997)	Assessment not required			
Colletotrichum coccodes (Wallr.) S. Hughes [Incertae sedis: Glomerellaceae]	Yes (Ben-Daniel et al. 2010)	Assessment not required			
Colletotrichum gloeosporioides (Penz.) Penz. & Sacc [Incertae sedis: Glomerellaceae]	Yes (Ireland et al. 2008)	Assessment not required			
Coniothyrium cassiicola Cooke [Pleosporales: Leptosphaeriaceae]	Not known to occur	No: This fungus is associated with foliage causing leaf spot on *Zantedeschia* (Starr 2005). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Corynespora cassiicola (Berk. & M.A. Curtis) C.T. Wei [Pleosporales: Corynesporascaceae]	Yes (Vawdrey et al. 2008)	Assessment not required			
Drechslera dematioidea (Bubák & Wróbl.) Subram. & B.L. Jain [Pleosporales: Pleosporaceae]	Yes (Sivanesan 1990)	Assessment not required			
Epicoccum nigrum Link [Pleosporales: Pleosporaceae]	Yes (PHA 2001)	Assessment not required			
Fusarium culmorum (W.G. Sm.) Sacc. [Hypocreales: Nectriaceae]	Yes (Summerell et al. 2011)	Assessment not required			
Fusarium graminearum Schwabe (Schwein.) Petch [Hypocreales: Nectriaceae]	Yes (Quazi et al. 2009)	Assessment not required			
Fusarium oxysporum Schltdl. [Hypocreales: Nectriaceae]	Yes (Summerell et al. 2011)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Fusarium solani (Mart.) Sacc. [Hypocreales: Nectriaceae] (Synonym: *Neocosmospora solani* (Mart.) L. Lombard & Crous)	Yes (Pegg et al. 2002)	Assessment not required			
Helicobasidium purpureum (Tul.) Pat. [Helicobasidiales: Helicobasidiaceae]	Yes (Grgurinovic & Cayzer 2003)	Assessment not required			
Leveillula taurica (Lév.) G. Arnaud [Erysiphales: Erysiphaceae]	Yes (Persley et al. 2010)	Assessment not required			
Mycosphaerella tassiana (De Not.) Johanson [Capnodiales: Mycosphaerellaceae]	Yes (Maxwell & Scott 2008)	Assessment not required			
Myrothecium roridum Tode [Hypocreales: Incertae sedis]	Yes (Shivas & Alcorn 1996; PHA 2001)	Assessment not required			
Nectria inventa Pethybr. [Hypocreales: Nectriaceae]	Yes (PHA 2001)	Assessment not required			
Nectria radicicola Gerlach & L. Nilsson [Incertae sedis: Incertae sedis] (Synonym: *Ilyonectria radicicola* (Gerlach & L. Nilsson) P. Chaverri & Salgado)	Yes (Summerell et al. 1990)	Assessment not required			
Periconia byssoides Pers. [Pleosporales: Incertae sedis]	Yes (Chakraborty et al. 1994)	Assessment not required			
Phoma glomerata (Corda) Wollenw. & Hochapfel [Pleosporales: Incertae sedis]	Yes (Taylor et al. 1999)	Assessment not required			
Phoma richardiae Mercer [Pleosporales: Incertae sedis]	Not known to occur	No: This fungus is associated with foliage and causes leaf spot on *Zantedeschia* (Farr & Rossman 2014). Therefore, foliage-free dormant tubers do not provide a pathway for this fungus.	Assessment not required		

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Phoma zantedeschiae Dippen. [Pleosporales: Incertae sedis]	Not known to occur	**Yes**: This fungus has been recorded on *Zantedeschia* (Boerema & Hamers 1990; Farr & Rossman 2014) causing large brown blotches on the leaves and spathes (Boerema et al. 2004). Additionally, this fungus has been isolated from *Zantedeschia* tubers (Aveskamp et al. 2010). Therefore, dormant tubers may provide a pathway for this fungus.	**Yes**: This fungus has established in areas with a wide range of climatic conditions (Farr & Rossman 2014) similar to Australia and can spread naturally in infected bulbs. Therefore, this fungus has the potential for establishment and spread in Australia.	**No**: There is a historical record of this fungus causing a serious disease of *Zantedeschia* (Brooks 1932). However, no further information could be found to suggest that this fungus causes significant economic losses. Therefore, this fungus is not of economic concern to Australia.	
Phyllosticta richardiae F.T. Brooks [Pleosporales: Incertae sedis]	Not known to occur	No: This fungus has been recorded on *Zantedeschia* (Farr & Rossman 2014) causing brown blotches on the aerial shoot system (Brooks 1932). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Phytophthora cryptogea Pethybr. & Laff. [Peronosporales: Peronosporaceae]	Yes (Irwin 1997)	Assessment not required			
Phytophthora erythroseptica Pethybr. [Peronosporales: Peronosporaceae]	Yes (Oxspring et al. 2000; Persley et al. 2010)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Phytophthora meadii McRae [Peronosporales: Peronosporaceae]	Not known to occur	**Yes:** This fungus causes leaf blight, flower rot and root rot of *Zantedeschia* (Liou et al. 1999). Therefore, dormant tubers can provide a pathway for this species.	**Yes:** This fungus has established in areas with a wide range of climatic conditions (Farr & Rossman 2014) similar to Australia; and can spread naturally in infected bulbs. Therefore, this fungus has the potential for establishment and spread in Australia.	**Yes**: *Phytophthora meadii* is associated with a number of commercial crops (for example, pineapple, peach) and has been implicated in economic losses in rubber, causing up to a 40 percent drop in yield (Drenth & Sendall 2004). Therefore, this fungus has the potential to cause economic consequences in Australia.	**Yes**
Phytophthora richardiae Buisman [Peronosporales: Peronosporaceae]	Not known to occur	**Yes:** This fungus causes root rot of *Zantedeschia* (Boerema & Hamers 1990). The fungus penetrates the tuber at the point of attachment of the roots (Boerema & Hamers 1990; Erwin & Ribeiro 1996). Therefore, dormant tubers can provide a pathway for this species.	**Yes:** This fungus has established in areas with a wide range of climatic conditions (Farr & Rossman 2014) similar to Australia; and can spread naturally in infected bulbs. Therefore, this fungus has the potential for establishment and spread in Australia.	**Yes:** *Phytophthora richardiae* has a host range that includes a number of commercial crops including asparagus, carrot, tomato and cassava (Verhoeff & Weber 1966; Farr & Rossman 2014; Poltronieri et al. 1997). This species causes a destructive root rot disease in *Zantedeschia*, causing leaf necrosis, flower malformation, root rot and eventual plant death (Erwin & Ribeiro 1996). Therefore, this fungus has the potential to cause economic consequences in Australia.	**Yes**
Pythium aphanidermatum (Edson) Fitzp. [Pythiales: Pythiaceae]	Yes (Cook & Dubé 1989)	Assessment not required			
Pythium coloratum Vaartaja [Pythiales: Pythiaceae]	Yes (Maxwell 1997)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Pythium myriotylum Drechsler [Pythiales: Pythiaceae]	Yes (Stirling & Eden 2008)	Assessment not required			
Pythium ultimum Trow [Pythiales: Pythiaceae]	Yes (Fang et al. 2011)	Assessment not required			
Ramularia richardiae Kalchbr. & Cooke [Capnodiales: Mycosphaerellaceae]	Not known to occur	No: This fungus has been recorded on *Zantedeschia* (Farr & Rossman 2014). *Ramularia* species generally occur on leaves and cause leaf spot (Farr et al.1989). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Rhizoctonia solani J.G. Kühn [Cantharellales: Ceratobasidiaceae]	Yes (Neate & Warcup 1985)	Assessment not required			
Rhizopus stolonifer (Ehrenb.) Vuill. 1902 [Mucorales: Rhizopodaceae]	Yes (Washington et al. 1992)	Assessment not required			
Rosellinia necatrix Berl. ex Prill. 1904 [Xylariales: Xylariaceae]	Yes (Shivas 1989)	Assessment not required			
Septoria aracearum R.K. Verma & Kamal [Capnodiales: Mycosphaerellaceae]	Not known to occur	No: This species has been recorded on *Zantedeschia* (Farr & Rossman 2014). *Septoria* species generally are associated with the leaves (Koike et al. 2007). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Pyrenochaeta terrestris (H.N. Hansen) Gorenz et al [Incertae sedis: Incertae sedis] (Synonym: *Setophoma terrestris* (H.N. Hansen) Gruyter et al.)	Yes (Hall et al. 2007)	Assessment not required			
Thielaviopsis basicola (Berk. & Broome) Ferraris [Microascales: Ceratocystidaceae]	Yes (Nehl et al. 2004)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Trichopeltheca asiatica Batista et al. [Capnodiales: Euantennariaceae]	Yes (Hughes 1965)	Assessment not required			
Ulocladium zantedeschiae X.G. Zhang & T.Y. Zhang [Pleosporales: Pleosporaceae]	Not known to occur	No: This fungus is associated with the leaves of *Zantedeschia aethiopica* (Zhang & Zhang 2006). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Uromyces ari-triphylli (Schwein.) Seeler [Uredinales: Pucciniaceae]	Not known to occur	No: This fungus has been recorded on *Zantedeschia* plants causing rust (Alfieri et al. 1984). Therefore, foliage-free dormant tubers do not provide a pathway for this species.	Assessment not required		
Verticillium cinnabarinum (Corda) Reinke & Berthold [Incertae sedis: Plectosphaerellaceae]	Yes (PHA 2001)	Assessment not required			
Verticillium tricorpus I. Isaac [Incertae sedis: Plectosphaerellaceae]	Yes (Edwards & Taylor 1998)	Assessment not required			
VIRUSES					
Alfalfa mosaic virus (AMV) [Bromoviridae: *Alfamovirus*]	Yes (Garran & Gibbs 1982)	Assessment not required			
Arabis mosaic virus (ArMV) [Comoviridae: *Nepovirus*]	Yes (Sharkey et al. 1996). This virus has been identified as a regional pest for one or more Australian states or territories.	Assessment not required			
Bean yellow mosaic virus (BYMV) [Potyviridae: *Potyvirus*]	Yes (Gibbs et al. 2008)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Calla lily chlorotic spot virus (CCSV) [Bunyaviridae: *Tospovirus*]	Not known to occur	**Yes**: CCSV is associated with *Zantedeschia* causing leaf necrosis and chlorotic lesions (Chen et al. 2005). Viruses, as a rule, infect host plants systemically and all plant parts, including parts used for vegetative propagation, are infected (Bos 1999). Therefore, dormant tubers may provide a pathway for CCSV.	**Yes**: CCSV has established in areas with a wide range of climatic conditions (Chen et al. 2005; Liu et al. 2012) similar to Australia; and may spread naturally in infected dormant tubers. Additionally, its vector, *Thrips palmi* (Chen et al. 2005), which is present in Australia (Mound 2004), will help spread this virus within Australia. Therefore, CCSV has the potential to establish and spread in Australia.	**Yes**: CCSV affects the marketability of *Zantedeschia* by inducing chlorosis with yellow spots on the leaves (Chen et al. 2005). It also infects spider lily (*Hymenocallis litteralis*) and tobacco plants (*Nicotiana tabacum*), causing systemic yellow spots, chlorotic spots, necrotic spots and rugosity symptoms (Liu et al. 2012). These symptoms would reduce the marketability of the ornamental host plants in the domestic cut flower and nursery industries. Therefore, this virus has the potential for economic consequences in Australia.	**Yes**

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Calla lily latent virus (CLLV) [Potyviridae: *Potyvirus*]	Not known to occur	**Yes**: CLLV infection is symptomless (Chen et al. 2004a). This may lead to the propagation and distribution of infected propagative material. CLLV spreads by vegetative propagation through infected rhizomes or tubers (Chen et al. 2004a). Therefore, dormant tubers may provide a pathway for CLLV.	**Yes:** CLLV has established in areas with a wide range of climatic conditions similar to Australia; and may spread naturally in infected propagative material (Chen et al. 2004a). The symptomless nature of this virus may contribute to the inadvertent propagation and distribution of infected material that will help spread CLLV within Australia. Therefore, CLLV has the potential to establish and spread in Australia.	No: Information on the economic consequences of this virus is almost non-existent. CLLV does not appear to be a threatening pathogen to *Zantedeschia,* as infections are symptomless (Chen et al. 2004a) and infected plants are indistinguishable from uninfected plants in yield and quality (Chen et al. 2006a). Therefore, this virus is unlikely to have the potential for significant economic consequences in Australia.	
Capsicum chlorosis virus (CaCV) [Bunyaviridae: *Tospovirus*]	Yes (McMichael et al. 2002)	Assessment not required			
Carnation mottle virus (CarMV) [Tombusviridae: *Carnovirus*]	Yes (Moran et al. 1985)	Assessment not required			
Cucumber mosaic virus (CMV) [Bromoviridae: *Cucumovirus*]	Yes (Alberts et al. 1985)	Assessment not required			
Dasheen mosaic virus (DsMV) [Potyviridae: *Potyvirus*]	Yes (Greber & Shaw 1986)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Impatiens necrotic spot virus (INSV) [Bunyaviridae: *Tospovirus*] (Synonym: *Tomato spotted wilt virus*—Impatiens strain (TSWV-I))	Not known to occur	**Yes**: INSV is associated with *Zantedeschia* (Elliot et al. 2009; Rizzo et al. 2012). Symptoms of infection include chlorotic or yellow spots on leaves (Rizzo et al. 2012). Viruses, as a rule, infect host plants systemically and all plant parts, including parts used for vegetative propagation, are infected (Bos 1999). Whilst limited information exists on the transmissibility of INSV through *Zantedeschia* bulbs, tospoviruses, including INSV, have been detected in other bulbs (Sastry 2013). Therefore, dormant tubers may provide a pathway for the entry of INSV into Australia.	**Yes**: INSV has established in areas with a wide range of climatic conditions (CABI/EPPO 1997) similar to Australia; and may spread naturally in infected propagative material. Distribution of infected propagative material and its vector, *Frankliniella occidentalis* (Elliot et al. 2009), which is present in Australia (Mound 2004) will help spread this virus within Australia. Therefore, INSV has the potential to establish and spread in Australia.	**Yes**: INSV has become a major pathogen in the floriculture industry in the USA and Europe (Daughtrey et al. 1997; CABI/EPPO 1997; Wick 2009). There have been severe economic losses from INSV in the United States (Daughtrey et al. 1997). Therefore, INSV has the potential for economic consequences in Australia.	**Yes**

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Konjac mosaic virus (KoMV) (Synonym: *Zantedeschia mosaic virus* (ZaMV)) [Potyviridae: *Potyvirus*]	Not known to occur	**Yes**: KoMV is associated with *Zantedeschia* causing mosaic or mottle symptoms on leaves (Chen et al. 2006b). Viruses, as a rule, infect host plants systemically and all plant parts are infected (Bos 1999). Therefore, dormant tubers may provide a pathway for the entry of KoMV into Australia.	**Yes**: KoMV has established in areas with a wide range of climatic conditions (Chang et al. 2001; Chen et al. 2006b; Manikonda et al. 2011) similar to Australia; and may spread naturally in infected dormant bulbs. Additionally, its vector, *Aphis gossypii* (Shimoyama et al. 1992), which is present in Australia (Wool et al. 1995), will help spread KoMV within Australia. Therefore, KoMV has the potential to establish and spread in Australia.	**Yes**: KoMV affects several ornamental plants causing yellowing, mosaic, green spots on leaves and discoloured spots on flowers (Chang et al. 2001; Manikonda et al. 2011; Padmavathi et al. 2013). As affected hosts are ornamental commodities, there is the potential for this virus to affect the cut flower industry through the loss of productivity and markets. Therefore, KoMV has the potential for economic consequences in Australia.	**Yes**
Lisianthus necrosis virus (LNV) [Tombusviridae: *Necrovirus*]	Not known to occur	**Yes**: LNV is associated with *Zantedeschia* causing systemic necrosis (Chen et al. 2006c). Viruses, as a rule, infect host plants systemically and all plant parts are infected (Bos 1999). Therefore, dormant tubers may provide a pathway for the entry of LNV into Australia.	**Yes**: LNV has established in areas with a wide range of climatic conditions (Chen et al. 2006c) similar to Australia; and may spread through propagative material. Therefore, LNV has the potential to establish and spread in Australia.	**Yes**: LNV causes systemic necrosis in *Zantedeschia* and lisianthus (*Eustoma russellianum*) affects plant health (Iwaki et al. 1987; Chen et al. 2006c). As affected species are ornamental commodities, there is the potential for this virus to affect the cut flower industry through the loss of productivity and markets. Therefore, LNV has the potential for economic consequences in Australia.	**Yes**
Potato virus X (PVX) [Alphaflexiviridae: *Potexvirus*]	Yes (Holmes & Teakle 1980)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Tobacco mosaic virus (TMV) [Virgaviridae: *Tobamovirus*]	Yes (Cook & Dubé 1989)	Assessment not required			
Tobacco rattle virus (TRV) [Virgaviridae: *Tobravirus*]	Yes (Sharkey et al. 1996). This virus has been identified as a regional pest for one or more Australian states or territories.	Assessment not required			
Tomato spotted wilt virus (TSWV) [Bunyaviridae: *Tospovirus*]	Yes (Dietzgen et al. 2005)	Assessment not required			
Turnip mosaic virus (TuMV) [Potyviridae: *Potyvirus*]	Yes (Gibbs et al. 2008)	Assessment not required			
Watermelon silver mottle virus (WSMoV) [Bunyaviridae: *Tospovirus*]	Not known to occur	**Yes**: WSMoV is associated with the foliage of *Zantedeschia* (Chen et al. 2003) causing yellow-green spots (Chen et al. 2008). Viruses, as a rule, infect host plants systemically and all plant parts are infected (Bos 1999). Therefore, dormant tubers may provide a pathway for the entry of WSMoV into Australia.	**Yes**: WSMoV has established in areas with a wide range of climatic conditions (Chen et al. 2006d) similar to Australia; and may spread naturally in infected dormant bulbs. Distribution of infected bulbs and its vector, *Thrips palmi* (Chu et al. 2001), which is present in Australia (Mound 2004), will help spread WSMoV within Australia. Therefore, WSMoV has the potential to establish and spread in Australia.	**Yes**: Information on the economic consequences of this virus on *Zantedeschia* is almost non-existent. However, WSMoV is the most important pathogen of watermelon and other cucurbits (Chu et al. 2001; Chen et al. 2004b) and is considered to be one of the major limiting factors for melon and watermelon production in Eastern Asia (EPPO 1997; Chen et al. 2006d). Therefore, WSMoV has the potential for economic consequences in Australia.	**Yes**
Zantedeschia mild mosaic virus (ZaMMV) [Potyviridae: *Potyvirus*]	Yes (Kidanemariam et al. 2016)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
NEMATODES					
Aphelenchoides fragariae Ritzema-Bos, 1890 [Panagrolaimida: Aphelenchoididae]	Yes (McLeod et al. 1994)	Assessment not required			
Aphelenchus avenae Bastian, 1865 [Panagrolaimida: Aphelenchidae]	Yes (McLeod et al. 1994)	Assessment not required			
Criconemella jessiensis Van den Berg, 1992 [Panagrolaimida: Criconematidae]	Not known to occur	No: This nematode occurs around the roots of *Zantedeschia aethiopica* (Van den Berg 1992). *Criconemella* species are ectoparasites (Klass et al. 2012) and as such the nematodes remain in the soil and do not enter the plant's tissues. Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		
Ditylenchus dipsaci Kühn, 1857 [Panagrolaimida: Anguinidae]	Yes (Taylor & Szot 2000). This nematode has been identified as a regional pest for one or more Australian states or territories.	Assessment not required			
Helicotylenchus dihystera Cobb, 1893 [Panagrolaimida: Hoplolaimidae]	Yes (McLeod et al. 1994)	Assessment not required			
Meloidogyne arenaria Neal, 1889 [Panagrolaimida: Meloidogynidae]	Yes (McLeod et al. 1994)	Assessment not required			
Meloidogyne hapla Chitwood, 1949 [Panagrolaimida: Meloidogynidae]	Yes (McLeod et al. 1994)	Assessment not required			

Pest type	Present in Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest
Meloidogyne incognita Kofoid & White, 1919 [Panagrolaimida: Meloidogynidae]	Yes (McLeod et al. 1994)	Assessment not required			
Meloidogyne javanica Treub, 1885 [Panagrolaimida: Meloidogynidae]	Yes (Mcleod et al. 1994)	Assessment not required			
Paratrichodorus divergens Almeida et al., 2005 [Triplonchida: Trichodoridae]	Not known to occur	No: This species has been found around the roots of *Zantedeschia aethiopica* (Almeida et al. 2005). Trichodoridae are ectoparasites of roots (Decraemer & Robbins 2007), and as such the nematodes remain in the soil and do not enter the plant's tissues. Therefore, dormant tubers do not provide a pathway for this species.	Assessment not required		
Pratylenchus crenatus Loof, 1960 [Panagrolaimida: Pratylenchidae]	Yes (McLeod et al. 1994)	Assessment not required			
Rotylenchus robustus de Man, 1876 [Panagrolaimida: Hoplolaimidae]	Yes (McLeod et al. 1994)	Assessment not required			
Tylenchulus semipenetrans Cobb, 1913 [Panagrolaimida: Tylenchulidae]	Yes (McLeod et al. 1994)	Assessment not required			

Appendix B: Additional quarantine pest data

Quarantine pest	***Eumerus strigatus* (Fallen, 1817)**
Synonyms	*Pipiza strigata*; *Pipiza strigatus*
Common name(s)	Onion bulb fly; Lesser bulb fly; Onion fly; Small Narcissus fly; Garlic fly
Main hosts	*Allium cepa*, *Allium cepa* var. *aggregatum*, *Allium sativum*, *Amaryllis* species, *Brassica oleracea*, *Colchicum* species, *Fritillaria imperialis, Fritillaria persica*, *Eurycles* species, *Galtonia* species, *Gladiolus* species, *Hyacinthus* species, *Iris* species, *Lilium* species, *Narcissus* species, *Scilla* species, *Solanum tuberosum*, *Sprekelia formosissima*, *Vallota* species and *Zantedeschia elliottiana* (Poos & Weigel 1927; Gyulai 1980; Capinera 2001; Barbour et al*.* 2008; Kizil et al. 2008; Alford 2012). Capinera (2001) notes that reports of this species attacking *Daucus carota* and *Pastinaca sativa* are almost certainly incorrect.
Distribution	Canada, Chile, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Japan, Mongolia, the Netherlands, New Zealand, Norway, Serbia, Spain, Sweden, the United Kingdom and the United States (Gyulai 1980; Dymock & Holder 1996; Gerding et al*.* 1999; Capinera 2001; Perry 2007; GBIF 2014).
Quarantine pest	***Pseudococcus maritimus* (Ehrhorn 1900)**
Synonyms	*Dactylopius maritimus*; *Pseudococcus bakeri*; *Pseudococcus omniverae*
Common name(s)	American grape mealybug; Baker's mealybug; Grape mealybug; Ocean mealybug
Main hosts	*Acacia julibrissin, Acer* species, *Alternathera* species, *Annona hastata, Arbutus* species, *Astragalus* species, *Berberis compacta gracilis, Boerhavia nivea, Carya* species, *Catalpa* species, *Ceanothus* species, *Celtis* species, *Cestrum* species, *Chysis aurea, Citrus* species, *Cornus florida, Corylus americana, Cotoneaster* species, *Cupressus* species, *Cydonia* species, *Cyperus* species, *Diospyros* species, *Erigeron* species, *Eriogonum* species, *Eustoma russelianum, Fraxinus caroliniana, Genista* species, *Gleditsia triacanthos, Grevillea* species, *Haplopappus ericoides, Illex vomitoria, Ipomoea* species, *Juglans regia, Juniperus maritima, Liquidambar styraciflora, Maclura* species, *Magnolia* species, *Malus* species, *Manihot esculenta, Medicago sativa, Mesembryanthemum* species, *Morus* species, *Narcissus* species, *Odontoglossum grande, Ostrya virginiana, Parthenium* species, *Persea* species, *Platanus* species, *Polygonum* species, *Prunus* species, *Psoralea macrostachya, Pyrus communis, Ramona stachyoides, Rhododendron* species, *Rhus diversiloba, Robinia* species, *Rubus vitifolius, Sambucus glauca, Sambucus* species, *Sassafras* species, *Solanum melongena, Solidago sempervirens, Strelitzia* species, *Tapirira edulis, Taxus* species, *Thuja* species, *Tilia americana, Trifolium* species, *Ulmus* species, *Vaccinium* species, *Vitis* species and *Zantedeschia* species (Ben-Dov et al. 2012).
Distribution	Argentina, Armenia, Bermuda, Canada, Chile, Colombia, French Guiana, Guadeloupe, Guatemala, Indonesia, Mexico, Poland, Puerto Rico & Vieques Island and the United States (Ben-Dov et al. 2012).
Quarantine pest	***Pseudomonas veronii* (Elomari et al*.* 1996)**
Synonyms	-
Common name(s)	Bacterial soft rot
Main hosts	*Zantedeschia* species (Mikiciński et al. 2010a).
Distribution	Canada, France, Korea, the Netherlands and Poland (Nam et al. 2003; Hynes et al. 2008; Mikiciński et al. 2010a; GBIF 2014).
Quarantine pest	***Phytophthora meadii* McRae (1918)**
Synonyms	-
Common name(s)	Rubber bark rot; Rubber black thread; Rubber pod rot;Rubber stripe canker; Rubber secondary leaf fall; Top rot of pineapple
Main hosts	*Acacia mearnsii, Aglaonema nitidum* cv. *curtisii, Ananas comosus, Areca catechu, Catharanthus roseus, Cocos nucifera, Dianthus caryophyllus, Elettaria cardamomum,*

	Euonymus japonicas, Ficus species, *Hevea brasiliensis, Leea coccinea, Piper betle, Prunus persica, Solanum melongena, Theobroma cacao*, *Thryptomene saxicola*, *Vanilla planifolia* and *Zantedeschia aethiopica* (Stamps 1985; Ann 1992; Aragaki & Uchida 1994; Erwin & Ribeiro 1996; Liou et al. 1999; Uchida & Kadooka 1999; Bhai & Thomas 2000; Ann et al. 2003; Nagel et al. 2013; Farr & Rossman 2014).
Distribution	Brazil, Cambodia, Cameroon, China, Congo, Costa Rica, Ghana, Hawaii, India, Indonesia, Iran, Liberia, Malaysia, Mauritius, Myanmar, New Zealand, Nicaragua, Nigeria, Peru, Philippines, South Africa, Sri Lanka, Taiwan, Thailand, Venezuela and Vietnam (CABI 1989; Pennycook 1989; Erwin & Ribeiro 1996; Liou et al. 1999; Portales 2004; Nagel et al. 2013).
Quarantine pest	***Phytophthora richardiae*** **Buisman (1927)**
Synonyms	*Phytophthora cryptogea* var. *richardiae* (Buisman) S.F. Ashby
Common name(s)	Tuber rot of Calla lily; Foot rot of tomato; Spear rot of asparagus; Stem and root rot of Calla lily
Main hosts	*Asparagus* species, *Daucus carota, Daucus carota* subspecies *sativus, Manihot esculenta*, *Solanum lycopersicum* and *Zantedeschia* species (Verhoeff & Weber 1966; Boerema & Hamers 1990; Hall 1991; Poltronieri et al. 1997; Falloon et al. 2002; Farr & Rossman 2014).
Distribution	Belgium, Brazil, Bulgaria, Czech Republic, England, Ireland, Japan, the Netherlands, Philippines, Slovakia and the United States (Hall 1991; Poltronieri et al. 1997; Farr & Rossman 2014)
Quarantine pest	***Calla lily chlorotic spot virus*** **(CCSV)**
Synonyms	-
Common name(s)	Calla lily chlorotic spot
Main hosts	*Hymenocallis litteralis*, *Nicotiana tabacum* and *Zantedeschia* species (Chen et al. 2005; Liu et al. 2012).
Distribution	China and Taiwan (Chen et al. 2005; Liu et al. 2012).
Quarantine pest	***Impatiens necrotic spot virus*** **(INSV)**
Synonyms	*Tomato spotted wilt virus*—Impatiens strain (TSWV-I)
Common name(s)	Necrotic spot
Main hosts	Ornamental hosts include: *Aconitum* species, *Alstroemeria* species, *Anemone* species, *Anthemis* species, *Anthurium* species, *Antirrhinum* species, *Aquilegia* species, *Ardisia* species, *Argyranthemum* species, *Aster* species, *Aucuba* species, *Begonia* species, *Bougainvillea* species, *Bouvardia* species, *Browallia* species, *Calendula* species, *Callistephus* species, *Campanula* species, *Chelone* species, *Chrysanthemum* species, *Cineraria* species, *Columnea* species, *Coreopsis* species, *Cycas* species, *Cyclamen persicum*, *Dahlia* species, *Delphinium* species, *Dendranthema* x *grandiflorum*, *Dendrobium* species, *Dianthus* species, *Diascia* species, *Digitalis* species, *Dracaena* species, *Euphorbia marginata, Eustoma* species, *Exacum* species, *Fatsia japonica*, *Ficus benjamina, Freesia refracta, Gaillardia* species, *Gardenia jasminoides, Gazania* species, *Gerbera* species, *Gladiolus* species, *Hedera* species, *Hibiscus rosa-sinensis, Hippeastrum* species, *Hosta* species, *Hydrangea* species, *Impatiens* species, *Ipomoea* species, *Iris* species, *Kalanchoe* species, *Kohleria* species, *Lantana* species, *Lavandula* species, *Leucanthemum* species, *Lilium* species, *Limonium* species, *Lobelia* species, *Lupinus* species, *Myosotis* species, *Nemesia strumosa, Nicotiana* species, *Oenothera* species, *Oncidium* species, *Paeonia* species, *Papaver* species, *Pelargonium* species, *Penstemon* species, *Petunia* x *hybrida, Phalaenopsis* species, *Phlox* species, *Pittosporum* species, *Plectranthus* species, *Polemonium* species, *Pothos* species, *Primula* species, *Ranunculus* species, *Rhododendron* species, *Rohdea* species, *Rosa* species, *Ruscus* species, *Saintpaulia* species, *Schefflera* species, *Sedum* species, *Senecio cruentus, Senecio hybridus, Sinningia speciosa, Spathiphyllum* species, *Stephanotis* species, *Stokesia* species, *Streptocarpus* species, *Tagetes* species, *Trachelium* species, *Tropaeolum* species, *Vinca* species, *Viola* species, *Zantedeschia aethiopica, Zantedeschia albomaculata, Zantedeschia odorata* and *Zinnia* species (Hausbeck et al. 1992; Ruter & Gitaitis 1993a;

	Ruter & Gitaitis 1993b; Verhoeven & Roenhorst 1994; Loebenstein et al. 1995; Lockhart & Currier 1996; Bellardi & Lisa 1998; Miller et al.1998; Rudzinska-Langwald & Kaminska 1998; Windham et al. 1998; EPPO 1999; Roggero et al. 1999; Koike & Mayhew 2001; Materazzi & Triolo 2001; Shahraeen et al. 2002; Ghotbi et al. 2005; Baker et al. 2007; Hausbeck 2007; Elliot et al. 2009; Werkman et al. 2010; Zhang et al. 2010; McDonough et al. 2011). Fruit, vegetable and other non-ornamental hosts include *Capsicum annuum, Cichorium* species, *Cucumis sativus*, *Lactuca sativa*, *Lycopersicon esculentum, Ocimum basilicum, Rubus* species, *Salvia* species, *Solanum* species, *Spinacia oleracea*, *Valerianella olitoria* and *Vicia faba* (Hausbeck et al. 1992; Daughtrey et al. 1997; EPPO 1999; Liu et al. 2009; Tzanetakis et al. 2009; Werkman et al. 2010; El-Wahab et al. 2011).
Distribution	Belgium, Canada (British Columbia, Manitoba), Chile, China, Costa Rica, Egypt, France, Germany, Iran, Israel, Italy, Japan, the Netherlands, New Guinea, New Zealand, Poland, Portugal, Spain, the United Kingdom and the United States (Lisa et al. 1990; De Avila et al. 1992; Adam & Lesemann 1994; EPPO/CABI 1996; Louro 1996; EPPO 1999; Elliott et al 2009; Kuwabara et al. 2010; El-Wahab et al. 2011).
Quarantine pest	***Konjac mosaic virus* (KoMV)**
Synonyms	*Zantedeschia mosaic virus; Calla lily mosaic virus; Japanese hornwort mosaic virus*
Common name(s)	Konjac mosaic
Main hosts	*Amorphophallus* species, *Colocasia esculenta*, *Caladium* species, *Dieffenbachia* species, *Philodendron oxycardium, Philodendron selloum, Philodendron verrucosum*, *Tetraginia expansa*, *Typhonium flagelliforme*, *Zamioculcas zamiifolia* and *Zantedeschia* species (Chang et al. 2001; Shi et al. 2005; Chen et al. 2006b ; ICTVdB Management 2006; Nishiguchi et al. 2006; Manikonda et al. 2011; Padmavathi et al. 2013; Alexandre et al. 2013).
Distribution	Brazil, China, Germany, India, Japan, Korea, Taiwan, the Netherlands and New Zealand (Shi et al. 2005; Wei et al. 2008; Manikonda et al. 2011; Alexandre et al. 2013).
Quarantine pest	***Lisianthus necrosis virus* (LNV)**
Synonyms	-
Common name(s)	Lisianthus necrosis
Main hosts	*Dianthus caryophyllus*, *Eustoma russellianum* and *Zantedeschia* species (Iwaki et al. 1987; Chen & Hsu 2002; Chen et al. 2006c).
Distribution	Japan and Taiwan (Iwaki et al. 1987; Chen et al. 2006c).
Quarantine pest	***Watermelon silver mottle virus* (WSMoV)**
Synonyms	*Watermelon silvery mottle virus; Watermelon tospovirus*
Common name(s)	Watermelon silver mottle disease
Main hosts	*Amaranthus viridis, Benincasa hispida, Capsicum annuum, Citrullus vulgaris* (= *Citrullus lanatus*), *Cucumis melo, Cucumis sativus, Cucurbita pepo, Lagenaria leucantha*, *Luffa aegyptiaca, Physalis* species, *Solanum lycopersicum*, *Solanum nigrum* and *Zantedeschia* species (EPPO 1997; Chu et al. 2001; Chen et al. 2003; Chen et al. 2004b; Chiemsombat et al. 2008; Anurag 2012).
Distribution	China, India, Japan, Taiwan and Thailand (EPPO 1997; Chen et al. 2003; EPPO 2004; Rao et al. 2011). Reported but not confirmed from Brazil (EPPO 1997) and the United States (Texas and Mississippi) (Ali et al. 2012).

Appendix C: Stakeholders comments on the draft review

The department circulated the draft review of policy for *Zantedeschia* dormant tubers in July 2015 for stakeholder consultation (G/SPS/N/AUS/368). The department received six submissions, which were generally supportive of the review. Stakeholders requested additional information on the recognition of regional pests and the new treatment options. The department has consulted with these stakeholders and made changes to the document, where appropriate. A summary of the responses to issues raised by stakeholders is provided below.

Issues raised by the stakeholders in response to the draft review

Recognition for regional pests

Further information was requested in relation to regional differences in pest status.

There are different biosecurity requirements across national, state and territory borders, which are equally important in preventing or minimising the impact of harmful pests and diseases.

Australia is a party to the World Trade Organization (WTO) which, among other things, binds Members to comply with their obligations under the Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement) and conduct its risk analysis in accordance with the International Plant Protection Convention's (IPPC) International Standards for Phytosanitary Measures (ISPMs).

The department recognises that certain areas of Australia have a different pest and disease status from other areas and works with state and territory governments on this issue. Risk assessments to determine regional pest and disease status must comply with Australia's international obligations including the IPPC.

In accordance with Australia's international obligations, the department may only regulate quarantine pests at the border if they meet the IPPC definition of a quarantine pest. A quarantine pest is defined by the IPPC as "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" (ISPM 5, FAO 2016c). A quarantine pest should be:

- absent from Australia or under official control[2];
- associated with the import pathway (in this case, dormant *Zantedeschia* tubers);
- have the potential to establish and spread in Australia; and
- have the potential for significant economic or environmental consequences in Australia.

For regional pests to be regulated at the international border by the department they must be absent from, or not widely distributed within, a given state or territory and being officially controlled. In an active sense, this would require that pests are listed in state or territory

[2] *Official control* is defined as "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 2016c).

legislation and that control measures are implemented to prevent the entry and spread of the pest. Evidence of official control could include results from surveillance activities, eradication or containment programs, and other management practices. This information may need to be provided by the department to international trading partners, if requested.

When conducting its assessment, the department did not identify any pests associated with *Zantedeschia* dormant tubers that were present in Australia and under official control. However, the department has the ability to modify its import conditions should the status of a regional pest change.

The Commonwealth, states and territories have also entered into an Intergovernmental Agreement on Biosecurity (IGAB 2012), which states that “states and territories shall not apply any sanitary or phytosanitary measures within their jurisdictions which would not comply with the provisions of the SPS Agreement”.

The IGAB also states that “where, as part of a national approach to managing established pests and diseases, regional measures are required, they will be applied under state and territory legislation”. This means that it is the responsibility of the states and territories to enforce quarantine restrictions at and within their own borders, providing those restrictions are compliant with the provisions of the SPS Agreement.

In order to support the states and territories in their efforts to enforce quarantine restrictions at their own borders the department will include a caveat in the final policy review that puts responsibility on the importer to ensure that state quarantine requirements are met.

> “This policy review is limited to recommending appropriate phytosanitary measures to address the risk of introducing quarantine pests of *Zantedeschia* propagative material into Australia. It is the importer's responsibility to ensure compliance with the requirements of all other regulatory and advisory bodies associated with importing commodities to Australia. Among others, these could include the Department of Immigration and Border Protection, Department of Health, Therapeutic Goods Administration, Australian Pesticides and Veterinary Medicines Authority, Department of the Environment and state departments of agriculture. For example, at the time this review was written, *Zantedeschia aethiopica* was permitted entry into Australia; however, it is now prohibited entry into certain states, including South Australia and Western Australia. Importers are advised to contact state and territory agriculture departments where necessary to ensure that regional requirements are met.”

Diagnostic methods used for pathogen screening

Stakeholders have commented that the draft review does not provide details of the diagnostic methods to be used for pathogen screening of *Zantedeschia* dormant tubers.

This policy review recommends two different sets of import conditions for *Zantedeschia* dormant tubers:

Dormant tubers from non-approved sources

Dormant tubers from non-approved sources require growth on-arrival in Australia in a closed government Post Entry Quarantine (PEQ) facility or at an Approved Arrangement site for visual screening for a minimum period of six weeks, or until sufficient new growth has occurred (where the plant has developed multiple, open and green leaves), to manage the risk posed by pathogens of quarantine concern to Australia identified in Table 2.

If disease symptoms appear during the PEQ period, further testing to identify the causal agent will be necessary and the appropriate remedial actions undertaken, if required.

Dormant tubers produced under a systems approach

Dormant tubers produced under a systems approach should be sourced from high health mother stock that has been established from seeds or virus tested by the NPPO, or an NPPO approved laboratory.

- Mother stock raised from nursery stock (tissue cultures or tubers) must be tested using PCR to verify freedom from viruses of quarantine concern to Australia identified in Table 2. The prior inspection and testing of mother stock ensures that only virus-free plant material is used for the production of *Zantedeschia* tubers*.*
- Mother stock raised from true seed does not require testing as none of the viruses of quarantine concern to Australia identified in Table 2 are seed-borne; therefore, mother plants grown from seed will be free of quarantine pathogens.

In both sets of import conditions, details of the diagnostic methods to be used for pathogen testing of *Zantedeschia* dormant tubers are deliberately broad to allow operational staff to use their best judgement and to ensure that testing protocols as outlined in the post-entry quarantine manuals can be periodically reviewed and kept up-to-date with current best practice.

Insecticidal dip as an alternative to methyl bromide fumigation

Further information was requested in relation to the use of an insecticidal dip as an alternative to the existing methyl bromide fumigation of *Zantedeschia* dormant tubers.

In the draft review, mandatory insecticidal dip (Imidacloprid 100 milligrams per litre and one percent eco-oil® for a minimum of 30 seconds) is offered as an alternative to methyl bromide fumigation for the control of mealybugs (*Pseudococcus maritimus*) and bulb flies (*Eumerus strigatus*) associated with *Zantedeschia* dormant tubers.

Imidacloprid is an Australian Pesticides and Veterinary Medicines Authority (APVMA) approved insecticide. Products containing imidacloprid come in many forms, including liquids, granules, dusts and packages that dissolve in water. Imidacloprid is the active constituent of the commonly used Confidor®, which is a systemic insecticide with known efficacy against sap-sucking insects such as mealybugs (NGIA 2015).

Soil applications of imidacloprid have been used to control bulb flies in the field (e.g. Ben-Yakir et al. 1997). Therefore, it is known that imidacloprid causes mortality of bulb flies. The efficacy of imidacloprid at causing the mortality of bulb fly larvae internally within a host, however, has not been documented in the scientific literature.

Based on a thorough review of the scientific literature, and the expertise of the department's operational scientists, the department considers that imidacloprid will be effective in controlling *E. strigatus* associated with *Zantedeschia* dormant tubers. The addition of one percent eco-oil® to the insecticidal dip will reduce the surface tension of the liquid and enable it to penetrate the burrows created by *E. strigatus* larvae.

Stakeholders should also note that the insecticidal dip is not a stand-alone measure. Dormant tubers from unapproved sources are also subject to on-arrival visual inspection and growth in PEQ, which act in combination with the insecticidal dip to ensure that the risk is adequately and progressively managed. In the case of *E. strigatus*, larvae preferentially burrow into diseased tubers—healthy tubers are less suitable for larval survival and development (Capinera 2001). Therefore, tubers infested with *E. strigatus* are likely to also be detected during visual inspection.

Hot water treatment as an alternative to methyl bromide fumigation

Further information was requested in relation to the use of hot water treatment as an alternative to the existing methyl bromide fumigation of *Zantedeschia* dormant tubers.

In the draft review, mandatory hot water treatment (minimum of 44 degrees Celsius for one hour) is offered as an alternative to methyl bromide fumigation for the control of mealybugs (*Pseudococcus maritimus*) and bulb flies (*Eumerus strigatus*) associated with *Zantedeschia* dormant tubers.

Hot water treatment is a well-documented alternative to methyl bromide fumigation for the treatment of insect pests, both external and internal, associated with bulbs. Several integrated pest management handbooks recommend hot water treatments ranging in temperatures and time, with a minimum of 43–44 degrees Celsius for 40 minutes reported to control internal bulb flies (NCSU 2016).

The department has a long-standing policy for the importation of bulbs that are hosts of the related Narcissus fly (*Merodon equestris*), which includes the option of hot water immersion at a temperature of 44 degrees Celsius for at least 60 minutes. Like *E. strigatus*, Narcissus fly burrows into the bulb of its hosts. The department's treatment of hot water immersion at 44 degrees Celsius for at least 60 minutes has proven effective against Narcissus fly and is therefore likely to be equally successful in controlling *E. strigatus.*

Stakeholders should also note that hot water treatment is not a stand-alone measure. Dormant tubers from unapproved sources are also subject to on-arrival visual inspection and growth in PEQ, which act in combination with the hot water treatment to ensure that the risk is adequately and progressively managed. In the case of *E. strigatus*, larvae preferentially burrow into diseased tubers—healthy tubers are less suitable for larval survival and development (Capinera 2001). Therefore, tubers infested with *E. strigatus* are likely to also be detected during visual inspection.

Reduction of the PEQ period

Stakeholders have raised concerns about the reduction in PEQ period from 12 weeks to a minimum of six weeks.

In the draft review, the department recommended a reduction in PEQ period from 12 weeks to a minimum of six weeks, or until sufficient growth (where the plant has developed multiple, open and green leaves) occurs for visual disease screening.

The average time to flowering for *Zantedeschia* dormant tubers varies from eight to 13 weeks depending on variety. Therefore, the existing PEQ period of 12 weeks is not suitable for plants destined for the cut flower or potted colour markets.

None of the pathogens of quarantine concern to Australia identified in Table 2 are reported to have latent periods; and all of the identified pathogens produce visual symptoms of infection during the vegetative growth stages. Furthermore, plants grown in PEQ are grown under optimal conditions for disease expression. For example, under experimental conditions, *Zantedeschia* plants displayed symptoms of *Phytophthora meadii* infection within two to five days after inoculation (Liou et al. 1999). Therefore, tubers infected with pathogens of quarantine concern to Australia identified in Table 2 are likely to be detected during visual inspection of vegetative growth during the PEQ period.

Based on a thorough review of the scientific literature, and the expertise of the department's operational scientists, it was concluded that a PEQ period of six weeks would produce sufficient vegetative growth to visually screen for disease symptoms whilst ensuring those plants destined for the cut flower or potted colour markets were saleable. Tubers must be grown in PEQ for a minimum of six weeks, or until sufficient growth (where the plant has developed multiple, open and green leaves) occurs for disease screening. Therefore, if insufficient growth has occurred for disease screening, plants will be grown in PEQ for longer than six weeks.

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 2016c).
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).
Approved Arrangement site	Previously referred to as a Quarantine Approved Premises (QAP) under the *Quarantine Act 1908.*
Area	An officially defined country, part of a country or all or parts of several countries (FAO 2016c).
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 2016c).
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.
Consignment	A quantity of plants, plant products 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 2016c).
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO 2016c).
The department	The Australian Government Department of Agriculture and Water Resources.
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 2016c).
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 2016c).
Equivalence (of phytosanitary terms)	The situation where, for a specified pest, different phytosanitary measures achieve a contracting party’s appropriate level of protection (FAO 2016c).
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO 2016c).
Fumigation	A method of pest control that completely fills an area with gaseous pesticides to suffocate or poison the pests within.
Host	An organism that harbours a parasite, mutual partner, or commensal partner, typically providing nourishment and shelter.
Host range	Species capable, under natural conditions, of sustaining a specific pest or other organism (FAO 2016c).
Import permit	Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2016c).
Import risk analysis	An administrative process through which quarantine policy is developed or reviewed, incorporating risk assessment, risk management and risk communication.

Term or abbreviation	Definition
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 2016c).
Inspection	Official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (FAO 2016c).
Intended use	Declared purpose for which plants, plant products, or other regulated articles are imported, produced or used (FAO 2016c).
Interception (of a pest)	The detection of a pest during inspection or testing of an imported consignment (FAO 2016c).
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 2016c).
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO 2016c).
Latency	Stage of an infectious disease, other than the incubation period, where no symptoms are expressed in the host (Shurtleff & Averre 1997).
Larva	A juvenile form of animal with indirect development, undergoing metamorphosis (for example, insects or amphibians).
Life cycle	Cyclical progression of stages in the growth and development of an organism (plant, animal, or pathogen) that occur between the appearance and reappearance of the same stage of the organism (Shurtleff & Averre 1997).
National Plant Protection Organization (NPPO)	Official service established by a government to discharge the functions specified by the IPPC (FAO 2016c).
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 2016c).
Pathogen	A biological agent that can cause disease to its host.
Pathway	Any means that allows the entry or spread of a pest (FAO 2016c).
Pest	Any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products (FAO 2016c).
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 2016c).
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 2016c).
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 2016c).
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 2016c).

Term or abbreviation	Definition
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 2016c).
Pest risk assessment (for quarantine pests)	Evaluation of the probability of the introduction and spread of a pest and of the magnitude of the associated potential economic consequences (FAO 2016c).
Pest risk assessment (for regulated non-quarantine pests)	Evaluation of the probability that a pest in plants for planting affects the indented use of those plants with an economically unacceptable impact (FAO 2016c).
Pest risk management (for quarantine pests)	Evaluation and selection of options to reduce the risk of introduction and spread of a pest (FAO 2016c).
Pest risk management (for regulated non-quarantine pests)	Evaluation and selection of options to reduce the risk that a pest in plants for planting causes an economically unacceptable impact on the intended use of those plants (FAO 2016c).
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 2016c).
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 2016c).
Phytosanitary certification	Use of phytosanitary procedures leading to the issue of a phytosanitary certificate (FAO 2016c).
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 2016c).
Phytosanitary procedure	Any official method for implementing phytosanitary measures including the performance of inspections, tests, surveillance or treatments in connection with regulated pests (FAO 2016c).
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 2016c).
PRA area	Area in relation to which a pest risk analysis is conducted (FAO 2016c).
Quarantine	Official confinement of regulated articles for observation and research or for further inspection, testing or treatment (FAO 2016c).
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 2016c).
Regulated article	Any plant, plant product, storage place, packaging, 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 2016c).
Regulated non-quarantine pest	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party (FAO 2016c).
Regulated pest	A quarantine pest or a regulated non-quarantine pest (FAO 2016c).
Restricted risk	Risk estimate with phytosanitary measure(s) applied.

Term or abbreviation	Definition
Soil	The loose surface material of the earth in which plants grow, in most cases consisting of disintegrated rock with an admixture of organic material (NAPPO 2003).
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO 2016c).
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.
Surveillance	An official process which collects and records data on pest occurrence or absence by surveying, monitoring or other procedures (FAO 2016c).
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.
Tissue culture	The products of 'an in vitro technique of cultivating (propagating) cells, tissues, or organs in a sterile synthetic medium' (Shurtleff & Averre 1997); comprising plant cells, tissues or organs, sterile synthetic medium, and the vessel in which cells have been propagated.
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 2016c).
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.

References

Adam G & Lesemann DE 1994, 'Identification and characterization of a new tospovirus isolate from *Anemone coronaria* L. by TAS-ELISA and electron microscopy', *Acta Horticulturae*, 377: 129–139.

Alberts E, Hannay J, Randles JW 1985, 'An epidemic of *Cucumber mosaic virus* in South Australia', *Australian Journal of Agricultural Research,* 36: 267–273.

Alexandre MAV, Duarte LML, Rivas EB, Kitajima EW Harakava R 2013, 'First Report of *Konjac mosaic virus* in *Zamioculcas zamiifolia'*, *Plant Disease,* 97: 1517.

Alfieri Jr. SA, Langdon KR, Wehlburg C, Kimbrough JW 1984, ' Index of plant diseases in Florida (revised)', *Florida Department of Agriculture and Consumer Service Division Plant Industry Bulletin,* 11: 1–389.

Alford, DV 2012, 'Pests of Ornamental Trees, Shrubs and Flowers', Manson Publishing Ltd, London.

Ali A, Abdalla O, Bruton B, Fish W, Sikora E, Zhang S, Taylor M 2012, ' Occurrence of viruses infecting watermelon, other cucurbits, and weeds in the parts of southern United States, Online'. *Plant Health Progress,* doi:10.1094/PHP-2012-0824-01-RS.

Almeida MTM, Santos MSNDA, Abrantes IMDO, Decraemer W 2005, '*Paratrichodours divergens* species n., a new potential vector of *Tobacco rattle virus* and additional observations on *P. hispanicus* Roca & Arias, 1986 from Portugal (Nematoda: Trichodoridae)', *Nematology*, 7: 343–361.

Ann PJ 1992, '*Phytophthora* diseases of ornamental plants in Araceae in Taiwan', *Plant Pathology Bulletin*, 1: 79–89.

Ann PJ, Tsai JN, Wang IT, Shi SD, Hwang JW, Liou RF 2003, '*Phytophthora* fruit rot of peach in Taiwan', *Plant Pathology Bulletin* 12: 181–190.

Anurag S 2012, 'The occurrence and disease incidence of Tospovirus infecting pepper (*Capsicum annuum* L.) in Southern Thailand,' *The Philippine Agricultural Scientist*, 95: 411–415.

Aragaki M & Uchida JY 1994, '*Phytophthora* blight of West Indian holly', *Plant Disease*, 78:523–525.

Arthur AL, Weeks AR, Hill MP, Hoffmann AA 2011, 'The distribution, abundance and life cycle the pest mites *Balaustium medicagoense* (Prostigmata: Erythraeidae) and *Bryobia* species (Prostigmata: Tetranychidae) in Australia', *Australian Journal of Entomology*, 50: 22–36.

Aston P 2009, 'Chrysomelidae of Hong Kong Part 2: Subfamily Alticinae', *Hong Kong Entomological Bulletin*, 1: 1–13.

Aveskamp MM, de Gruyter J, Woudenberg JCH, Verkley GJM, Crous PW 2010, ' Highlights of the Didymellaceae: A polyphasic approach to characterise *Phoma* and related pleosporalean genera', *Studies in Mycology*, 65: 1–60.

Azidah AA 2011, 'Thripidae (Thysanoptera) species collected from common plants and crops in Peninsular Malaysia', Scientific *Research and Essays*, 6: 5107–5113.

Baker CA, Davison D, Jones L 2007, 'Impatiens necrotic spot virus and Tomato spotted wilt virus diagnosed in *Phalaenopsis* orchids from two Florida nurseries', *Plant Disease*, 91: 1515.

Barbour JD, Syedbagheri M, Thornton M, Johnson JB, Merickel F, Alvarez J 2008, ‘ Lesser bulb flies on potatoes in the Pacific Northwest’, *University of Idaho extension, publication CIS 1150* http://www.cals.uidaho.edu/edcomm/pdf/CIS/CIS1150.pdf Accessed August 2013

Beenan R & Roques A 2010, ‘Leaf and seed beetles (Coleoptera: Chrysomelidae)’, Chapter 8.3. *BioRisk*, 4: 267–292.

Bellardi MG & Lisa V 1998, ‘Aggiornamento delle conoscenze sulle virosi della piante ornamentali in Italia’, *Informatore Fitopatologico*, 48: 51–64.

Ben-Daniel B, Bar-Zvi D, Johnson D, Harding R, Hazanovsky M, Tsror Lahkim L 2010, ‘Vegetative compatibility groups in *Colletotrichum coccodes* subpopulations from Australia and genetic links with subpopulations from Europe/Israel and North America’, *Phytopathology*, 100: 271–278.

Ben-Dov Y 2013a, ‘Coccidae’, ScaleNet, Catalogue Query Results. http://www.sel.barc.usda.gov/scalenet/valid.htm Accessed March 2013.

Ben-Dov Y 2013b, ‘Pseudococcidae’, ScaleNet, Catalogue Query Results. http://www.sel.barc.usda.gov/scalenet/valid.htm Accessed March 2013.

Ben-Dov Y, Miller DR, Denno BD 2013, ‘Rhizoecidae’, ScaleNet, Catalogue Query Results. http://www.sel.barc.usda.gov/scalenet/valid.htm Accessed March 2013.

Ben-Dov Y, Miller DR, Gibson GAP 2012, ‘ScaleNet’, http://www.sel.barc.usda.gov/scalenet. Accessed February 2012

Benyon F H L, Jones AS, Tovey ER, Stone G 1999, ‘Differentiation of allergenic fungal spores by image analysis, with application to aerobiological counts’, *Aerobiologia*, 15: 211–223.

Berge O, Guinebretière MH, Achouak W, Normand P, Heulin T 2002, ‘*Paenibacillus graminis* species nov. and *Paenibacillus odorifer* species nov., isolated from plant roots, soil and food’, *International Journal of Systemic and Evolutionary Microbiology*, 52: 607–616.

Berlandier FA 1997, ‘Distribution of aphids (Hemiptera: Aphididae) in potato growing areas of South-western Australia’, *Australian Journal of Entomology*, 36: 365–375.

Bhai RS & Thomas J 2000, ‘*Phytophthora* rot – a new disease of vanilla (*Vanilla planifolia* Andrews) in India’, *Journal of Spices and Aromatic Crops*, 9: 73–75.

Blackman RL 2013, ‘Aphids on the world’s plants: an online identification and information guide’, http://www.aphidsonworldsplants.info/ Accessed 20 March 2013.

Boerema GH, de Gruyter J, Noordeloos ME, Hamers MEC 2004, ‘Phoma identification manual: Differentiation of specific and infra-specific taxa in culture’, CABI Publishing, Oxfordshire.

Boerema GH & Hamers MCE 1990, ‘Check-list for scientific names of common parasitic fungi. Series 3c: Fungi on bulbs: 'additional crops' belonging to the Araceae, Begoniaceae, Compositae, Oxalidaceae and Ranunculaceae’, *Netherlands Journal of Plant Pathology*, 96 1: 1–23.

Bolland HR, Gutierrez J, Flechtmann CHW 1998, ‘World catalogue of the spider mite family (Acari: Tetranychidae)’, Brill Academic Publishers, Leiden, Netherlands.

Borg-Karlson AK, Ågren L, Dobson H, Bergström G 1988, ‘Identification and electroantennographic activity of sex-specific geranyl esters in an abdominal gland of female *Agriotes obscurus* (L.) and *A. lineatus* (L.) (Coleoptera, Elateridae)’, *Experientia*, 44: 531–534.

Bos L 1999, ‘Plant viruses, unique and intriguing pathogens’, Backhuys Publishers, Leiden.

Brockerhoff EG, Barratt B, Beggs JR, Fagan LL, Kay MK, Phillips CB, Vink CJ 2010, 'Impacts of exotic invertebrates on New Zealand's indigenous species and ecosystems', *New Zealand Journal of Ecology*, 31: 158–174.

Brooks FT 1932, 'A disease of the arum lily caused by *Phyllosticta richardiae*, n. sp', *Annals of Applied Biology*, 19: 16–20.

Brown BN & Ferreira FA 2000, 'Disease during propagation of Eucalypts', In Keane PJ, Kile GA, Podger FD, Brown BN (eds) Diseases and Pathogens of Eucalypts. CSIRO Publishing, Collingwood, Australia.

Burešová V, Franta Z, Kopáček P 2006, 'A comparison of *Chryseobacterium indologenes* pathogenicity to the soft tick *Ornithodoros moubata* and hard tick *Ixodes ricinus*', *Journal of Invertebrate Pathology*, 93: 96–104.

Burgess, DR, Bretag T, Keane PJ 1997, 'Biocontrol of seed borne *Botrytis cinerea* in chickpea with *Gliocladium roseum*', *Plant Pathology*, 46: 298–305.

Bussière LF, Hunt J, Jennions MD, Brooks R 2006, 'Sexual conflict and cryptic choice in the black field cricket, *Teleogryllus commodus*', *Evolution*, 60: 792–800.

CAB International (CABI) 1989, '*Phytophthora meadii*', [Distribution map]. Distribution Maps of Plant Diseases, October (Edition 2). Wallingford, UK: CAB International, Map 548.

CABI/EPPO 1997, 'Datasheets on quarantine pests: Impatiens necrotic spot tospovirus', European and Mediterranean Plant Protection Organisation. http://www.eppo.int/QUARANTINE/virus/Impatiens_necrotic_spot_virus/INSV00_ds.pdf Accessed March 2013.

Cammell ME 1981, 'The black bean aphid, *Aphis fabae*', *Biologist*, 28: 247–258.

Capinera J 2001, 'Handbook of Vegetable Pests', Academic Press, London.

Carvalho LM, Ladeira VA, Almeida EFA, Lessa MA, Reis SN 2012, 'Ocorrência de atrópodes em cultivo de copo-de-leite', Consulta de trabalhos aprovados no XXIV Congresso Braileiro de Entomologia, Expo Unimed Curitiba, 16–20 September 2012, 1809. Universidade Federal do Paraná, Curitiba, Brazil.

Carvalho LM, Oliveira EH, de Almeida K, Taques TC, Almeida EFA 2011, 'Case study: First record of phytophagous bug *Parafurius discifer* (Stäl, 1860) (Hemiptera: Miridae) attacking of calla lily in Brazil)', *Revista Brasileira de Agropecuária Sustentável (RBAS)*, 1: 42–44.

Chakraborty S, Charudattan R, De Valerio JT 1994, 'Reaction of selected accessions of forage Cassia species to some fungal pathogens', *Tropical Grasslands*, 28: 32–27.

Chang YC, Chen YL, Chung FC 2001, 'Mosaic disease of calla lily caused by a new potyvirus in Taiwan', *Plant Disease*, 85: 1289.

Chen CC, Yeh SD, Cheng YH, Chang CA 2008, 'Serological and molecular identification of *Watermelon silver virus* infecting calla lily', *Plant Pathology Bulletin*, 17: 88.

Chen CC, Hsu HT, Cheng YH, Huang CH, Liao JY, Tsai HT, Chang CA 2006a, 'Molecular and serological characterization of a distinct potyvirus causing latent infection in calla lilies', *Botanical Studies*, 47: 369–378.

Chen CC, Hsu HT, Chiang FL, Chang CA 2006b, 'Serological and molecular properties of five potyviruses infecting calla lily', *Acta Horticulturae*, 722: 259–269.

Chen YK, Jan FJ, Chen CC, Hsu HT 2006c, 'A new natural host of *Lisianthus necrosis virus* in Taiwan', *Plant Disease*, 90: 1112.

Chen, TC, Huang CW, Kuo YW, Liu FL, Hsuan Yuan CH, Hsu HT, Yeh SD 2006d', Identification of common epitopes on a conserved region of NSs proteins among tospoviruses of *Watermelon silver mottle virus* serogroup', *Phytopathology*, 96: 1296–1304.

Chen CC, Chen TC, Lin YH, Yeh SD, Hsu HT 2005, 'A chlorotic spot disease on calla lilies (*Zantedeschia* species) is caused by a Tospovirus serologically but distantly related to Watermelon silver mottle virus', *Plant Diseases*, 89: 440–445.

Chen CC, Chang CA, Tsai HT 2004a, 'Identification of a Potyvirus causing latent infection in calla lilies', *Plant Disease*, 88: 1046.

Chen CC, Ko WF, Pai KF, Yeh SD 2004b, 'Ecology of *Watermelon silver mottle virus* disease on watermelon in Taiwan', *Plant Pathology Bulletin*, 13: 317–328.

Chen CC, Ko WF, Lin CY, Jan FJ, Hsu HT 2003, 'First report of *Carnation mottle virus* in Calla lily (*Zantedeschia* species)', *Plant Disease*, 87: 1539.

Chen CC & Hsu HT 2002, 'Occurrence of a severe strain of *Lisianthus necrosis virus* in imported carnation seedlings in Taiwan', *Plant Disease*, 86: 444.

Chiemsombat P, Gajanandana O, Warin N, Hongprayoon R, Bhunchoth A, Pongsapich P 2008, 'Biological and molecular characterization of tospoviruses in Thailand', *Archives of Virology*, 153: 571–577.

Chu FH, Chao CH, Chung MH, Chen CC, Yeh SD 2001, 'Completion of the genome sequence of *Watermelon silver mottle virus* and utilization of degenerate primers for detecting tospoviruses in five serogroups', *Phytopathology*, 91: 361–368.

Clunie L 2004, 'What is this bug?', A guide to common invertebrates of New Zealand. http://www.landcareresearch.co.nz/research/biosystematics/invertebrates/invertid/ Accessed July 2012.

Colless DH 1982, 'Australian Anthomyiidae (Diptera)', *Australian Journal of Zoology*, 30: 81–91.

Cook EF 2007, 'Superfamily Scatopsoidea: 17. Family Scatopsidae', In Evenhuis NL (ed) Catalogue of the Diptera of the Australasian and Oceanian Regions (online version). http://hbs.bishopmuseum.org/aocat/pdf/17scatops.pdf Accessed November 2015.

Cook RP & Dubé AJ 1989, 'Host-pathogen index of plant diseases in South Australia', South Australian Department of Agriculture, Adelaide.

Cortopassi-Laurino M & Ramalho M 1988, 'Pollen harvest by Africanized *Apis mellifera* and *Trigona spinipes* in Sao Paulo botanical and ecological views', *Apidologie*, 19: 1–24.

Cother EJ, Stodart B, Noble D, Reinke R, Van De Ven RJ 2009, 'Polyphasic identification of Pseudomonas fuscovaginae causing sheath and glume lesions on rice in Australia', *Australian Plant Pathology*, 38: 247–261.

Cranshaw W 2004, 'Garden insects of North America: the ultimate guide to backyard bugs', Princeton University Press, New Jersey.

Cranshaw W & Kondratieff BC 2006, 'Field guide to Colorado insects', Westcliffe Publishers, Eaglewood CO.

CRC 2012, 'Thrips', Cotton Catchment Communities CRC. http://www.cottoncrc.org.au/industry/Publications/Pests_and_Beneficials/Cotton_Insect_Pest_and_Beneficial_Guide/Pests_by_common_name/Thrips Accessed August 2012.

CSIRO 2004, 'Australian National Insect Collection Taxon Database'. http://anic.ento.csiro.au/database/ Accessed July 2012.

Cumber RA 1959, 'The insect complex of sown pastures in the North Island', *New Zealand Journal of Agricultural Research*, 2: 1–25.

Daane KM, Middleton MC, Sforza R, Cooper ML, Walton VM, Walsch DB, Zaviezo T, Almeida RPP 2011, 'Development of a multiplex PCR for identification of vineyard mealybugs', *Environmental Entomology*, 40: 1595–1603.

Daane KM, Malakar-Kuenen R, Guillén M, Bentley WJ, Bianchi M, González D 2003, 'Abiotic and biotic pest refuges hamper biological control of mealybugs in California vineyards', In Van Driesche RG (ed) Proceedings of the First International Symposium of Biological Control of Arthropods, Honolulu, Hawaii, 14–18 January 2002, 389–98.

Daughtrey ML, Jones RK, Moyer JW, Daub ME, Baker JR 1997, 'Tospoviruses strike the greenhouse industry: INSV has become a major pathogen on flower crops', *Plant Disease*, 81: 1220–1230.

De Avila AC, Haan P, Kitajima EW, Kormelink R, Resende RDO, Goldbach RW, Peters D 1992, 'Characterization of a distinct isolate of *Tomato spotted wilt virus* (TSWV) from Impatiens species in the Netherlands', *Journal of Phytopathology*, 134: 133–151.

De Barro PJ & Hart PJ 2000, 'Mating interactions between two biotypes of the whitefly, *Bemisia tabaci*', *Bulletin of Entomological Research*, 90: 103–112.

Decraemer W & Robbins RT 2007, 'The who, what and where of Longidoridae and Trichodoridae', *Journal of Nematology*, 39: 295–297.

Department of Agriculture 2006, 'Advanced Nursery Stock Mature Trees – Singapore', AQIS Horticulture Exports Program Industry Advice Notice no. 2006/19, Department of Agriculture website, http://www.agriculture.gov.au/export/plants-plantproducts

Dietzgen RG, Twin J, Talty J, Selladural S, Carroll M, Coutts BA, Berryman DI, Jones RAC 2005, 'Genetic variability of *Tomato spotted wilt virus* in Australia and validation of real time RT-PCR for its detection in single and bulked leaf samples', *Annals of Applied Biology*, 146: 517–530.

Dreistadt SH 2001, 'Integrated pest management for floriculture and nurseries', University of California, Oakland, California.

Drenth, A & Guest, DI 2004, 'Diversity and management of *Phytophthora* in Southeast Asia', Australian Centre for International Agricultural Research, Canberra.

Drenth A & Sendall B 2004, 'Economic impact of *Phytophthora* diseases in Southeast Asia', In: Drenth A and Guest DI, ed. Diversity and management of *Phytophthora* in Southeast Asia, ACIAR Monograph No. 114, 238.

Dymock JJ & Holder PW 1996, 'Nationwide survey of arthropods and molluscs on cut flowers in New Zealand', *New Zealand Journal of Crop and Horticultural Science*, 24: 249–257.

Eastop VF 1966, 'A taxonomic study of Australian Aphidoidea (Homoptera)', *Australian Journal of Zoology*, 14: 399–592.

Edwards M & Taylor C 1998, 'Dieback and canker in Australian Pistachios', *ACTA Horticulture Issue*, 470: 596–603.

Elliot DR, Lebas BSM, Ochoa-Corona FM, Tang J, Alexander BJR 2009, 'Investigation of *Impatiens necrotic spot virus* outbreaks in New Zealand', *Australasian Plant Pathology*, 38: 490–495.

Elomari M, Coroler L, Hoste B, Gillis M, Izard D, Leclerc H 1996, 'DNA relatedness amongst Pseudomonas strains isolated from natural mineral waters and proposal of *Pseudomonas veronii* species Nov', *International Journal of Systematic Bacteriology*, 46: 1138–1144.

El-Wahab ASEDA, El-Sheikh MABJ, Elnager S 2011, 'First record of *Frankliniella occidentalis* and *Impatiens necrotic spot virus* in Egypt', *Journal of Life Sciences*, 5: 690–696.

EPPO 2004, 'Diagnostic protocols for regulated pests: *Tomato spotted wilt tospovirus*, *Impatiens necrotic spot tospovirus* and *Watermelon silver mottle tospovirus*', *OEPP/EPPO Bulletin*, 34: 271–279.

EPPO 1999, '*Impatiens necrotic spot tospovirus*', *Bulletin OEPP/EPPO Bulletin*, 29: 473–476.

EPPO 1997, 'Datasheets on quarantine pests: *Watermelon silver mottle virus*', European and Mediterranean Plant Protection Organisation http://www.eppo.int/QUARANTINE/virus/Watermelon_silver_mottle_virus/WMSMOV_ds.pdf Accessed April 2013.

EPPO/CABI 1996, '*Frankliniella occidentalis*', In Smith IM, McNamara DG, Scott PR, Holderness M (eds) Quarantine pests for Europe. 2nd edition. CAB International, Wallingford, United Kingdom.

Erwin DC & Ribeiro OK 1996, '*Phytophthora* diseases worldwide', APS Press, St. Paul, Minnesota.

Falloon PG, Falloon LM, Andersen AM 2002, 'Breeding asparagus varieties resistant to *Phytophthora*', *ACTA Horticulture Issue*, 589: 185–191.

Fan QH & Zhang ZQ 2007, 'Tyrophagus (Acari: Astigmata: Acaridae)', Fauna of New Zealand Number 56. Landcare Research New Zealand, Lincoln, Canterbury, New Zealand.

Fan QH & Zhang ZQ 2003, '*Rhizoglyphus echinopus* and *Rhizoglyphus robini* (Acari: Acaridae) from Australia and New Zealand: identification, host plants and geographical distribution', *Systematic and Applied Acarology* Special Publication, 16: 1–16.

Fang XL, Phillips D, Li H, Sivasithamparam K, Barbetti MJ 2011, 'Severity of crown and root diseases of strawberry and associated fungal and oomycete pathogens in Western Australia', *Australasian Plant Pathology*, 40: 109–119.

FAO (Food and Agricultural Organization of the United Nations) 2016a, 'International Standards for Phytosanitary Measures (ISPM) No. 2: Framework for pest risk analysis', Secretariat of the International Plant Protection Convention, Rome, Italy.

FAO (Food and Agricultural Organization of the United Nations) 2016b, 'International Standards for Phytosanitary Measures (ISPM) No. 11: Pest risk analysis for quarantine pests', Secretariat of the International Plant Protection Convention, Rome, Italy.

FAO (Food and Agricultural Organization of the United Nations) 2016c, 'International Standards for Phytosanitary Measures (ISPM) No. 5: Glossary of phytosanitary terms', Secretariat of the International Plant Protection Convention, Rome, Italy.

FAO (Food and Agricultural Organization of the United Nations) 2016d, 'International Standards for Phytosanitary Measures (ISPM) No. 6: Guidelines for surveillance', Secretariat of the International Plant Protection Convention, Rome, Italy.

FAO (Food and Agricultural Organization of the United Nations) 2016e, 'International Standards for Phytosanitary Measures (ISPM) No. 7: Phytosanitary certification system', Secretariat of the International Plant Protection Convention, Rome, Italy.

FAO (Food and Agricultural Organization of the United Nations) 2016f, 'International Standards for Phytosanitary Measures (ISPM) No. 1: Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade', Secretariat of the International Plant Protection Convention, Rome, Italy.

FAO (Food and Agricultural Organization of the United Nations) 2016g, 'International Standards for Phytosanitary Measures (ISPM) No. 4: Requirements for the establishment of pest free areas', Secretariat of the International Plant Protection Convention, Rome, Italy.

FAO (Food and Agricultural Organization of the United Nations) 2016h, 'International Standards for Phytosanitary Measures (ISPM) No. 10: Requirements for the establishment of pest free places of production and pest free production sites', Secretariat of the International Plant Protection Convention, Rome, Italy.

Farr DF & Rossman AY 2014, 'Fungal Databases, Systematic Mycology and Microbiology Laboratory, ARS, USDA', http://nt.ars-grin.gov/fungaldatabases/ Accessed July 2013.

Farr DF, Bills GF, Chamuris GP, Rossman AY 1989, 'Fungi on plants and plant products in the United States', APS Press, St. Paul, Minnesota USA.

Fennemore PG 1984, 'HortFACT: Grass grub life cycle, *Costelytra zealandica* (White)', NZ Department of Scientific and Industrial Research. http://www.hortnet.co.nz/publications/hortfacts/hf401004.htm Accessed July 2013.

FERA 2008, 'Rapid assessment of the need for a detailed Pest Risk Analysis for *Crenidorsum aroidephagus'*, The Food and Environment Research Agency. http://www.fera.defra.gov.uk Accessed March 2013.

Fields PG & White NDG 2002, 'Alternatives to methyl bromide treatments for stored-product and quarantine insects', *Annual Review of Entomology*, 47: 1–39.

Fitt GP, Gregg PC, Zalucki MP, Murray DAH 1995, 'New records of *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) from South Australia and Western Australia', *Journal of Australian Entomological Society*, 34: 65–67.

Flechtmann HW & Knihinicki DK 2002, 'New species and new record of Tetranychus Dufour from Australia, with a key to the major groups in this genus based on females (Acari: Prostogmata: Tetranychidae)', *Australian Journal of Entomology*, 41: 118–127.

Fletcher MJ & Eastop V 2005, 'Illustrated key to the aphids (Hemiptera: Aphididae) found on lettuce in Australia', http://www1.dpi.nsw.gov.au/keys/aphid/index.html Accessed March 2013.

Frolov AN 2009, 'Interactive agricultural ecological atlas of Russia and neighbouring countries – *Agriotes lineatus* (L.) – Common click beetle', http://www.agroatlas.ru/en/content/pests/Agriotes_lineatus/ Accessed May 2013.

García HA 2012, '*Euphoria basilis'*, La Ruta Del Bichologo. http://www.rutadelbichologo.org/2012/12/24/euphoria-basalis/ Accessed June 2013.

Garran J & Gibbs A 1982, 'Studies on Alfalfa mosaic virus and alfalfa aphids', *Australian Journal of Agricultural Research*, 33: 657–664.

GBIF (2014) *Eumerus strigatus* (Fallen, 1817). GBIF Portal. http://data.gbif.org/ Accessed October 2014.

Gerding M, Cisternas E, Aguilera A, Apablaza J 1999, '*Eumerus strigatus* (Fallen) (Diptera: Syrphidae) infestando Alliaceae en Chile', *Agricultura Tecnica*, (Santiago) 59: 133 –135.

Gerlach J 2011, 'Attempts to establish a new population of the threatened plant Impatiens gordonii on Silhouette island, Seychelles', *Conservation Evidence*, 8: 87–92

Gherasim, V 1973, 'The bulb fly – *Eumerus strigatus* Fall. (Diptera – Syrphidae) a pest new to onion crops in the Republic of Romania', *Analele Institutului de Cercetari centru Protectia Plantelor*, 11: 141–146.

Ghotbi T, Shahraeen N, Winter S 2005, 'Occurrence of tospoviruses in ornamental and weed species in Markazi and Tehran Provinces in Iran', *Plant Disease*, 89: 425–429.

Gibbs AJ, Mackenzie AM, Wei KJ, Gibbs MJ 2008, 'The potyviruses of Australia', *Archives of Virology*, 153: 1411–1420.

Global Biodiversity Information Facility (GBIF), http://data.gbif.org/welcome.htm Accessed February 2014.

Golding FD 1927, 'Notes of the food-plants and habits of some southern Nigerian insects', *Bulletin of Entomological Research*, 18: 95–99.

Grandgirard J, Hoddle MS, Roderick GK, Petite JN, Percy D, Putoa R, Garnier C, Davies N 2006, 'Invasion of French Polynesia by the glassy-winged sharpshooter, *Homalodisca coagulata* (Hemiptera: Cicadellidae): a new threat to the South Pacific', *Pacific Science*, 60: 429–438.

Grasswitz TR & James DG 2008, 'Movement of grape mealybug, *Pseudococcus maritimus*, on and between host plants', *Entomologia Experimentalis et Applicata*, 129: 268–275.

Greber RS & Shaw DE 1986, 'Dasheen mosaic virus in Queensland', *Australasian Plant Pathology*, 15: 29–33.

Greenslade P 2007, 'The potential of Collembola to act as indicators of landscape stress in Australia', *Australian Journal of Experimental Agriculture*, 47: 424–434.

Grgurinovic CA & Cayzer L 2003, 'Fungi of Australia', Volume 2B. ABRS/CSIRO Publishing, Melbourne.

Gu, H, Fitt, GP & Baker, GH 2007, 'Invertebrate pests of canola and their management in Australia: a review', *Australian Journal of Entomology*, 46: 3: 231–243.

Gullan PJ 2000, 'Identification of the immature instars of mealybugs (Hemiptera: Pseudococcidae) found on citrus in Australia', *Australian Journal of Entomology*, 39: 160–166.

Gutierrez AP, Nix HA, Havestein DE, Moore PA 1974, 'The ecology of Aphis craccivora Koch and Subterranean clover stunt virus in south-east Australia', *Journal of Applied Ecology*, 11: 21–35.

Gutierrez J & Schichta E 1983, 'The spider mite family Tetranychidae (Acari) in New South Wales', *International Journal of Acarology*, 9: 99–116.

Gyulai P 1980, 'A holdfoltos hagymalegy (Eumerus strigatus Meig.) mint a sargarepa kartevoje', *Növényvédelem*, 16: 58–61.

Hall BH, Hitch CJ, Oxspring EA, Wicks TJ 2007, 'Leek diseases in Australia', *Australasian Plant Pathology*, 36: 383–388.

Hall G 1991, 'IMI Descriptions of Fungi and Bacteria No. 1066 *Phytophthora richardiae'*, *Mycopathologia*, 115: 231–232.

Hall G 1989, 'Unusual or interesting records of plant pathogenic Oomycetes', *Plant Pathology*, 38: 604–611.

Halliday B 1998, 'Mites of Australia: A checklist and bibliography', Monographs on Invertebrate Taxonomy Vol 5. CSIRO Publishing, Australia.

Hausbeck M 2007, 'INSV remains a problem, even after all these years. The latest in pest and disease management', *Greenhouse Management and Production*, 69: 1–4.

Hausbeck MK, Welliver RA, Derr MA, Gildow FE 1992, 'Tomato spotted wilt virus survey among greenhouse ornamentals in Pennsylvania', *Plant Disease*, 76: 795–800.

Haye T, Van Achterberg C, Goulet H, Barratt BIP, Kuhlmann U 2006, 'Potential for classical biological control of the potato bug *Closterotomus norvegicus* (Hemiptera: Miridiae): description, parasitism and host specificity of *Peristenus closterotomae* species N. (Hymenoptera: Braconidae)', *Bulletin of Entomological Research*, 96: 421–431.

Healy JM & Jamieson BGM 1989, 'An ultrastructural study of spermatozoa of *Helix aspersa* and Helix pomatia (Gastropoda, Pulmonata)', *Journal of Molluscan Studies*, 55: 389–404.

Heppner JB 2000, 'Spanish moth, *Xanthopastis timais* (Lepidoptera: Noctuidae): a pest of amaryllis and other lilies', Entomology Circular No. 401. Division of Plant Industry, Florida Department of Agriculture & Consumer Services, Gainesville, Florida.

Heppner JB, Barbara KA, Buss EA 2002, 'Spanish moth or convict caterpillar, *Xanthopastis timais* (Cramer) (Insecta: Lepidoptera: Noctuidae)', Featured Creatures EENY-271. Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Herron GA, Powis K, Rophail J 2001, 'Insecticide resistance in *Aphis gossypii* Glover (Hemiptera: Aphididae), a serious threat to Australian cotton', *Australian Journal of Entomology*, 40: 85–91.

Hoddle MS, Stosic CD, Mound LA 2006, 'Populations of North American bean thrips, *Caliothrips fasciatus* (Pergande) (Thysanoptera: Thripidae: Panchaetothripinae) not detected in Australia', *Australian Journal of Entomology*, 45: 122–129.

Hodson WEH 1927, 'The bionomics of the lesser bulb flies, *Eumerus strigatus* Flyn., and *Eumerus tuberculatus* Rond., in south-west England', *Bulletin of Entomological Research*, 17: 373–384.

Holmes IR & Teakle 1980, 'Incidence of potato viruses S, X, and Y in potatoes in Queensland', *Australasian Plant Pathology*, 9: 3–4.

Houston KJ, Mound LA, Palmer JM 1991, 'Two pest thrips (Thysanoptera) new to Australia, with notes on the distribution and structural variation of other species', *Australian Journal of Entomology*, 30: 231–232.

Huang Y & Wong PTW 1998, 'Effect of *Burkholderia* (Pseudomonas) *cepacia* and soil type on the control of crown rot in wheat', *Plant and Soil*, 203: 103–108.

Hughes RD, Casimir M, O'Loughlin GT, Martyn EJ 1964, 'A survey of aphids flying over eastern Australia in 1961', *Australian Journal of Zoology*, 12: 174–200.

Hughes SJ 1965, 'New Zealand fungi', *New Zealand Journal of Botany*, 3: 320–332.

Hynes RK, Leung GC, Hirkala DL, Nelson LM 2008, 'Isolation, selection, and characterization of beneficial rhizobacteria from pea, lentil, and chickpea grown in western Canada', *Canadian Journal of Microbiology*, 54: 248–258.

ICTVdB Management 2006, '*Konjac mosaic virus*', In: ICTVdB – The Universal Virus Database, version 4. Büchen-Osmond, C. (Ed), Columbia University, New York, USA.

IGAB 2012, 'Intergovernmental Agreement on Biosecurity: An Agreement between the Commonwealth of Australia, state and territory governments to strengthen the national biosecurity system' https://www.coag.gov.au/node/47.

Ireland KB, Haji Mohamad Noor NA, Aitken EAB, Schmidt S 2008, 'First report of *Glomerella cingulata* (*Colletotrichum gloeosporioides*) causing anthracnose and tip dieback of *Lygodium microphyllum* and *L. japonicum* in Australia', *Plant Disease*, 92: 1369.

Irwin JAG 1997, 'Biology and management of *Phytophthora* species, attacking field crops in Australia', *Australasian Plant Pathology*, 26: 207–216.

Iwaki M, Hanada K, Maria ERA, Onogi S 1987, 'Lisianthus necrosis virus, a new Necrovirus from *Eustoma russellianum'*, *Phytopathology*, 77: 867–870.

Jones RAC, Smith LJ, Smith TN, Latham LJ 2006, 'Relative abilities of different aphid species to act as vectors of Carrot virus Y', *Australasian Plant Pathology*, 35: 23–27.

Keane, PJ 2000, '*Diseases and pathogens of eucalypts*', CSIRO Publishing, Collingwood, Victoria.

Kidanemariam DB, Abraham AD, Sukal AC, Holton TA, Dale JL, James AP, Harding RM 2016, 'Complete genome sequence of a novel *Zantedeschia mild mosaic virus* isolate, the first report from Australia and from *Alocasia* sp.', *Archives of Virology*, 161: 1079–1082.

Kimber I 2012, '*Coleophora versurella*, your guide to the moths of Great Britain and Ireland', http://ukmoths.org.uk/show.php?bf=568 Accessed August 2013.

Kizil S, Arslan N, Ölmez-Bayhan S, Khawar KM 2008, 'Effects of different planting dates on improving yield of *Fritillaria imperialis* L. and *Fritillaria persica* L. bulbs damaged by small narcissus fly (*Eumerus strigatus* Fallen)', *African Journal of Biotechnology*, 7: 4454–4458.

Klass JR, Peters DPC, Trojan JM, Thomas SH 2012, 'Nematodes as an indicator of plant–soil interactions associated with desertification', *Applied Soil Ecology*, 58: 66–77.

Knight KMM & Gurr GM 2007, 'Review of *Nezara viridula* (L.) management strategies and potential for IPM in field crops with emphasis on Australia', *Crop Protection*, 26: 1–10.

Koike ST, Gladders P, Paulus AO 2007, 'Vegetable diseases: A color handbook', Manson Publishing, London.

Koike ST & Mayhew DE 2001, '*Impatiens necrotic spot virus* found in *Oncidium*: reporting a new ailment for orchids', *Orchids*, 70: 746–747.

Kuwabara K, Yokoi N, Ohki T, Tsuda S 2010, 'Improved multiplex reverse transcription-polymerase chain reaction to detect and identify five tospovirus species simultaneously', *Journal of General Plant Pathology*, 76: 273–277.

Larivière MC 1995, 'Cydnidae, Acanthosomatidae and Pentatomidae (Insecta: Heteroptera): systematic, geographical distribution and bioecology', Fauna of New Zealand 35. Obtained through Landcare Research New Zealand. http://www.landcareresearch.co.nz/research/biosystematics/invertebrates/faunaofnz/Extracts/.asp Accessed July 2013.

Lee, DW, Choo, HY, Shin, OJ, Yun, JS & Kim, YS 2002, 'Damage of perennial ryegrass, *Lolium perenne* by chestnut brown chafer, *Adoretus tenuimaculatus* (Coleoptera: Scarabaeidae) and biological control with Korean isolate of entomopathogenic nematodes', *Korean Journal of Applied Entomology*, 41: 3: 217–224.

Lee YA, Chen KP, Chang YC 2005, 'First report of bacterial leaf blight of white-flowered calla lily caused by *Xanthomonas campestris* pv. *zantedeschiae* in Taiwan', *Plant Pathology*, 54: 239.

Leong SL, Hocking AD, Scott ES 2007, 'Aspergillus species producing ochratoxin A: isolation from vineyard soils and infection of Semillon bunches in Australia', *Journal of Applied Microbiology*, 102: 124–133.

Liberato JR & Stephens PM 2006, '*Cercospora apii* on lettuce in Australia', *Australasian Plant Pathology*, 35: 379–381.

Liburd O, Seferina G, Weihma S 2004, 'Insect pests of grapes in Florida', Entomology and Nematology Department, Institute of Food and Agricultural Sciences (IFAS), University of Florida. http://edis.ifas.ufl.edu/pdffiles/IN/IN52700.pdf Accessed February 2013.

Liefting LW, Beever RE, Winks CJ, Pearson MN, Forster RLS 1997, 'Planthopper transmission of Phormium yellow leaf phytoplasma', *Australasian Plant Pathology*, 26: 148-154.

Lindquist EE, Sabelis MW, Bruin J 1996, 'World crop pests: Eriophyoid Mites—Their biology natural enemies and control', Volume 6. Elsevier, The Netherlands.

Liou RF, Lee JT, Ann PJ 1999, 'First report of *Phytophthora* blight of White arum lily caused by *Phytophthora meadii'*, *Plant Pathology Bulletin*, 8: 37–40.

Lisa V, Vaira AM, Milne RG, Luisoni E, Rapetti S 1990, '*Tomato spotted wilt virus* in five crops in Liguria', *Informatore Fitopatologico*, 40: 34–41.

Liu H, Sears JL, Mou B 2009, 'Spinach: A new natural host of Impatiens necrotic spot virus in California', *Plant Disease*, 93: 673.

Liu Y, Lu X, Zhi L, Zheng Y, Chen X, Xu Y, Wu F, Li Y 2012, '*Calla lily chlorotic spot virus* from spider lily (*Hymenocallis littoralis*) and tobacco (*Nicotiana tabacum*) in the South-west of China', *Journal of Phytopathology*, 160: 201–205.

Loch AD 1997, 'Natural enemies of pink wax scale, *Ceroplastes rubens* Maskell (Hemiptera: Coccidae), on umbrella trees in southeastern Queensland', *Australian Journal of Entomology* 36: 303–306.

Lockhart BEL & Currier S 1996, 'Viruses occurring in Hosta species in the USA', *Acta Horticulturae*, 432: 62–71.

Loebenstein G, Lawson RH, Brunt AA 1995, 'Virus and virus-like diseases of bulb and flower crops', John Wiley & Sons, UK.

Louro D 1996, 'Detection and identification of *Tomato spotted wilt virus* and *Impatiens necrotic spot virus* in Portugal', *Acta Horticulturae*, 431: 99–105.

Mackenzie A 1996, 'A trade-off for host plant utilization in the black bean aphid, *Aphis fabae*', Evolution, 50: 155–162.

Maddison PA 1993, 'UNDP/FAO-SPEC Survey of agricultural pests and diseases in the South Pacific, Technical report. Vol. 3', Pests and other fauna associated with plants, with botanical accounts of plants. Auckland: Manaaki Whenua – Landcare Reseach. http://nzac.landcareresearch.co.nz Accessed August 2013.

Manikonda P, Srinivas KP, Reddy CVS, Ramesh B, Navodayam N, Krishnaprasadji J, Ratan PB, Sreenivasulu P 2011, '*Konjac mosaic virus* naturally infecting three aroid plant species in Andhra, Pradesh, India', *Journal of Phytopathology*, 159: 133–135.

Martin JH, Aguiar AMF, Baufeld P 2001, '*Crenidorsum aroidephagus* Martin & Aguiar species nov. (Sternorrhyncha: Aleyrodidae), a new world whitefly species now colonising cultivated Araceae in Europe, Macaronesia and The Pacific', *Zootaxa*, 4: 1–8.

Martyn EJ & Miller LW 1963, 'A check list of the aphids of Tasmania and their recorded host plants', *Papers and Proceedings of the Royal Society of Tasmania*, 97: 53–62.

Materazzi A & Triolo E 2001, 'Spathyphyllum species: a new natural host of Impatiens necrotic spot virus', *Plant Disease*, 85: 448.

Maxwell A 1997, 'The potential for biological control of Zantedeschia aethiopica: a survey of southwestern Australia for pathogens', In Scott JK, Wykes BJ (eds) Proceedings of a workshop on

Arum Lily (Zantedeschia aethiopica), HMAS Stirling, Garden Island, Western Australia, 7 August, 1997 59–60. CRC for Weed Management Systems, Adelaide, Australia.

Maxwell A & Scott JK 2008, 'Pathogens on wild radish, *Raphanus raphanistrum* (Brassicaceae), in south-western Australia—implications for biological control', *Australasian Plant Pathology*, 37: 523–533.

Maxwell A & Scott JK 2004, 'The potential for using mycoherbicides to control weeds from the family Brassicaceae in Australia', In Sindel BM, Johnson SB (eds) Proceedings of the 14th Australian Weeds Conference, Wagga Wagga, 6–9 September, 2004 333–336. Weed Society of NSW, Sydney.

McAlpine DK 1993, 'Review of the upside-down flies (Diptera: Neurochaetidae) of Madagascar and Africa, and evolution of neurochaetid host plant associations', *Records of the Australian Museum*, 45: 221–239.

McDonough MJ, Gerace D, Ascerno ME 2011, 'Western flower thrips feeding scars and tospovirus lesions on petunia indicator plants', College of Agriculture, Food, and Environmental Science, University of Minnesota, Minnesota. http://www.extension.umn.edu/distribution/horticulture/DG7375.html Accessed August 2013.

McKenzie HL 1967, 'Mealybugs of California: with taxonomy, biology and control of North American species', Cambridge University Press, London.

McLaren GF & Walker AK 2012, 'HortFACT New Zealand flower thrips life cycle', http://www.hortnet.co.nz/publications/hortfacts/hf401053.htm Accessed August 2012.

McLaren GF, Reid S, Colhoun KM 2010, 'Long-distance movement of New Zealand flower thrips (*Thrips obscuratus* Crawford) (Thysanoptera: Thripidae) into Central Otago orchards', *New Zealand Entomologist*, 33: 5–13.

McLeod R, Reay F, Smyth J 1994, 'Plant nematodes of Australia listed by plant and by genus', NSW Agriculture.

McMichael LA, Persley DM, Thomas JE 2002, 'A new tospovirus serogroup IV species infecting capsicum and tomato in Queensland, Australia', *Australasian Plant Pathology*, 31: 231–239.

Mekuria TA, Smith TJ, Beers E, Watson GW, Eastwell KC 2013, 'First report of transmission of Little cherry virus 2 to Sweet Cherry by *Pseudococcus maritimus* (Ehrhorn) (Hemiptera: Pseudococcidae). *Plant Disease*, 97: 851.

Memmott J, Fowler SV, Paynter Q, Sheppard AW, Syrett P 2000, 'The invertebrate fauna on broom, *Cystisus scoparius*, in two native and two exotic habitats', *Acta Oecologica*, 21: 213–222.

Mikiciński A, Sobiczewski P, Sulikowska M, Pulawska J, Treder J 2010a, 'Pectolytic bacteria associated with soft rot of calla lily (Zantedeschia species) tubers', *Journal of Phytopathology*, 158: 201–209.

Mikiciński, A, Sobiczewski, P, Pulawska, J, Treder, J 2010b, 'Involvement of *Paenibacillus polymyxa* in the etiology of bacterial soft rot of calla lily', *Journal of Plant Pathology*, 92: 375–380.

Miller WB, Scott SW, Blake JH, Whitwell T 1998, 'Host range of *Impatiens necrotic spot virus* (INSV) and *Tomato spotted wilt virus* (TSWV) on herbaceous perennials', http://www.clemson.edu/cafls/departments/horticulture/research/ornamental/landscape/pdf/insv_tswv.pdf Accessed March 2014.

Moran J, Wilson JM, Garrett RG, Smith PR 1985, 'ELISA indexing of commercial carnations for Carnation mottle virus using a urease-antibody conjugate', *Plant Pathology*, 34: 467–471.

Mound LA 2004, 'Australian Thysanoptera—biological diversity and a diversity of studies', *Australian Journal of Entomology*, 43: 248–257.

Mound LA & Gillespie P 1997, 'Identification guide to thrips associated with crops in Australia', NSW Agriculture, Orange, NSW.

Mound LA & Minaei K 2007, 'Australian thrips of the Haplothrips lineage (Insecta: Thysanoptera)', *Journal of Natural History*, 41: 2919–2978.

Mulin, Y.I 1990, 'A dangerous pest of onion', *Zashchita Rastenii Moskva*, 3: 31–32.

Nagel JH, Gryzenhout M, Slippers B, Wingfield MJ 2013, 'The occurrence and impact of *Phytophthora* on the African continent', In: Lamour, K (ed) *Phytophthora*: a global perspective. CABI, Wallingford.

Nakahara S 1988, 'A new synonym and revised status in Apterothrips (Thysanoptera: Thripidae)', *Proceedings of the Entomological Society of Washington*, 90: 508–509.

Nakahara S 1981, 'List of the Hawaiian Coccoidea (Homoptera: Sternorhyncha)', *Proceedings Hawaiian Entomological Society*, 23: 387–424.

Nam IH, Chang YS, Hong HB, Lee YE 2003, 'A novel catabolic activity of *Pseudomonas veronii* in biotransformation of pentachlorophenol', *Applied Microbiology and Biotechnology*, 62: 284–290.

NAPPO (North American Plant Protection Organisation) 2003, 'NAPPO position on soil movement', accessed April 2015, http://www.nappo.org/en/data/files/download/Positions%20and%20Decisions/PNo.1-Soil%20Movement-e.pdf.

NCSU 2016, 'Narcissus Bulb Fly', NC State University A&T State University Cooperative Extension. http://ipm.ncsu.edu/AG136/fly4.html.

Neate SM & Warcup JH 1985, 'Anastomosis groupings of some isolates of *Thanatephorus* cucumeris from agricultural soils in South Australia', Transactions of the British Mycological Society, 85: 615–320.

Nehl DB, Allen SJ, Mondal AH, Lonergan PA 2004, 'Black root rot: a pandemic in Australian cotton', Australasian Plant Pathology, 33: 87–95.

NGIA 2015, 'Mealybugs, a pest of a different scale', http://www.ngia.com.au/Attachment?Action=Download&Attachment_id=1941.

Nielson ES, Edwards ED, Rangsi TV 1996, 'Checklist of the Lepidoptera of Australia', CSIRO Division of Entomology, Canberra, Australia.

Nishiguchi M, Yamasaki S, Lu XZ, Shimoyama A, Hanada K, Sonoda S, Shimono M, Sakai J, Mikoshiba Y, Fujisawa I 2006, 'Konjak mosaic virus: the complete nucleotide sequence of the genomic RNA and its comparison with other potyviruses', Archives of Virology, 151: 1643–1650.

O'Dowd DJ 1994, 'Mite association with the leaf domatia of coffee (*Coffea arabica*) in north Queensland, Australia', Bulletin of Entomological Research, 84: 361–366.

Oxspring L, Wicks T, Hall B 2000, 'Studies on pink rot', South Australian Research and Development Institute http://www.sardi.sa.gov.au/pestsdiseases/horticulture/horticultural_crops/potatoes/pink_rot_of_potatoes/studies_on_pink_rot.

Padaga M, Heard GM, Paton JE, Fleet GH 2000, 'Microbial species associated with different sections of broccoli harvested from three regions in Australia', *International Journal of Food Microbiology*, 60: 15–24.

Padmavathi M, Srinivas KP, Hema M, Sreenivasulu P 2013, ‘First report of *Konjac mosaic virus* in elephant foot yam (*Amorphophallus paeoniifolius*) from India’, *Australasian Plant Disease Notes*, 8: 27–29.

Pearson WD 1991, ‘Effect of meadow spittlebug and Australian crop mired on white clover seed production in small cages’, *New Zealand Journal of Agricultural Research*, 34: 439–444.

Pegg KG, Willingham SL, O’Brien RG, Cooke AW, Coates LM 2002, ‘Base rot of golden passionfruit caused by a homothallic strain of *Fusarium solani*’, *Australasian Plant Pathology*, 31: 305–306.

Peltzer S & Sivasithamparam K 1985, ‘Soft-rot erwinias and stem rots in potatoes’, *Australian Journal of Experimental Agriculture*, 25: 693–696.

Pennycook SR 1989, ‘Plant diseases recorded in New Zealand’, Plant Diseases Division, D.S.I.R., Auckland.

Perry S 2007, ‘Onion industry biosecurity plan: pest risk review’, Plant Health Australia.

Persley D, Cooke T, House S 2010, ‘Diseases of Vegetable Crops in Australia’, CSIRO Publishing, Collingwood, Australia.

Peterson RK, Higley LG, Buntin GD, Pedigo FP 1993, ‘Flight activity and ovarian dynamics of the Yellow woolybear, *Spilosoma virginica* (F.) (Lepidoptera: Arctiidae), in Iowa’, *Journal of the Kansas Entomological Society*, 66: 97–103.

PHA (Plant Health Australia) 2001, ‘Australian Plant Pest Database, online database’, www.planthealthaustralia.com.au/appd Accessed June 2012.

Piper RG 1985, ‘The male genitalia of some Australian Rhyparochromini (Hemiptera: Lygaeidae)’, *Journal Australian Entomological Society*, 24: 45–56.

Plantbook 2013, ‘Plantbook: Indigenous plants of Southern Africa’, http://www.plantbook.co.za/ Accessed March 2013.

Poltronieri LS, Trindade DR, Silva HM, Albuquerque FC 1997, ‘Pathogens associated with cassava soft root rot in the State of Para, Brazil’, *Fitopatologia Brasileira*, 22: 111.

Poos, FW, Weigel, CA 1927, ‘The bulb flies of Narcissus with special reference to the bulb industry in Virginia’, *Virginia Truck Experiment Station Bulletin*, 60.

Portales LA 2004, ‘*Phytophthora* diseases in the Philippines’, In: Drenth, A. and Guest, D.I., ed. Diversity and management of *Phytophthora* in Southeast Asia, ACIAR Monograph No. 114, 238p

Qin TK & Gullan PJ 1992, ‘A revision of the Australian pulvinariine soft scales (Insecta: Hemiptera: Coccidae)’, *Journal of Natural History*, 26: 103–164.

Quazi SA, Burgess LW, Smith-White J 2009, ‘Sorghum is a suitable break crop to minimise *Fusarium pseudograminearum* in any location regardless of climatic differences, whereas *Gibberella zeae* is location and climate specific’, *Australasian Plant Pathology* 38: 91–99.

Queensland Museum 2013, ‘Hawk Moths (Family Sphingidae)’, Queensland Museum, Queensland Government. http://www.qm.qld.gov.au/Find+out+about/Animals+of+Queensland/Insects/Butterflies+and+moths/Common+species/Hawk+Moths Accessed March 2013.

Rao X, Liu Y, Wu Z, Li Y 2011, ‘First report of natural infection of watermelon by *Watermelon silver mottle* virus in China’, *New Disease Reports*, 24: 12.

Reid S & Eyre D 2010, 'FERA plant pest factsheet: wheat bug (*Nysius huttoni*) The Food and Environment Research Agency', http://www.hortweek.com/news/998099/fera-plant-pest-factsheet-wheat-bug-nysius-huttoni/ Accessed August 2012.

Rizzo D, Lazzereschi S, Nesi B, Stefani L, Paoli M, Della Bartola M, Materazzi A, Grassotti A 2012, '*Zantedeschia aethiopica* L.: serious damages by INSV', *Colture Protette*, 41: 62–66.

Robinson GS, Ackery PR, Kitching IJ, Beccaloni GW, Hernández LM 2010, 'HOSTS – A Database of the world's Lepidopteran hostplants', Natural History Museum, London. http://www.nhm.ac.uk/hosts Accessed March 2013.

Roggero P, Ciuffo M, Dellavalle G, Gotta P, Gallo S, Peters D 1999, 'Additional ornamental species as hosts of *Impatiens necrotic spot tospovirus* in Italy', *Plant Disease*, 83: 967.

Rojo S, Isidro PM, Perez-Bañon C, Marcos-García MA 1997, 'Revision of the hoverflies (Diptera: Syrphidae) from the Azores Archipelago with notes on Macronesian syrphid fauna Arquipélago', *Life and Marine Sciences*, 15A: 65–82.

Rudzinska-Langwald A & Kaminska M 1998, 'Cytopathological changes in *Schefflera actinophylla* Harms. naturally infected with *Impatiens necrotic spot virus* (INSV)', *Acta Societatis Botanicorum Poloniae*, 67: 229–234.

Ruter JM & Gitaitis RD 1993a, ' First report of *Tomato spotted wilt virus* on bedding plants in Georgia', *Plant Disease*, 77: 101.

Ruter JM & Gitaitis RD 1993b, '*Impatiens necrotic spot virus* in woody landscape plants in Georgia', *Plant Disease*, 77: 318.

Ryke PAJ & Meyer MKP 1960, 'South African gall mites, rust mites and bud mites (Acarina: Eriophyidae) of economic importance', *South African Journal of Agricultural Science*, 3: 231–242.

Sabrosky CW (2014) 'Family: Chloropidae', In: Evenhuis NL (ed.), Catalog of the Diptera of the Australasian and Oceanian Regions. (online version), http://hbs.bishopmuseum.org/aocat/aocathome.html, accessed November 2015.

Sabrosky CW 1987, 'Chloropidae', In McAlpine JF, Peterson BV, Shewell GE, Teskey HJ, Vockeroth JR, Wood DM (eds) Manual of Nearctic Diptera. Volume 2 1049–1067. Agriculture Canada Monograph No. 28.

Sacoto Bravo GF 2010, 'Respuesta fitotécnia de tres variedades de Zantedeschia (*Zantedeschia aethiopica* L. Spreng), a la aplicación de ácido giberélico y fertilización orgánica, en el Quinche, Provincia de Pichincha', http://www.biblioteca.ueb.edu.ec/bitstream/15001/250/14/REVISION percent20DE percent20LITERATURA.pdf Accessed March 2013.

Salam MU, Davidson JA, Thomas GJ, Ford R, Jones RAC, Lindbeck KD, MacLeod WJ, Kimber RBE, Galloway J, Mantri N, van Leur JAG, Coutts BA, Freeman AJ, Richardson H, Aftab M, Moore KJ, Knights EJ, Nash P, Verrell A 2011, 'Advances in winter pulse pathology research in Australia', *Australasian Plant Pathology*, 40: 549–567.

Sandrock C, Razmjou J, Vorburger C 2011, 'Climate effects on life cycle variation and population genetic architecture of black bean aphid, *Aphis fabae*', *Molecular Ecology*, 20: 4165–4181.

Sasakawa M 2010, 'Agromyzidae (Diptera) from Kermadec Islands, New Zealand', *New Zealand Entomologist*, 33: 14–16.

Sastry, KS 2013, 'Seed-borne plant virus diseases', Springer Science & Business Media.

Scott JK 1997, 'The potential of classical biological control of Arum lily (*Zantedeschia aethiopica*) in Australia', In Scott JK, Wykes BJ (eds) Proceedings of a workshop on Arum Lily (*Zantedeschia aethiopica*), HMAS Stirling, Garden Island, Western Australia, 7 August, 1997 59–60. CRC for Weed Management Systems, Adelaide, Australia.

Scott JK & Neser S 1996, 'Prospects for the biological control of the environmental weed, *Zantedeschia aethiopica* (arum lily)', In Shepherd RCH (ed) Proceedings of the 11th Australian Weeds Conference, Melbourne, Australia, 30 September–3 October, 1996 413–416. Weed Science Society of Victoria, Melbourne.

Scudder GGE & Eyles AC 2003, 'Heterogaster urticae (Hemiptera: Heterogastridae), a new alien species and family to New Zealand', *The Weta*, 25: 8–13.

Shahraeen N, Ghotbi T, Mehraban AH 2002, 'Occurrence of *Impatiens necrotic spot virus* in ornamentals in Mahallat and Tehran provinces in Iran', *Plant Disease*, 86: 694.

Sharkey PJ, Hepworth G, Whattam MJ 1996, 'A survey of Narcissus crops in Victoria for *Tobacco rattle virus* and *Arabis mosaic virus'*, Agriculture Victoria, Australia.

Shi YH, Hong XY, Chen J, Adams MJ, Zheng HY, Lin L, Qinm BX, Chen JP 2005, 'Further molecular characterisation of potyviruses infecting aroid plants for medicinal use in China', *Archives of Virology*, 150: 125–135.

Shimoyama J, Kameya-Iwaki M, Hanada K, Gunji T 1992, '*Konkaj mosaic virus*, a new potyvirus infecting konjak, *Amorphophallus konjac*. *Annals of the Phytopathological Society of Japan*, 58: 706–712.

Shivas RG 1989, 'Fungal and bacterial diseases of plants in Western Australia', *Journal of the Royal Society of Western Australia*, 72: 1–62.

Shivas RG, Alcorn JL 1996, 'A checklist of plant pathogenic and other microfungi in the rainforests of the wet tropics of northern Queensland', *Australasian Plant Pathology*, 25: 158–173.

Shurtleff & MC & Averre, CW 1997, 'Glossary of Plant-Pathological Terms', American Phytopathology Society Press, St. Paul, MN.

Silva TBM, Siqueira HAA, Oliveira AC, Torres JB, Oliveira JV, Montarroyos PAV, Farias MJDC 2011, 'Insecticide resistance in Brazilian populations of the cotton leaf worm, *Alabama argillacea'*, *Crop Protection*, 30: 1156–1161.

Sivanesan A 1990, 'CMI Descriptions of Fungi and Bacteria No. 1009: *Drechslera dematioidea'*, *Mycopathologia*, 111: 127–128.

Skinkis PA, Dreves AJ, Walton VM, Martin RR 2009, 'Field monitoring for Grapevine leafroll virus and mealybug in Pacific Northwest Vineyards', Oregon State University Extension bulletin 9885. http://library.state.or.us/repository/2010/201002191206395/index.pdf Accessed March 2013.

Smithers CN 1998, 'A species list of the insects recorded from Norfolk Island', *Technical reports of the Australian Museum*, 13: 1–55.

Stamps DJ 1985, '*Phytophthora meadii'*, IMI Descriptions of Fungi and Bacteria, 84, Sheet 834. http://www.cabi.org/dfb/?loadmodule=review&page=4048&reviewid=9943&site=159 Accessed May 2013.

Starr F (2005) Pathogens of plants in Hawaii. Hawaiian Ecosystems at Risk project (HEAR). http://www.hear.org/pph/pathogens/1013.htm Accessed March 2013.

Starý P & Carver M 1979, 'Two new species of Aphidius Nees (Hymenoptera: Ichneumonoidea: Aphidiidae) from Australia', *Journal of the Australian Entomological Society*, 18: 337–341.

Stirling AM 2002, '*Erwinia chrysanthemi*, the cause of soft rot in ginger (*Zingiber officinale*) in Australia', *Australasian Plant Pathology*, 31: 419–420.

Stirling GR & Eden LM 2008, 'The impact of organic amendments, mulching and tillage on plant nutrition, Pythium root rot, root-knot nematode and other pests and diseases of capsicum in a subtropical environment, and implications for the development of more sustainable vegetable farming systems', *Australasian Plant Pathology*, 37: 123–131.

Summerell BA, Leslie JF, Liew ECY, Laurence MH, Bullock S, Petrovic T, Bentley AR, Howard CG, Peterson SA, Walsh JL & Burgess LW 2011, '*Fusarium* species associated with plants in Australia', *Fungal Diversity*, 46: 1–27.

Summerell BA, Nixon PG, Burgess LW 1990, 'Crown and stem canker of waratah caused by *Cylindrocarpon destructans*', *Australasian Plant Pathology*, 19: 13–15.

Taylor JE, Hyde KD, Jones EBG 1999, 'Endophytic fungi associated with the temperate palm, *Trachycarpus fortunei*, within and outside its natural geographic range', *New Phytologist*, 142: 335–346.

Taylor S & Szot D 2000, 'First record of damage to canola caused by the oat race of stem nematode (*Ditylenchus dipsaci*)', *Australasian Plant Pathology*, 29: 153.

Thompson FC 2008, 'A conspectus of New Zealand flower flies (Diptera: Syrphidae) with the description of a new genus and species', *Zootaxa*, 1716: 1–20.

Tillekaratne K, Edirisinghe JP, Gunatilleke CVS, Karunaratne WAIP 2011, 'Survey of thrips in Sri Lanka: a checklist of thrips species, their distribution and host plants', *Ceylon Journal of Science* (Biological Sciences), 40: 89–108.

Tosh CR, Vamvatsikos PG, Hardie J 2004, 'A highly viable cross between *Aphis fabae* (Homoptera: Aphididae) clones with different plant preference', *Environmental Entomology*, 33: 1081–1087.

Toth IK, Avrova AO, Hyman LJ 2001, 'Rapid identification and differentiation of the soft rot Erwinias by 16S–23S intergenic transcribed spacer-PCR and restriction fragment length polymorphism analysis', *Applied and Environmental Microbiology*, 67: 4070–4076.

Tzanetakis IE, Guzmán-Baeny TL, Van Esbroeck ZP, Fernandez GE, Martin RR 2009, 'First Report of *Impatiens necrotic spot virus* in Blackberry in the Southeastern United States', *Plant Disease*, 93: 432.

Uchida JY & Kadooka CY 1999, 'Three species of *Phytophthora* causing Catharanthus blight in Hawaii', *Phytopathology*, 89: S78.

Upsher FJ & Upsher CM 1995, 'Catalogue of the Australian National Collection of Biodeterioration Microfungi', Department of Defence, Defence Science and Technology Organisation, Melbourne.

Van den Berg E 1992, 'New Criconematinae (Nemata) from the Carolina area of the Eastern Transvaal, South Africa', *Phytophylactica*, 24: 253–269.

Van den Berg MA, Vermeulen JB, Braack HH, Braack AL 1975, 'Pylstertmotte (Lepidoptera: Sphingidae) van die Nasionale Krugerwildtuin', Koedoe – African Protected Area Conservation and Science, 18: 13–29.

Van der Kamp BJ & Hood IA 2002, '*Armillaria* root disease of *Pinus radiata* in New Zealand', 2: Invasion and host reaction, *New Zealand Journal of Forestry Science*, 32: 103–115.

Vanneste, J 1996, 'Biological control of soft rot on calla lily and potatoes. http:/ www.hortnFet.co.nz/publications/science/jvann.2htm Accessed December 2013

Varga L, Fedor PJ, Suvák M, Kiseľák J, Atakan E 2010, 'Larval and adult food preferences of the poinsettia thrips *Echinothrips americanus* Morgan, 1913 (Thysanoptera: Thripidae)', *Journal of Pest Science*, 83: 319–327.

Vawdrey LL, Grice KRE, Westerhuis D 2008, 'Field and laboratory evaluations of fungicides for the control of brown spot (*Corynespora cassiicola*) and black spot (*Asperisporium caricae*) of papaya in far north Queensland, Australia', *Australasian Plant Pathology*, 37: 552–558.

Verhoeff K & Weber L 1966, 'Footrot of tomatoes caused by two *Phytophthora* species', *Netherlands Journal of Plant Pathology*, 72: 317–318.

Verhoeven JTJ & Roenhorst JW 1994, '*Tomato spotted wilt virus*: ecological aspects in ornamental crops in the Netherlands from 1989 up to 1991', *Acta Horticulturae*, 377: 175–182.

Vieira V 2002, 'New records and observations on Macrolepidoptera (Insecta: Lepidoptera) from Azores', *Arquipélago Life and Marine Sciences*, 19A: 55–65.

Walker K 2005, 'Glassy-Winged Sharp Shooter (*Homalodisca vitripennis*)', Pest and Diseases Image Library. http://www.padil.gov.au Accessed August 2012.

Walker PL 1980, 'Laboratory rearing of the garden weevil, *Phlyctinus callosus* Boheman (Coleoptera: Curculionidae), and the effect of temperature on its growth and survival', *Australian Journal of Zoology*, 29: 25–32.

Warham J & Johns PM 1975, 'The University of Canterbury antipodes island expedition', *Journal of the Royal Society of New Zealand*, 5: 103–131.

Warren A 2012, 'Zantedeschia Production: Zantedeschia Technical Bulletin C01/12', http://www.bloomz.co.nz/files/file/795/BLOOMZ percent20Zantedeschia_12.pdf Accessed May 2013.

Washington WS, Sanmuganathan N, Forbes C 1992, 'Fungicide control of strawberry fruit rots, and the field occurrence of resistance of *Botrytis cinerea* to iprodione, benomyl and dichlofluanid', *Crop Protection*, 11: 355–360.

Webley DJ, Jackson KL, Mullins JD, Hocking AD, Pitt JI 1997, 'Alternaria toxins in weather-damaged wheat and sorghum in the 1995–1996 harvest', *Australian Journal of Agricultural Research*, 48: 1249–1255.

Webster KW, Cooper P, Mound LA 2006, 'Studies on Kelly's citrus thrips, *Pezothrips kellyanus* (Bagnall) (Thysanoptera: Thripidae): sex attractants, host associations and country of origin', *Australian Journal of Entomology*, 45: 67–74.

Wei T, Pearson MN, Cohen D, Tang JZ, Clover JRC 2008, 'First report of *Zantedeschia mosaic virus* infecting a Zantedeschia species in New Zealand', *Plant Disease*, 82: 1253.

Werkman AW, Verhoeven JThJ, Roenhorst JW 2010, 'Plant species found infected by *Tomato spotted wilt virus* and *Impatiens necrotic spot virus* at the Dutch Plant Protection Service since 1989. www.vwa.nl/txmpub/files/?p_file_id=2001083 Accessed November 2010.

Wick RL 2009, 'Pest Management: *Impatiens necrotic spot virus* and *Tomato spotted wilt virus*', University of Massachusetts Amherst Extension. http://extension.umass.edu/floriculture/fact-sheets/impatiens-necrotic-spot-virus-and-tomato-spotted-wilt-virus Accessed August 2013.

Williams DJ, Watson GW 1990, *The scale insects of the tropical South Pacific region, Part 3, The soft scales (Coccidae) and other families*, CAB International, Wallingford, UK.

Williams GA, Adam P, Mound LA 2001, 'Thrips (Thysanoptera) pollination in Australian subtropical rainforests, with particular reference to pollination of Wilkiea huegeliana (Monimiaceae)', *Journal of Natural History*, 35: 1–21.

Wimalajeewa DLS, Hayward AC, Price TV 1985, 'Head rot of broccoli in Victoria, Australia, caused by *Pseudomonas marginalis*', *Plant Disease*, 69: 177.

Windham AS, Hale FA, Yanes Jr J 1998, 'Impatiens necrotic spot virus – A serious pathogen of floral crops', University of Tennessee, Agricultural Extension Service. https://utextension.tennessee.edu/publications/documents/sp370a.pdf Accessed January 2013.

Withers TM 2001, 'Colonization of eucalypts in New Zealand by Australian insects', *Austral Ecology*, 26: 467–476.

Wool D, Hales D, Sunnucks P 1995, 'Host plant relationships of *Aphis gossypii* Glover (Hemiptera: Aphididae) in Australia', *Australian Journal of Entomology*, 34: 265–271.

Wright, PJ, Clarke, GE, Koolaard, J 2005, 'Growing methods and chemical drenches control calla soft rot'. *Acta Horticulturae* 673: 769–774.

Wright PJ, Burge GK, Triggs CM 2002, 'Effects of cessation of irrigation and time of lifting of tubers on bacterial soft rot of calla (*Zantedeschia* species) tubers', *New Zealand Journal of Crop and Horticultural Science*, 30: 265–272.

WTO (World Trade Organisation) 1995, 'Agreement on the application of sanitary and phytosanitary measures'. World Trade Organisation, Geneva', http://www.wto.org/english/tratop_e/sps_e/spsagr_e.htm Accessed August 2013.

Xue XF, Sadeghi H, Hong XY 2009, 'Eriophyoid mites (Acari: Eriophyoidea) from Iran, with descriptions of three new species, one new record and a checklist', *International Journal of Acarology*, 35: 461–483.

Zhang Q, Ding YM, Li M 2010, 'First report of *Impatiens necrotic spot virus* infecting Phalaenopsis and Dendrobium orchids in Yunnan Province, China', *Plant Disease*, 94: 915.

Zhang XG & Zhang TY 2006, 'Taxonomic studies of *Ulocladium* from China II', *Mycosystema*, 25: 516–520.