

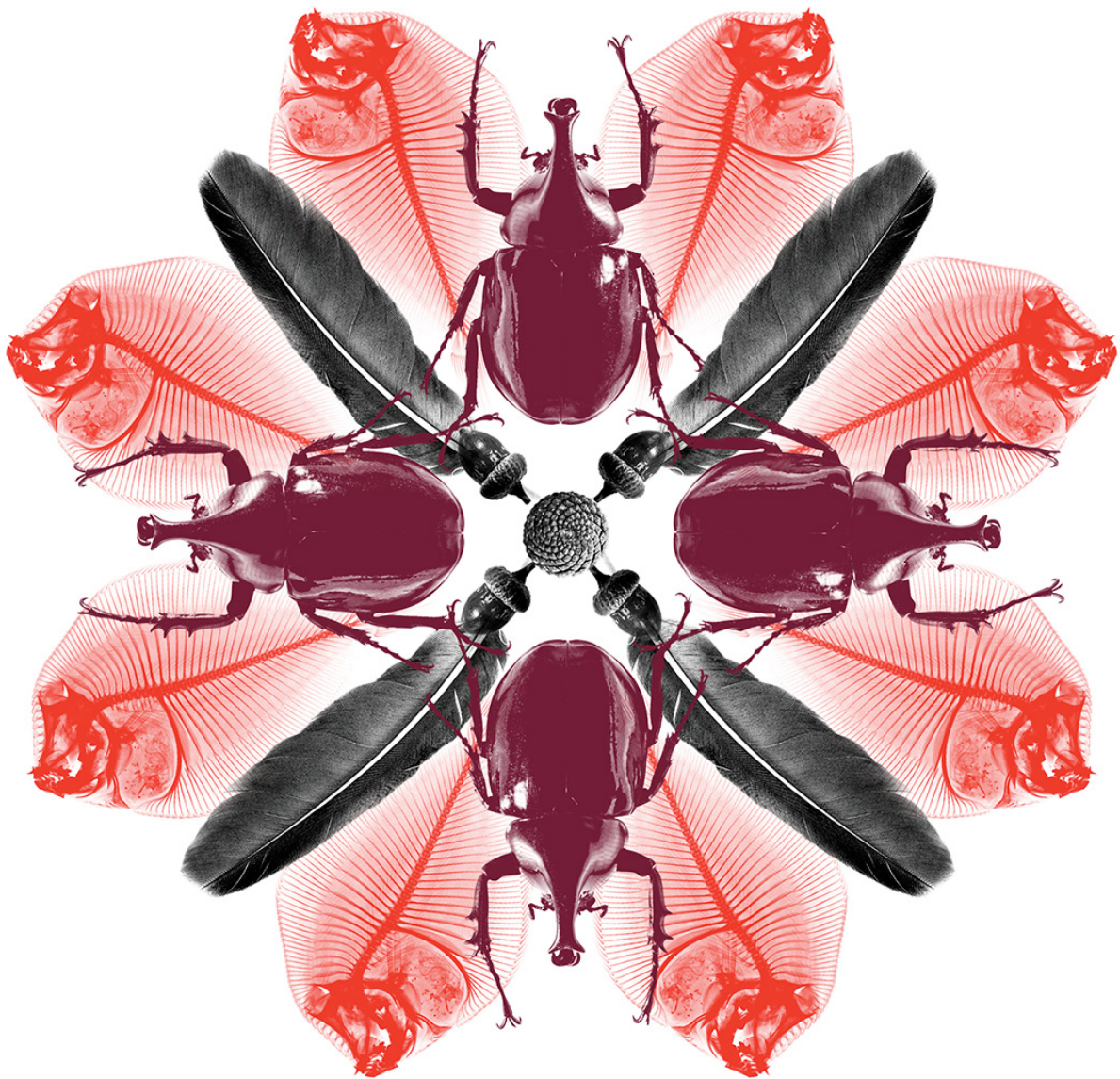


Australian Government  
Department of Agriculture

# Final Pest Risk Analysis for Cut Flower and Foliage Imports—Part 1

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June 2019



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**Map 1 Map of Australia**



## Acronyms and abbreviations

Term or abbreviation	Definition
ACT	Australian Capital Territory
ALOP	Appropriate level of protection
BCA	Biological control agent
BICON	Australia's Biosecurity Import Conditions System
DAWR	The former Department of Agriculture and Water Resources
FAO	Food and Agriculture Organization of the United Nations
FSI	Floriculture Sustainability Initiative
ICA	Instituto Colombiano Agropecuario
ICS	Integrated Cargo System
IGB	Inspector-General of Biosecurity
IIGB	Interim Inspector-General of Biosecurity
IPPC	International Plant Protection Convention
ISO	International Organisation for Standardisation
ISPM	International Standard for Phytosanitary Measures
KFC	Kenya Flower Council
NSW	New South Wales
NPPO	National Plant Protection Organisation
NT	Northern Territory
PRA	Pest risk analysis
Qld	Queensland
SA	South Australia
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures
Tas.	Tasmania
The department	The Australian Government Department of Agriculture
URE	Unrestricted risk estimate
Vic.	Victoria
WA	Western Australia
WTO	World Trade Organization



## Summary

Fresh cut flowers and foliage have been imported into Australia on a commercial basis for about 45 years. The global cut flower trade has changed, specifically in relation to increased volumes of trade, different flower and foliage species being traded, and the countries from which the flowers and foliage originate. These factors increase the risk of arthropod pests of biosecurity concern, associated with the fresh cut flower and foliage pathway, arriving in Australia.

In 2017, the Department of Agriculture and Water Resources (now known as the Department of Agriculture) conducted an Agricultural Competitiveness White Paper-funded review of the import conditions for fresh cut flowers and foliage. This identified a high number of arthropod pests being found on consignments of imported cut flowers and foliage. Based on these findings, the department revised the import conditions for fresh cut flowers and foliage to reduce the risk of quarantine pests arriving in Australia, as well as initiated this Pest Risk Analysis (PRA). The revised conditions were introduced on 1 March 2018.

The department initiated this PRA to assess the pests of biosecurity concern to Australia associated with fresh cut flower and foliage imports; and to determine whether the introduction of revised import conditions manages the biosecurity risks to achieve the appropriate level of protection (ALOP) for Australia. The PRA is being conducted in two parts, (i) an assessment of the three major arthropod pest groups—mites, aphids and thrips, and (ii) an assessment of other arthropod pests associated with fresh cut flowers and foliage. This report presents the assessment of Part 1 of the PRA for cut flower and foliage imports.

The department has taken a group approach in conducting this PRA, grouping all flower and foliage commodity types and major pests. With numerous species of flowers imported from at least 19 countries, a group pest risk analysis is an efficient, consistent and practical approach. The group approach is consistent with relevant international standards and requirements including, ISPM No.2 Framework for pest risk analysis (FAO 2016a), ISPM 11: Pest risk analysis for quarantine pests (FAO 2016d), and the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) (WTO 1995).

This PRA found that of all commodity types arriving in Australia between the years 2000 and 2017, a high proportion of interceptions of arthropod pests (23 per cent) occurred on imported cut flowers and foliage. Imports of consignments of cut flowers and foliage arriving in Australia have tripled in the past decade, from 2,271 consignments in 2007 to 8,097 consignments in 2018. Detections of live arthropod pests at the Australian border have also been of concern, with 58 per cent of total consignments having live arthropods detected in 2017, and 50 per cent of total consignments having live pests of biosecurity concern detected from 1 March 2018 to 28 February 2019. In addition, the three major pest groups assessed in this PRA have been detected on the majority of cut flower and foliage types exported to Australia.

The department assessed all 259 species of mites, aphids and thrips known to be associated with the imported commercial cut flower and foliage pathway. Of the 259 species, a total of 47 mites, 21 aphids and 84 thrips are identified as quarantine pests and/or regulated articles for Australia. A further 32 aphids are identified as potential regulated articles because they can transmit viruses that are quarantine pests for Australia (the definition of 'regulated articles' is given in the Glossary). These pests did not achieve Australia's ALOP and therefore, require specific risk management measures to manage the biosecurity risks.



The department recommends phytosanitary measures to manage the biosecurity risks posed by thrips, mites and aphids, to achieve Australia's ALOP:

- before cut flowers and foliage are exported to Australia, the exporting country must use one of three arthropod pest management options:
  - NPPO-approved systems approach, or
  - pre-export methyl bromide fumigation, or
  - NPPO-approved alternative pre-export disinfestation treatment
- in addition, the exporting country must ensure consignment freedom from live quarantine arthropod pests verified by NPPO pre-export visual inspection and remedial action if live pests are found, prior to export.
- import permits may be required in certain circumstances, for example, when a country continues to export consignments with high levels of live pests, import permits will be required to allow the department to have greater oversight and assurance that the product arriving in Australia is compliant.
- when consignments arrive in Australia, they will be:
  - visually inspected to verify that the biosecurity status of consignments of cut flowers and foliage meet Australia's import conditions.
  - released if arthropod pests are non-quarantine or unregulated, subject to freedom from other contaminants and pathogens.
  - treated if arthropods are identified as quarantine or regulated, or if the consignment does not meet Australia's import conditions.

Written submissions on the draft report were received from 24 stakeholders. The department has made a number of changes to the report following consideration of technical comments from stakeholders and subsequent review of literature. These changes include:

- addition of Appendix A, listing the taxa of cut flowers and foliage that were permitted entry into Australia at the time of publication of this Final PRA.
- incorporation of departmental interception data from March 2018 to May 2019 into the analysis of compliance with import conditions.
- addition of import permits as a phytosanitary measure for highly non-compliant pathways.
- reassessment of the distribution likelihood for mites and aphids from 'High' to 'Moderate', and reassessment of the spread likelihood for mites from 'Moderate' to 'High'. The change in likelihood ratings does not alter the unrestricted risk estimate for mites and aphids on this pathway, which remain at 'Low' to 'Moderate' for both groups.
- amendment of text in the pest categorisation table (Appendix F) to include additional species that were intercepted between 1 March 2018 and 28 February 2019, to recognise

pests of regional significance to Western Australia, and to update the distribution of certain species on the advice of NPPOs.

- addition of Appendix H 'Issues raised in stakeholder comments', which summarises key stakeholder comments, and how they have been considered in this final report.
- updated Australian production statistics and import volumes and amended the value of imported cut flowers and foliage in Australia.
- minor corrections, rewording and editorial changes for consistency, clarity and web-accessibility.

# 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 level of biosecurity risk that may be associated with importing goods into Australia. If the biosecurity risks do not achieve the appropriate level of protection (ALOP) for Australia, risk management measures are proposed to reduce the risks to an acceptable level. If the risks cannot be reduced to an acceptable level, the goods will not be imported into Australia until suitable measures are identified.

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 the ALOP for Australia, which is defined in the *Biosecurity Act 2015* 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 Department of Agriculture (the department) using technical and scientific experts in relevant fields, and involve consultation with stakeholders at various stages during the process.

Risk analyses may take the form of a biosecurity import risk analysis or a review of biosecurity import requirements (such as scientific review of existing policy and import conditions, pest-specific assessments, weed risk assessments, biological control agent (BCA) assessments or scientific advice).

Further information about Australia's biosecurity framework is provided in the *Biosecurity Import Risk Analysis Guidelines 2016* located on the department's website ([www.agriculture.gov.au/biosecurity/risk-analysis/conducting](http://www.agriculture.gov.au/biosecurity/risk-analysis/conducting)).

## 1.2 This Pest Risk Analysis

This Pest Risk Analysis (PRA) is being conducted for commercial fresh cut flower and foliage imports into Australia. The import pathway for cut flowers and foliage into Australia has not previously been subject to a full risk analysis. This PRA focuses on key arthropod pest groups associated with cut flowers and foliage and determines the pests that are of biosecurity concern to Australia. The PRA draws upon relevant risk analyses conducted by the department and other National Plant Protection Organisations (NPPOs), 18 years of interception data collected at Australia's borders, information provided by NPPOs of countries that export cut flowers and foliage to Australia, and an extensive literature review.

The ISPM No.2 Framework for pest risk analysis (FAO 2016a) states that 'Specific organisms may ... be analysed individually, or in groups where individual species share common biological characteristics.' The department is undertaking a group approach to this PRA which is consistent with relevant international standards and requirements—including ISPM 2, ISPM 11: Pest risk

analysis for quarantine pests (FAO 2016d) and the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) (WTO 1995).

This PRA is being conducted in two parts. This has allowed for earlier consultation on the import conditions, which have been put in place to manage the biosecurity risks to achieve Australia's ALOP.

### 1.2.1 Background

For around 45 years Australia has permitted the importation of fresh cut flowers and non-woody foliage from many countries, provided Australian biosecurity requirements are met. With this trade comes the potential to introduce quarantine pests into Australia. Imports of various species of cut flowers have increased and are likely to continue to increase, due to significantly lower production costs in overseas countries, and continuing consumer demand for varied and new varieties throughout the year (Interim Inspector-General of Biosecurity 2015).

In 2017, the department conducted an internal review of Australia's import conditions for fresh cut flowers and foliage. This was part of a program of import condition reviews funded by the *Agricultural Competitiveness White Paper*, under the biosecurity surveillance and analysis initiative (more information is available from [www.agriculture.gov.au/biosecurity/agwhitepaper-bio-surveillance-analysis](http://www.agriculture.gov.au/biosecurity/agwhitepaper-bio-surveillance-analysis)). The import conditions review considered whether the import conditions in place at that time:

- were easy to understand and find in the department's Biosecurity Import Conditions system (BICON).
- were based on current information and risk management approaches.
- provided the department the ability to identify treatments available to manage biosecurity risks such as pests, diseases and contaminants.

The import conditions review found, at that time, that cut flower and foliage imports into Australia had increased considerably, citing Australian Bureau of Statistics data that showed growth in imports from around \$14.8 million in value in 2000–01 to \$64.1 million in value in 2015–16 (in 2015–16 dollar rate) (ABS 2017). An analysis of interception records showed that a high proportion of consignments of cut flowers and foliage had been infested with arthropod pests (primarily thrips, aphids and mites), with some countries having in excess of 50 per cent of consignments infested with live arthropods. This high approach rate of arthropod pests was previously addressed through the use of onshore methyl bromide fumigation, however this placed significant reliance on one pest control measure at the border.

In November 2017, the department finalised the *Group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports* (Group Thrips PRA) (Australian Government Department of Agriculture and Water Resources 2017). The Group Thrips PRA considered the biosecurity risk posed by all thrips across numerous import pathways, including cut flowers and foliage, and the biosecurity risk posed by the virus genus *Orthotospovirus*, which is transmitted by certain thrips species. The Group Thrips PRA identified phytosanitary measures for quarantine and regulated thrips (the definition of 'regulated articles' is given in the Glossary and more detail is provided in Section 6.1.3) to reduce the risk of entry, establishment and spread of these organisms to Australia.

As a consequence, import conditions were revised and implemented on 1 March 2018. These conditions require exporting countries to manage biosecurity risks before they send cut flowers and foliage to Australia, so as to reduce the number of pests that arrive at Australia's borders. Australia now also recognises multiple pest control options (relating to production, packaging and the export system) and pre-export treatments which give greater confidence that any pests on these items are dealt with appropriately before they reach Australia.

As required under the SPS Agreement, this PRA was initiated to assess the pests of biosecurity concern to Australia that are associated with global imports of fresh cut flowers and foliage, and whether the introduction of revised import conditions will manage the biosecurity risks to achieve the ALOP for Australia.

### 1.2.2 Scope

The scope of the PRA is restricted to arthropod taxa associated with the pathway for commercially produced fresh cut flower and foliage imports for decorative purposes from all sources to Australia. In this PRA fresh cut flowers and foliage are defined as stems with flowers and foliage, without propagules (for example, bulbils, fruit and seeds).

The PRA does not examine the risks posed by pathogens, weeds or non-arthropod pests on the cut flower and foliage pathway, except for the orthotospoviruses transmitted by thrips. It also does not examine Australia's current requirements for herbicide devitalisation for propagatable species.

The PRA incorporates:

- findings from previous internal and publicly-available risk analyses and policy reviews of the cut flower pathway, including the department's policy reviews on the importation of *Lilium* species cut flowers and *Phalaenopsis* nursery stock from Taiwan, and the *Final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut flower and foliage imports* (available from [www.agriculture.gov.au/biosecurity/risk-analysis](http://www.agriculture.gov.au/biosecurity/risk-analysis))
- information from pest risk analyses conducted by the department for other commodities
- pest and BCA information supplied by a number of the NPPOs of key exporting countries
- the results of visits undertaken by the department to cut flower growing facilities, packing houses and NPPO inspection points in Colombia, Ecuador, India and Kenya
- an analysis of arthropod interception data recorded by the department for the period 1 January 2000 to 28 February 2018, used to determine the approach rate of quarantine pests on this pathway.

The PRA is focused on major cut flower exporting countries, currently permitted and most commonly traded cut flower genera/species (a summary list is given in Appendix A), and key pest groups that are known to be associated with this pathway. The PRA is being conducted in two parts—this first part is an assessment of the three most frequently intercepted arthropod taxa on cut flower and foliage imports arriving in Australia. These are the mites (Arachnida: Acari), aphids (Insecta: Hemiptera: Aphididae) and thrips (Insecta: Thysanoptera). The second

part of the PRA will be an assessment of the remaining arthropod pests associated with imported fresh cut flowers and foliage.

Part 1 of the PRA categorises species within the mite, aphid and thrips groups as quarantine pests and/or regulated articles, or non-quarantine pests, and assesses the level of biosecurity risk posed by those pests.

Of note for this PRA, one arthropod pest of biosecurity concern identified on the pathway, *Diuraphis noxia* (sexual type) commonly known as the Russian Wheat Aphid. This organism is listed as one of Australia's national priority plant pests (DAWR 2017). The asexual invasive form of *D. noxia* was first detected in Australia in 2016 and it has since spread from South Australia to Victoria, Tasmania and southern New South Wales (Watt 2017). The National Priority Plant Pest List is endorsed by Australia's Plant Health Committee (Australia's peak government plant biosecurity policy and decision-making forum) and identifies national priority plant pests that are exotic to Australia, are under eradication, or have limited distribution. These national priority plant pests are of significant concern as they are capable of damaging Australia's natural environment, food production and agricultural industries. Recent research has identified that the *D. noxia* in Australia is a single biotype (named RWAau1) (Watt 2017). The sexual form and/or other biotypes may cause additional damage to cereal crops if they were to establish in Australia.

The second part of this PRA will include a number of other arthropod pests that are national priority plant pests for Australia, or which are capable of transmitting a national priority plant pest. These pests include leafhoppers and sharpshooters (Insecta: Hemiptera: Cicadellidae) with the potential to transmit Australia's number one national priority plant pest, the bacterium *Xylella fastidiosa*. Also included will be the brown marmorated stink bug *Halyomorpha halys* (Insecta: Hemiptera: Pentatomidae), tarnished plant bug *Lygus lineolaris* (Insecta: Hemiptera: Miridae), leaf mining flies from the Agromyzidae family (Insecta: Diptera), and exotic bees (Insecta: Hymenoptera: Apidae).

### 1.2.3 Contaminating pests

In addition to the pests of fresh cut flowers and foliage that are included in this PRA, there are other organisms that may arrive with imported cut flowers and foliage. The department considers these organisms to be contaminating pests ('contaminants') that could pose sanitary and phytosanitary risks. These organisms include:

- pests of other crops or household pests (for example, ants, cockroaches and earwigs)
- natural enemies of arthropods and other beneficial organisms, including predators (for example, spiders and ants) and parasitoids of arthropod pests (for example, wasps)
- BCAs (for example, predatory insects, parasitoid wasps, and predatory mites) used to control pests during the production of cut flowers or foliage.

The risks posed by contaminants on the plant import pathway are addressed by existing standard operational procedures. Contaminating BCAs and other beneficial organisms on the plant import pathway are subject to additional requirements in Australia (Appendix B).

### 1.2.4 Regulatory framework

The *Biosecurity Act 2015* (Biosecurity Act) and its subordinate legislation provides the legal basis for preventing or controlling the entry of plants and plant products including cut flowers and foliage into Australia, and for managing the biosecurity risk arising from cut flower and foliage consignments after they arrive in Australia.

Commercial cut flower and foliage imports are covered by Sections 26(1) and 26(2) of the *Biosecurity (Prohibited and Conditionally Non-prohibited Goods) Determination 2016*, which includes a list of permitted cut flower and foliage species with their permitted countries of origin and listed pre-export measures (the *List of Species of Fresh Cut Flowers and Foliage with Alternative Conditions for Import – Mainland*, available from the department's website ([www.agriculture.gov.au/biosecurity/legislation/fresh-cut-flowers-mainland](http://www.agriculture.gov.au/biosecurity/legislation/fresh-cut-flowers-mainland))).

### Domestic arrangements

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



## 2 Commercial trade and production

This chapter provides information about Australia's cut flower and foliage industry and the global cut flower and foliage trade in relation to exports to Australia. Summary information is also provided on the pre-harvest, harvest and post-harvest practices considered to be standard globally for the commercial production of fresh cut flowers and foliage for export. The export capabilities of five major cut flower producing countries are also outlined.

This information is provided as context in understanding the potential biosecurity risks associated with imported cut flowers and foliage due to international production and trade practices.

### 2.1 Australian cut flower and foliage industry

In Australia, fresh cut flowers produced for the domestic and export markets are grown under protected and controlled conditions in greenhouses, protected cropping systems, and also in open fields. In 2017-18, the value of Australian cut flower production was estimated at \$281 million, while the local wholesale value of the fresh supply was estimated at \$376 million (Horticulture Innovation Australia 2019). Cut flowers are grown year round, with peaks in February for Valentine's Day, May for Mother's Day and a smaller peak in December for Christmas. In 2017-18, imported cut flowers and foliage were estimated to form 22 per cent of Australia's cut flower consumption (where the value was calculated using Australian Bureau of Statistics data estimating the pre-markup value of imports at the border).

Table 2.1 summarises the total area of fresh cut flowers grown in each Australian state, and provides a comparison of areas for those grown undercover and those grown in open fields. The state of Victoria has the largest total growing area.

**Table 2.1 Cut flower production in Australia: 2017–2018**

	<b>Total Area (ha)</b>	<b>Undercover area (ha)</b>	<b>Outdoor area (ha)</b>
Australia	5384	435	4949
New South Wales	1604	102	1502
Victoria	2687	230	2457
Queensland	398	35	363
South Australia	186	53	133
Western Australia	480	9	471
Tasmania	26	7	19
Northern Territory	2	2	0

**Source:** (Australian Bureau of Statistics 2019)

Cut flowers are mainly produced in Australia's southern states, and the principal fresh cut flower production areas are summarised in Table 2.2.

**Table 2.2 Principal cut flower production areas of Australia.**

<b>State</b>	<b>Region</b>
Victoria	Wimmera and the Melbourne region
Western Australia	Perth region
New South Wales	Central Coast and Northern Rivers region
Queensland	South East region

**Source:** (Horticulture Innovation Australia 2019).

The predominant species of cut flowers produced in Australia can be divided into four

categories:

- traditional species such as roses (*Rosa* spp.), carnations (*Dianthus* spp.) and chrysanthemums (*Chrysanthemum* spp.)
- Australian native species such as waxflower (*Chamelaucium* spp. and hybrids), kangaroo paw (*Anigozanthos* spp. and *Macropidia* spp.) and Christmas bush (*Ceratopetalum gummiferum*)
- tropical species such as anthuriums (*Anthurium* spp.), calatheas (*Calathea* spp.) and orchids (*Phalaenopsis* spp., *Cymbidium* spp., *Oncidium* spp., *Dendrobium* spp.)
- South African native species such as protea (*Protea* spp.), leucadendron (*Leucadendron* spp.) and brunia (*Brunia* spp.) (Plant Health Australia 2016).

The Australian wildflower industry (the name given to growers of Australian native species and South African plants) is estimated to comprise between 10 and 15 per cent of the total domestic flower industry (Gollnow 2013).

### 2.1.1 Comparison with global trade values

The value of Australia's cut flower and foliage exports is small in comparison to the global share.

Australia's cut flower exports are smaller than amounts imported, and Horticulture Innovation Australia Ltd (Horticulture Innovation Australia 2019) estimates that exports of Australian-grown fresh cut flowers were valued at approximately \$10 million in 2017–18, whereas imports were valued at approximately \$70 million. For the same period, Australia's major export markets were Japan, the Netherlands, and the USA with values of approximately \$4 million, \$3 million and \$1 million respectively (Horticulture Innovation Australia 2019).

Statistics on the value of global trade draw on a variety of information, and in some cases report on cut flowers only, or combine flowers as part of nursery trade. The value of global sales from cut flower exports was estimated to be close to US\$9 billion in 2017 (International Trade Centre 2018). The International Trade Centre (2018) also has data for global trade drawn from international tariff codes for cut flowers (tariff code 0603) and foliage (tariff code 0604) totalling US\$10 billion in 2017 (it should be noted that these codes also include products such as dried flowers and mosses, which have been excluded from the scope of this PRA).

## 2.2 Global production practices

This PRA considers all countries that export cut flowers and foliage to Australia, and has drawn information from multiple public sources about commercial cut flower and foliage production practices. Minimal assumptions are made about the production practices involved, as countries have varying production and pest management practices, and some countries specialise in producing particular species of flowers. For this reason, only basic standards of pre-harvest, harvest and post-harvest handling practices are assumed.

As part of this PRA, the department conducted visits to major cut flower and foliage production areas in Colombia, Ecuador, India and Kenya to verify pest control practices, and observe production, harvesting, processing and packing procedures for the export of cut flowers and foliage. The department's observations, and additional information provided during and after

the visits, confirmed the production and processing procedures described in this chapter as standard commercial production practices in those countries. A number of countries (including Colombia, Ecuador, Kenya, Malaysia, Singapore and Sri Lanka) have previously provided Australia with information on the standard commercial production practices used in their production.

### **2.2.1 Growing environment**

Due to strict product specifications by retailers and year-round demand, cut flowers for the export market are generally produced under the protected controlled environments of greenhouses constructed from plastic or glass (Papademetriou, Dadlani & FAO-RAP 1998), or the more economical option of shade houses (FAO 2011). Cut flower production from commercial open-field establishments is more typically used to supply domestic markets, as the variations in climate, pests and other environmental factors can affect the quality of the flowers harvested (Papademetriou, Dadlani & FAO-RAP 1998).

Cut flowers harvested from the wild undergo minimal management, contain higher incidences of pests, and are not monitored during the growing period (Heywood 1999). The biosecurity risk posed by cut flowers harvested from the wild is therefore significantly higher.

### **2.2.2 Certification schemes**

Many of the major fresh cut flower and foliage exporting countries produce these commodities under national codes of practice or international certification programs. These schemes certify a variety of practices, including environmental sustainability, agrochemical use and worker welfare. Examples include the Floriculture Sustainability Initiative 'Basket of Standards' (FSI2020 2017) and the Kenya Flower Council Certification Scheme (KFC 2017). General standards, for example ISO 9001 (quality management systems), are also commonly used to ensure quality along the supply chain.

Quality, social and environmental standards do not specifically address biosecurity concerns, but they do provide greater confidence in the systems in place for producing the cut flowers and foliage being exported, support traceability and give more transparency to consumers (Rikken 2011).

### **2.2.3 Cultivation practices**

Both tissue culture and vegetative propagation are commonly used in the commercial cut flower and foliage industries to produce material for mass propagation. These propagation methods are of relevance as procedures for sourcing disease-free planting material. The procedures described below can give some degree of confidence in the disease-freedom of mother stock, and enable trace-back if diseases are found.

Tissue culture is often used in the commercial orchid, carnation and chrysanthemum industries to begin plant multiplication; current technologies allow for mass propagation (Akin-Idowu, Ibitoye & Ademoyegun 2009; DeYoung, Rowe & Runkle 2011; ICA 2017b, a). Plants produced from tissue culture are then used to produce the cuttings from which the plants that will produce the fresh flowers for harvest are grown.

Some countries, however, practise other forms of vegetative propagation. For example, roses are generally propagated by grafting sections of the desired rose variety onto a more vigorous

rootstock cutting (Aggie Horticulture 2014). The grafted cuttings are then planted into prepared greenhouses or shade houses.

It is common for producers to be registered, and to maintain traceability records and index propagative material for specific pathogens (ICA 2017a). Generally, pest and quality monitoring is conducted throughout the production process and prior to harvest (ICA 2017c).

In some countries, production areas for cut flowers for export must also meet specific requirements to obtain registration to allow export activity. For example, Ecuadorian rose production areas are required to be registered and certified by the Phytosanitary Certification Program of Ornamentals of Exportation (MAGAP 2017).

#### **2.2.4 Pest management**

Standard pest management practices for the production of fresh cut flowers and foliage include acquiring high-health plant material, selecting resistant or less susceptible cultivars, sterilising growing media, making regular pest monitoring assessments, applying pre-harvest and post-harvest treatments, and using integrated pest management and/or BCAs.

BCAs are used widely to manage pests in the fresh cut flower and cut foliage industries, as well as in production of other greenhouse- or shade house-grown produce. The BCAs can be parasitoids, predators (including insects and mites) or pathogens of the pests of concern (Cloyd & Nechols 2013). In some cases, BCAs are used to control pests that have become resistant to standard pesticides.

At the harvest and post-harvest stages, pest control options can involve inspection by trained staff, chemical controls, use of new and secure packaging, and fumigation and devitalisation (FAO & IPPC 2017). Records are often kept of these processes, and their selection and application generally rely on the grower's experience and their knowledge of the crop. Where countries are using a systems approach, NPPO officers may also inspect the plants during their growth, and supervise the packing of the cut flowers for export. Under current Australian import conditions, exported cut flowers must be accompanied by NPPO phytosanitary certification. It is expected that NPPOs will not certify any plants that show quarantine pest presence or disease-like symptoms. However there has been a high level of non-compliance detected on arrival (discussed in Section 5.2.1).

#### **2.2.5 Harvesting and handling procedures**

Different flower and foliage types are harvested at different stages of their development, and this can influence the number of arthropod pests that are present. Single flowers (for example, roses) can be harvested prior to the buds opening as they will fully open post-harvest (Dole & Schnelle 2015). Composite flowers (for example, chrysanthemums) that have flower heads that are a composite of individual flowers, are harvested fully open as they will not open any further post-harvest (Centre for Agriculture 2016). Harvest times for orchid flowers vary. Orchids such as *Phalaenopsis* spp. and *Cattleya* spp. are harvested three to four days after opening, whereas orchid flowers such as *Dendrobium* spp. are harvested when the flowers are almost fully open (Dole & Schnelle 2015).

As flowers are harvested for transport to the packing shed, they are often labelled with the variety, number of stems, greenhouse/shade house identifying number, date of harvest and the

identification of the harvester (ICA 2017b, c). Exposure to water, high temperatures and direct sunlight are minimised during transportation to the packing shed (MAGAP 2017).

### **2.2.6 Packing house**

Packing house procedures usually involve a post-harvest inspection for pests, with inspections tailored to the importing country's requirements. If pests are found, a decision is made as to whether the cut flowers or foliage should continue to be used for the export market, and if so, a treatment is conducted.

Flowers are graded for size and quality, dead and excess leaf material is removed, stems are re-cut to length, and then flowers are bunched, treated (if required), pre-cooled and packed. Each bunch of flowers is usually individually wrapped with either a polypropylene, polyethylene or paper product (Pedapati 2017).

Packing boxes are generally made of cardboard, are long and narrow, and contain a vent at either end for ventilation to assist cooling. Australia's current import conditions state that all cut flowers and foliage exported to Australia must be packaged in pest-proof cartons, or containers that eliminate the possibility of pests escaping or entering. Ventilation holes on cartons must be covered with plastic (for example, using tape or shrink wrap) or mesh. The Phytosanitary Certificate must include the following additional declaration: 'The consignment was packaged in pest-proof cartons or containers that eliminate the possibility of entry or egress of insect pests'.

### **2.2.7 Product traceability**

Production facilities are generally able to demonstrate capacity for trace-back of exported fresh cut flowers and foliage to the original packing house. Cartons are also generally identifiable to the packing house level, allowing traceability of the pathway should any non-compliance issues be detected on arrival in Australia.

Some countries, such as Kenya, utilise electronic export certification systems that allocate unique identification numbers to each consignment. Relevant consignment details are associated with the unique identification number. This allows for traceability and compliance tracking, and was confirmed by the department during a visit in 2017.

### **2.2.8 Transport**

Cut flowers are perishable, and need rapid transport under optimal conditions to ensure maximum vase life. After harvest, cut flowers are generally placed in a cool room and transported under refrigeration (Jones 2001). The temperatures used during transport vary depending on the flower type; for example, tropical flowers are damaged by cool temperatures (Jones 2001).

Although fresh cut flowers and foliage are predominantly transported by air freight, it is considered to be an expensive mode of transport (van Rijswijk 2016). Sea freight is a cheaper method of transport, costing US\$1.2 per kilo between Colombia and the European Union, compared to US\$2.3 per kilo for air freight on the same route (van Rijswijk 2016). Colombia is the largest user of sea freight for cut flower exports, and shipped 30 sea containers of cut flowers to Australia in 2015 (van Rijswijk 2016).

## **2.3 On arrival in Australia**

### **2.3.1 Biosecurity border procedures**

Fresh cut flower and foliage consignments are imported into all major ports of Australia (Sydney, Melbourne, Brisbane, Perth and Adelaide). Importers present documentation (that is, a Phytosanitary Certificate including additional declarations, any commercial documentation and treatment certificates) to the department for assessment. If the documentation requirements are not met, the consignment is held pending updated documentation.

On arrival, consignments are inspected to verify that they are free of live arthropods, plant or animal debris, soil and other biosecurity risk material. Consignments that arrive as air freight are inspected at the port of entry to confirm that the consignment is suitably contained for movement to the inspection point. Consignments that arrive unsecured are generally secured by shrink-wrapping to prevent the escape of arthropod pests during transport.

All consignments are representatively sampled by a biosecurity officer and inspected to verify freedom from live pests, disease symptoms and contamination with other biosecurity risk material. If live pests or disease symptoms are detected the consignment is secured pending identification and assessment of the pest by a specialist. Most inspections are performed in department-approved facilities used for the handling, storage, inspection and treatment of perishable plant products. The department will release the cut flower consignment when all of the biosecurity requirements have been met. If live arthropods of biosecurity concern are detected the consignment is fumigated (where appropriate), exported or destroyed. If diseases of biosecurity concern are detected the consignment is destroyed in an approved manner.

### **2.3.2 Post-border**

Once released from biosecurity control, imported cut flowers and foliage are generally transported to and stored at wholesale flower markets where they are purchased by retailers. They are likely to be widely distributed across Australia through florists, supermarkets, grocery and convenience stores, service stations, hospitals and other points of sale. Due to the short shelf life of cut flowers, their distribution is likely to occur soon after importation. In Australia and globally, there has been a shift in the last ten years or so, with consumers more likely to buy cut flowers from a supermarket than a florist (Werren 2015).

Cut flower retailers sell directly to consumers, either as bunches, or as arrangements such as wreaths or bouquets (IBIS World 2018). There are no country of origin labelling requirements for imported cut flowers (Werren 2015), and flower bunches and floral arrangements may consist of imported and local cut flowers. Cut flowers may be disposed of through municipal waste systems, or discarded as green waste in household compost, on roadsides or left in other locations, such as cemeteries.

## **2.4 Production and export statistics**

Production and export statistics for the top five countries that export cut flowers and foliage to Australia are summarised in the following sections. The geographical location of these countries, along with the different flower types grown and local trade practices, for example, transshipment of product grown in other countries, have potential biosecurity implications. These implications are discussed further in Chapters 3 and 4.

### 2.4.1 The Netherlands

The Netherlands's cut flower production area measures approximately 4,400 hectares of both open field and greenhouses, with the major production areas situated around Aalsmeer (Nations Encyclopedia 2018; van Rijswick 2016). Cut flower species with the highest area of production are roses, chrysanthemums, lilies, gerberas and orchids (Hübner 2017). Major export markets are Germany, France and the United Kingdom (Hübner 2017).

The Netherlands is the largest importer and exporter of cut flowers and foliage in the world, and the Dutch flower auction Royal Flora Holland is a major trade hub for all cut flowers and foliage (CBI 2016). In 2017, the Dutch flower auctions processed plant and flower sales of 11.7 billion globally sourced items (RFH 2017). The auctions trade over 60 per cent of cut flowers around the world, without the need for flowers to be physically present at the auctions (Phillips 2016). The practice of product transshipment can lead to mislabelling of country of origin (discussed in Section 3.1.2), which in turn can make trace-back difficult.

### 2.4.2 Colombia

Colombia's principal cut flower production areas are located in Antioquia and Cundinamarca (Conlon 2015), with a total area of production measuring around 6,800 hectares in 2016, primarily producing roses, hydrangeas, carnations and chrysanthemums, in that order of volume (Hübner 2017). Colombia's major export markets are the USA, Japan, United Kingdom, Canada, the Netherlands and the Russian Federation (Conlon 2015; International Trade Centre 2018). Flowers are also exported by sea freight to Australia (van Rijswick 2016). The total cut flower and foliage trade export value from Colombia has been steadily increasing from approximately €746 million in 2008, to €1.2 billion in 2016 (Hübner 2017).

During the department's visit to Colombia in 2018 it was observed that all farms produced flowers using an integrated pest management system, with a strong focus on pest monitoring through scouting and trapping. Pest populations identified by monitoring activities were controlled through the targeted application of chemicals, and supplemented by a combination of biological, physical and cultural control strategies. Most of the farms visited utilised pest management software to digitally record pest detections in real time, and to assist management and tracking of the effectiveness of pest management activities.

### 2.4.3 Kenya

Kenya's principal cut flower production areas are located in the east of the country, particularly around Lake Naivasha, Mt. Kenya, Nairobi and Athi River, (KFC 2018), with the total production area measuring approximately 4,100 hectares (van Rijswick 2016). The leading species of flowers produced are roses, carnations and *Alstromeria*, with roses dominating the export market (KFC 2018). In 2017, Kenya exported around US\$541 million worth of cut flowers and foliage to its export markets, with the top five export markets being the Netherlands, the United Kingdom, the Russian Federation, Norway and Germany (International Trade Centre 2018).

During the department's visit to Kenya in 2017 it was observed that all farms visited had quality assurance procedures in place, and that inspections were carried out by employees with integrated pest management expertise. The visit also confirmed the use of integrated pest management with a combination of BCAs, and approved chemicals for more significant pest



infestations. Kenya uses electronic certification systems that allocate unique identification numbers to each consignment. This allows for traceability and compliance tracking.

#### **2.4.4 Ecuador**

Ecuador's area of production measures around 8,500 hectares with around 75 per cent of the country's cut flower production and 61 per cent of rose production taking place in the province of Pichincha (Conefrey 2015; Hübner 2017). A range of cut flowers including carnations, lilies, chrysanthemums, *Hypericum*, *Gypsophila*, *Limonium* and *Liatris* are exported around the globe, but the primary cut flower export product is roses (Hübner 2017; Nag 2017). Ecuador's major cut flower export markets are the USA, Russian Federation and the Netherlands (Hübner 2017), with an export trade value of approximately US\$888 million in 2017 (Conefrey 2015; Hübner 2017; International Trade Centre 2018).

The department's visit to Ecuador observed very similar practices to those in place in Colombia. All farms produced flowers using an integrated pest management system with a strong focus on pest monitoring through scouting and trapping. Pest populations identified by monitoring activities were controlled through the targeted application of chemicals and supplemented by a combination of biological, physical and cultural control strategies. Most of the farms visited utilised pest management software to digitally record pest detections in real time, and to assist management and tracking of the effectiveness of pest management activities.

#### **2.4.5 Malaysia**

Malaysia's floriculture production area in 2017 was measured at approximately 2,700 hectares (Ismail 2017), with tropical flower production primarily occurring in the lowland regions such as the Johor, Sabah and Sarawak regions (Ismail 2017; Papademetriou, Dadlani & FAO-RAP 1998), and temperate flowers and foliage in areas such as the Cameron Highlands (Ismail 2017; Nag 2017). Malaysia specialises in growing orchids, but chrysanthemums and cut foliage are also major exports (Hamir et al. 2008; Ismail 2017).

The approximate export value of Malaysia's cut flowers and foliage was US\$119.6 million in 2017 (International Trade Centre 2018), and its top five major export markets were Japan, Thailand, Singapore, Australia and Hong Kong (China), in that order (FFTC Agriculture Policy Platform 2016; International Trade Centre 2018).

### 3 Cut flower and foliage pathway

A pathway is defined as any means that allows the entry or spread of a pest (FAO 2019). As previously mentioned (Section 1.2), the export of cut flowers and foliage to Australia is an historic pathway, and has not previously been subject to a full risk analysis. However, a number of researchers and NPPOs have identified cut flowers and foliage as a pathway for the entry and spread of arthropod pests, and the Group Thrips PRA considered the cut flower and foliage pathway. The following chapter discusses the international movement of arthropods on cut flowers and foliage as identified in scientific research and literature, the Group Thrips PRA and analyses by other NPPOs. Biosecurity risks created by the nature of the commodity, the global nature of the trade, and integrated pest management are also discussed.

#### 3.1 Cut flowers and foliage as a pathway for exotic pests

Many flowers are thought to have evolved to attract pollinators, and their attractiveness to different types of pollinators (for example, arthropods, birds and mammals) is based on factors such as flower shape, size, colour and scent (Begum et al. 2004; Dafni & Kevan 1997; Galen 1999; Mannion et al. 2013; Sivinski et al. 2011; Sletvold & Grindeland 2008). Many animals also feed on flowers, pollen or foliage, or predate upon species which feed on flowers or foliage. The trade in flowers is therefore an important pathway for movement of arthropods.

The floriculture trade has repeatedly been identified as a pathway for invasive pests (most commonly arthropods and pathogens) throughout the world (for example, in Europe: (Kenis et al. 2007; Perrings et al. 2005; Roques et al. 2009), the United Kingdom: (Smith et al. 2007), the USA: (Liebhold et al. 2012; Perrings et al. 2005), Korea: (Lee et al. 2016), Japan: (Genka & Yoshitake 2014; Kiritani 2001) and New Zealand: (MAF 2002)).

A number of studies have investigated the invasion risks associated with the international cut flower trade. Kiritani (2001) linked rapid increases in the number of imported cut flowers and other plant material to an increasing number of exotic greenhouse pests being detected in Japan. In that study the exotic introductions associated with cut flowers were identified as aphids, thrips and phytophagous mites. Cut flowers and seedlings have been reported to have the highest rates of quarantine pest interceptions at the Korean border (Hong et al. 2012). In addition, an analysis of the correlation between commodity types and insect species intercepted at the Korean border from 1996–2014 showed that cut flowers were likely to be one of the main pathways of incursions of exotic insect pests (Lee et al. 2016). Lee et al. (2016) also reported that the annual ‘invasion rate’ and number of quarantine pest detections on cut flowers imported into Korea had rapidly increased, with the substantial increase in the volume of cut flowers imported into Korea, leading Korea to impose stricter plant quarantine regulations (Lee et al. 2017; Lee et al. 2016).

There have also been similar reports from Europe and the USA. In Europe from 1995–2004, the highest percentage of quarantine pest interceptions (22 per cent) was on imported cut flowers (Roques & Auger-Rozenberg 2006), with 29 per cent of insect interceptions being on cut flowers (Kenis et al. 2007). Roques et al. (2009) also suggest that the main pathway for invasive insects and mites arriving in Europe had been on ornamental plants, including cut flowers. Similarly, in the USA from 1997–2001, 69 per cent of insect interceptions in air cargo were on cut flowers (Work et al. 2005). Supporting the argument that cut flowers are a high risk pathway, large numbers of quarantine pests have also been intercepted on cut flowers imported in baggage into

the USA (McCullough et al. 2006). Consistent with this, the USA assessed the risk of introduction of a wide range of quarantine pests on cut flowers imported from the Netherlands as being high (USDA-APHIS 2010).

Thrips are reported to be the most commonly intercepted insects on cut flowers internationally (Vierbergen 1995). In the 1990s, quarantine pests of concern to the European Union, including *Bemisia tabaci* (silverleaf whitefly), *Frankliniella occidentalis* and *Thrips palmi*, were regularly intercepted on cut flowers imported into European countries (Karnkowski 1999). *Thrips palmi* was intercepted most commonly on cut orchid flowers imported to the European Union and USA (Vierbergen 2001). Karnkowski (1999) also reported thrips, mites and whiteflies being regularly detected during border inspections in a number of European countries by their NPPOs, despite phytosanitary certification that the products were free of pests. The Group Thrips PRA (Australian Government Department of Agriculture and Water Resources 2017) also identified regular detections of thrips on the plant import pathway, including eight species (*Frankliniella fusca*, *F. intonsa*, *F. occidentalis*, *F. schultzei*, *Scirtothrips dorsalis*, *Thrips palmi*, *T. setosus* and *T. tabaci*) known to transmit orthotospoviruses.

In summary, multiple authors and countries have identified cut flowers and foliage as a pathway for the introduction of exotic pests. Consequently, the importation of cut flowers is regulated by many countries, including the European Union, USA, Korea, Japan and New Zealand (Council of the European Union 2000; Lawson & Hsu 2006; Lee et al. 2017; USDA 2014). Pathway risk analyses for cut flowers have also been conducted by NPPO's, such as for flower imports to Bangladesh (Ali et al. 2016), Taiwan *Oncidium* species imports to New Zealand (MPI 2017), and the Group Thrips PRA (Australian Government Department of Agriculture and Water Resources 2017).

### 3.1.1 Perishability and pest risk

Cut flowers are one of the most perishable plant commodities traded, and rapidly lose quality and vase life, with most cut flowers lasting 1–2 weeks (IIGB 2015; Jones 1959). The *Draft ISPM International movement of cut flowers and foliage* (FAO & IPPC 2017) considered cut flowers and foliage to be a relatively low pest risk class, on the basis that some pests may not complete their life cycle on these short-lived commodities. Together with their intended end use for mainly indoor purposes, it was thought that the risk of distribution of a pest from the cut flowers to a host plant was very low. The draft ISPM states that 'although foliage (and cut flowers) may be a pathway for entry, it may not always lead to establishment' (FAO & IPPC 2017). However, the draft also mentions that the large volumes of cut flowers and foliage increasingly being traded globally may increase the likelihood of introduction of pests of biosecurity concern.

The Draft ISPM does not, however, consider the risks of outdoor cut flower use, such as in fresh flower petal confetti, outdoor weddings, or funeral wreaths that are left close to potential host plants. Disposal of cut flowers in household compost systems is also not considered. There are also certain species of insects that can complete their life cycle more rapidly if resources become scarce, as on dying cut flowers. The Group Thrips PRA (Australian Government Department of Agriculture and Water Resources 2017) estimated the indicative likelihood of entry, establishment and spread of thrips to Australia on the plant pathway (which includes cut flowers and foliage) as 'Moderate', assessing the level of risk to be higher than the draft ISPM.

The first consultation on the Draft ISPM was concluded in September 2017, and while some countries supported the draft, others were concerned at the lack of specific phytosanitary requirements (FAO 2017a). In November 2017, the International Standards Committee of the IPPC decided to suspend further discussion on the Draft ISPM, and in May 2018 the committee assigned 'pending' status to the Draft ISPM, as it considered further work on the development of the document was required (IPPC 2018).

### 3.1.2 Country of origin labelling

Other internationally recognised risks include incorrect identification of the country of origin of imported cut flowers. For example, the USA intercepted prohibited species of imported cut flowers and other plant material from countries including Thailand, Europe and Mexico, mis-manifested as of Canadian origin (National Plant Board 1999). The Netherlands is the largest importer and exporter of cut flowers and foliage in the world, and many consignments of cut flowers certified as coming from the Netherlands have been transhipped/re-exported through that country, but actually originate from South America, Africa or Asia (CBI 2016).

The department has identified similar instances of incorrect identification of country of origin. For example, Phytosanitary Certification provided by the Netherlands has included flowers from Chile, Ethiopia, France, Germany, Israel, Italy, Kenya, Malaysia, Morocco, Portugal, Spain and Zimbabwe. Mis-labelling can make trace-back difficult, although the department is generally able to trace the country origin of consignments from documentation supplied with those consignments. In all cases, the exporting country's NPPO certifies the application of pre-export phytosanitary measures to meet Australia's import requirements, for example, pre-export treatment or packing house measures under an NPPO-approved systems approach.

### 3.1.3 Integrated pest management and biological control agents

Cut flowers for international trade tend to be grown under protection, in greenhouses or screen houses where environmental conditions can be controlled, and pests monitored. Growers often use integrated pest management to control pests and diseases, as repetitive insecticidal spraying can encourage pesticide-resistant pests (for example, *Frankliniella occidentalis* and *Tetranychus urticae*) in greenhouses (Casey et al. 2007) and a decrease in natural enemies (Bueno 2005).

The use of BCAs to supplement cost-effective cultural, physical, biological and chemical management strategies has been a significant component of integrated pest management systems in crops grown under protected greenhouse cultivation for many years (Bale, van Lenteren & Bigler 2008). The use of parasitoids, predators and pathogens as BCAs is one of the oldest chemical-free methods used to control arthropod pests on plants (Stenberg 2017). BCAs are especially useful for controlling pesticide-resistant pests in production areas.

The use of BCAs in production leads to these arthropods also being on imported consignments, and live BCAs are often intercepted on imported cut flowers during on-arrival inspections in Australia. If the BCA species are not present in Australia they too potentially pose a biosecurity risk, and are therefore regulated in order to achieve Australia's ALOP.

In many countries, including Australia, potential BCAs undergo a risk analysis process prior to release into the environment, to determine the likelihood of them causing effects on non-target species, and to assess the likely consequences of those effects (consistent with ISPM 3 *Guidelines for the export, shipment, import and release of biological control agents and other beneficial*

*organisms* (FAO 2005)). The outcomes of risk assessments vary between countries, due to differences in the indigenous and naturalised flora and fauna present in the countries in which the agent is to be introduced (Briese 2005; Sands & Van Driesche 1999). There is a risk that exotic BCAs imported on cut flowers could have unintended impacts on local species, and therefore they are considered to be of biosecurity concern.

## 4 Previous import policies and principles

Australia has long-established conditions for the importation of commercial consignments of cut flowers and foliage from many countries. The following chapter documents a chronology of key events in the development of these conditions, and includes significant decisions that influenced these policy settings, and outlines the principles set by whole-of-biosecurity reviews conducted in Australia. The chapter provides context to the department's identification of this pathway as a biosecurity risk, and concludes with a summary of recent import conditions, the revised import conditions implemented on 1 March 2018, and stakeholder consultation conducted by the department to date.

### 4.1 Chronology of events

#### 4.1.1 1960s

In 1964, the importation of fresh cut flowers carried by passengers was approved, provided the flowers were free from insects, and that the flower stems were incapable of propagation. Larger consignments for display were permitted under stricter conditions (Evans, Cordiner & Collier 1998).

In 1965, commercial cut flower importations were approved based on the following principles: prohibited and propagatable species were not permitted, fumigation was conducted if live pests were found, and consignments were to be treated or destroyed if disease, other than a virus, was identified. Consignments were subject to 100 per cent inspection, and consequently at that time the biosecurity risk of importing fresh cut flowers was considered to be low (Van de Klashorst & Harper 1982).

#### 4.1.2 1970s

The increasing prominence of air transport and the enhanced techniques involved in producing and harvesting fresh cut flowers prompted an increase in fresh cut flower imports in this decade (Van de Klashorst & Harper 1982). The previous 100 per cent inspection regime was resource intensive, so in 1977, inspection staff were instructed that the first consignment from any source required 100 per cent inspection. If no quarantine impediment was observed, the remaining consignments from that source required only a few packages to be inspected per consignment (Evans, Cordiner & Collier 1998).

In 1979, the Senate Standing Committee on Natural Resources concluded an enquiry on the adequacy of quarantine, and recommended that the effectiveness of the inspection system for cut flowers should be evaluated. In response, the department engaged consultants to address this and other matters raised by the committee. The consultant's report was delivered in 1982 (see Section 4.1.3).

#### 4.1.3 1980s

In 1980, due to a continued increase of fresh cut flowers arriving as air freight and the increased pressure this placed on inspection officers, the department specified that all air freight consignments of fresh cut flowers be fumigated (Evans, Cordiner & Collier 1998).

In 1982, consultants finalised the report *Cut flower imports: an investigation into the effectiveness of the Australian plant quarantine* (Van de Klashorst & Harper 1982), conducted in response to

the 1979 Senate Standing Committee's report. Import regulations in use at that time were found to be effective, but some improvements to inspection and treatment facilities were recommended. These included improving facilities so that all treatments could be conducted in one location, and including standardised inspection benches, lighting and magnification.

#### 4.1.4 1990s

In 1996, a major review of quarantine made a recommendation to manage the pest risk associated with imports of cut flowers. *Australian Quarantine, a shared responsibility*—the 'Nairn Review'—was a comprehensive review of quarantine issues facing Australia at that time (Nairn et al. 1996). Recommendation 53 of the Review stated that pathogen and pest risks on cut flowers should be managed offshore, where possible, and recommended pre-export fumigation at approved and audited premises overseas for cut flowers from sources with an established record of high prevalence of accompanying pests or diseases (Nairn et al. 1996). The Government accepted this recommendation in its response (Department of Primary Industries and Energy 1997), however, in 1996 fumigation was introduced on arrival because of concern about the efficacy of fumigation offshore, and the integrity of treatment certificates provided by some treatment providers (Evans, Cordiner & Collier 1998).

#### 4.1.5 2000s

During the 2000s, the department approved some specific arrangements for cut flower and foliage production that gave exemption status from fumigation for accredited suppliers in Malaysia and Singapore. The approvals were granted after submissions from NPPOs on pest status in the countries, followed by audit of their phytosanitary systems, and continuous monitoring of the schemes by the respective NPPO. China was also exempted from on-arrival fumigation, as cut flowers were fumigated prior to export and all fumigations were supervised and certified by the Chinese government.

In 2004, the department established the Australian Fumigation Accreditation Scheme (AFAS), a bilateral arrangement between the department and other countries' NPPOs, to reduce the number of ineffective methyl bromide fumigations. AFAS has been operating since that date, and AFAS-registered treatment providers are trained and undergo regular compliance assessments. This provides increased confidence in the pre-export fumigations conducted on Australia-bound consignments. The number of countries involved was initially small, but has now expanded to 11 (Cox 2011; Department of Agriculture and Water Resources 2018c).

In 2008, another major review of quarantine was completed. The 'Beale Review'—*One Biosecurity: A Working Partnership*—outlined the government's commitment to progressing reform to deliver a modern biosecurity system (Beale 2008). Three core principles were identified: the biosecurity continuum, science-based assessments, and a shared responsibility. The first principle—the biosecurity continuum—emphasised management of biosecurity risks offshore, prior to consignments landing at an Australian point of entry. The report suggested that this could be achieved by applying offshore risk management tools using concepts such as managed pathways and/or pre-export treatments to provide greater confidence that biosecurity risks were being managed in the country of origin.



#### 4.1.6 2010-2019

At the beginning of the current decade, the number of consignments of fresh cut flowers and foliage arriving in Australia began to increase rapidly, and the source countries that traditionally exported these commodities to Australia began to change. Kenya became the predominant exporter to Australia, and Colombia, Ecuador and Malaysia also had strong growth (these issues are discussed further in Section 5.1.3).

In 2013, the department instigated an Automated Fumigation Exemption System. This system was intended to encourage importers to supply goods free of arthropod pests in order to qualify for a fumigation exemption. Five consecutive pest-free consignments from the same importer/supplier pathway were required to obtain fumigation exemption, however, three consecutive inspection failures resulted in reinstatement of the requirement for fumigation on arrival (Interim Inspector-General of Biosecurity 2015).

Also in 2013, the department completed its first PRA for the cut flower pathway, for importation of *Lilium* species cut flowers from Taiwan (DAFF 2013). The risk assessment identified twenty quarantine pests associated with this pathway, and as a consequence, recommended either use of a systems approach to control insect pests (to be administered by Taiwan's NPPO), or pre-export methyl bromide fumigation.

In 2015, the Interim Inspector-General of Biosecurity (IIGB) examined the effectiveness of controls for importing fresh cut flowers (including fresh foliage) into Australia. Although the IIGB considered that the department was managing relevant biosecurity risks in an appropriate manner, areas for improvement were identified. The IIGB made six recommendations, and all were implemented by the department. The recommendations were to:

1. enforce requirements for integral packaging of all imported cut flower consignments.
2. review the need for security seals on trucks, applied to provide security for consignments being transported between cargo terminal operators, quarantine-approved premises and approved fumigation facilities.
3. consider the need for regular or random post-fumigation checks for live pests, in the context of the department's risk return policy.
4. reduce dependence on methyl bromide gas for treatment of pests in imported cut flower consignments, and undertake an assessment and approval process for alternative treatments.
5. review the existing cut flowers and foliage devitalisation policy and its implementation.
6. ensure that devitalisation test results (conducted by the department to verify whether devitalisation treatment has been correctly applied by exporting countries) are reliable (Interim Inspector-General of Biosecurity 2015).

In 2016, the department again found a notable increase in live arthropods being intercepted on imported consignments of fresh cut flowers and foliage (discussed further in Section 5.1.2).

In 2017, the department's import conditions review (discussed in Section 1.2.1) found that the number of imported consignments had increased considerably, and a high proportion of consignments had failed on-arrival inspection due to the presence of arthropod pests. The review also found that the Automated Fumigation Exemption System (established in 2013) did

not result in a reduction of pest incidences at the border, and this was removed as an option in late 2017.

Also in 2017, the department released the *Final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports* which considered the biosecurity risk posed by all plant-feeding thrips potentially associated with commercial consignments of those products. In addition, the Group Thrips PRA assessed the emerging risks posed by all members of the thrips-transmitted virus genus *Orthotospovirus* (Australian Government Department of Agriculture and Water Resources 2017). The Group Thrips PRA confirmed 79 thrips species as quarantine pests for Australia and a further three as regulated articles. Those species of particular relevance to the cut flower and foliage pathway are considered later in this document.

## 4.2 Summary of recent import conditions

### 4.2.1 Recent import conditions

Prior to 1 March 2018, importers were required to present a Phytosanitary Certificate or commercial invoice stating the full scientific name or the common name of the cut flowers or foliage, pack the goods in clean, new packaging and transport them in sealed containers, and, on arrival in Australia, enable the goods to be inspected to verify they were free of biosecurity risk material.

All consignments were subject to onshore treatment by methyl bromide fumigation except those exempted. Exemptions to the fumigation requirement had been available to eligible consignments and importers through two schemes:

- the Overseas Accreditation Scheme, which applied to permitted species of flowers and foliage from accredited overseas suppliers in Malaysia, and Singapore. China was also exempted from onshore fumigation, as cut flowers were fumigated prior to export and all fumigations were supervised and certified by the Chinese government.
- the Automated Fumigation Exemption Scheme, through which exemptions were granted for ongoing compliance for a specific importer/supplier pathway.

Cut flowers and foliage that could be grown from stem cuttings (that is, propagatable species) also required dipping in herbicide to prevent growth (devitalisation).

### 4.2.2 Transition period to revised import conditions

After the 2017 import conditions review, in September 2017 the department proposed revised import conditions for fresh cut flowers and foliage. The department agreed to delay this implementation until 1 March 2018 to allow the NPPOs of exporting countries, and exporters and importers sufficient time to transition to the revised conditions.

In preparation for the commencement of the revised conditions Australia permitted consignments to be exempt from onshore fumigation if they were treated prior to export, or were produced under an NPPO-approved systems approach. Details of pre-export treatment(s) were required to be provided on a treatment certificate or Phytosanitary Certificate. Consignments produced under a systems approach were required to be accompanied by a Phytosanitary Certificate with the relevant additional declaration.

All consignments were inspected on arrival to confirm that they met Australia's import requirements, including the absence of live quarantine pests. If live quarantine pests were detected the consignment was directed for remedial treatment.

Imports were closely monitored during the transition period for freedom from quarantine pests, and details of non-compliance were provided to countries and importers to allow them to apply corrective actions for subsequent exports, and to prepare for the commencement of the revised import conditions on 1 March 2018.

#### **4.2.3 Revised import conditions (implemented 1 March 2018)**

On 1 March 2018, the department implemented a requirement that all commercial consignments of cut flowers and foliage imported into Australia be free of live quarantine pests. From that date, all consignments required a Phytosanitary Certificate from the NPPO of the exporting country attesting to freedom from pests. Such freedom could be achieved through either pre-export treatment or through the use of a systems approach (a combination of pest control measures in production, transport and packing areas). Cut flowers and foliage must have been packed in insect-proof cartons, and any cut flowers and foliage that are propagatable required a devitalisation treatment.

Onshore fumigation is now used only as a remedial treatment when live quarantine pests have been detected on consignments that have been verified by the exporting NPPO as having met Australia's import conditions.

Countries were informed that if non-compliance continued to be high, Australia would notify countries in accordance with ISPM No. 13 *Guidelines for the notification of non-compliance and emergency action*, and request details of their investigation of the pathway, and of any corrective actions taken to ensure compliance consistent with the ISPM. NPPOs were also informed that continued detections of quarantine pests, or repeated arrival of non-compliant shipments to Australia might result in additional measures, suspension of measures, or trigger a departmental audit of the NPPO's phytosanitary certification system.

The revised import conditions are available on the department's Biosecurity Import Conditions (BICON) system on the department's website (from [www.agriculture.gov.au/import/online-services/bicon](http://www.agriculture.gov.au/import/online-services/bicon)). An overview of fresh cut flower and foliage import conditions is also available on the department's website (from [agriculture.gov.au/cut-flowers](http://agriculture.gov.au/cut-flowers)).

#### **4.3 Stakeholder consultation**

The department has engaged in an extensive program of consultation with international and domestic stakeholders. This has included corresponding with all countries through an SPS Notification (G/SPS/N/AUS/435 *Importing fresh cut flowers and foliage into Australia safely*) dated 14 September 2017, and addendums 1 to 4 to this SPS Notification in November 2017, November 2018, February 2019 and April 2019. The NPPOs of the nineteen leading exporting countries were also advised of the changes to conditions and provided with updates on compliance rates, and visits were made to Colombia, Ecuador, India and Kenya to observe and evaluate commercial production practices. The department has corresponded with leading Australian importers, and issued Industry Advice Notices to industry participants advising of the revision of import conditions. The department also established the Imported Cut Flowers and

Foliage Regulation Working Group to enable engagement with cut flower importing, production and nursery garden industry sectors, as well as Plant Health Australia (Appendix C gives more detail) on the biosecurity risks associated with imported fresh cut flowers and foliage, and the implementation of the revised import conditions.

Consultation on the PRA was conducted with countries and their Australian representatives, importers, and domestic horticultural industries. Most recently, in April 2019 the department held a stakeholder forum for all interested parties, with presentations from departmental staff on the import conditions, the PRA, inspection and scientific services, and from importers and domestic horticultural industries. More detail about all international and domestic consultation is presented in Appendix C.

#### **4.4 Conclusion**

A number of key events have occurred since 1964 to influence the department's policy settings for the importation of fresh cut flowers and foliage. The department has instigated different approaches to reducing the biosecurity risk in response to these events, however, biosecurity risk has escalated in prominence and revised measures were introduced in March 2018 in response to this risk. This PRA provides a more detailed examination of the biosecurity risk associated with fresh cut flower and foliage imports that necessitates Australia's current import policy and associated requirements.

## 5 Changing patterns of activity and risk

Cut flowers and foliage are traded globally, and trade patterns have changed. In an historic trade pathway such as fresh cut flowers and foliage to Australia, changes in trade patterns create changes to biosecurity risk, as different countries have different arthropod pest profiles. The changes to the biosecurity risk form the basis for Australia's initiation of this PRA.

This chapter considers the change in patterns of global cut flower and foliage trade as they relate to Australia, and as an indicator of changes in biosecurity risk. An analysis of tariff code data is presented to illustrate the increase in volume of exports to Australia, the change in countries of origin of these exports and the change in types of flowers. This chapter also presents an analysis of the department's arthropod detection data to determine the most frequently intercepted pest groups on pre-2018 consignments of imported cut flowers and foliage.

Tariff code data on imports of cut flowers and foliage were sourced from the Department of Home Affairs' Integrated Cargo System (ICS) (Department of Home Affairs 2018) under two tariff codes—0603.1: cut flowers and flower buds of a kind suitable for bouquets or for ornamental purposes (fresh), and 0604.1: foliage, branches and other parts of plants without flowers or flower buds (fresh).

These data were prepared to exclude any records associated with dried flowers and foliage, or non-flower and foliage species. ICS data enabled analysis of trends in numbers and types of consignments, as well as of countries of origin. For the purpose of this assessment, a consignment is defined as one entry against the relevant fresh cut flower tariff code as recorded in ICS. Consignment units have been used as a volume determiner in this instance, as there is no standardised method for recording volumes of imports in ICS (weights, carton numbers and stem numbers are all commonly used).

In addition to ICS data, the department records detections of pests from consignments, known as 'interceptions'. Each interception denotes one type of arthropod found (different species found on one consignment are recorded as separate interceptions), and one interception can record multiple instances of that species being found on one consignment. The ISPM No.5 *Glossary of phytosanitary terms* (FAO 2019) defines the interception of a pest as 'the detection of a pest during inspection or testing of an imported consignment'. This is distinct from the definition of an incursion, which is defined as 'an isolated population of a pest recently detected in an area, not known to be established, but expected to survive for the immediate future'.

The department's interception data enabled the analysis of the proportion of consignments detected with live arthropod pests, the countries of origin of those consignments, and also the types of pests found.

### 5.1 Importations by consignment, country and flower type

#### 5.1.1 Global cut flower and foliage trade

International trade is largely organised by region, with Asian-Pacific countries being the main suppliers to Japan and Hong Kong; African, Middle Eastern, and other European countries are the principal suppliers to Europe, and Colombia and Ecuador the principal suppliers to the USA (International Trade Centre 2018).

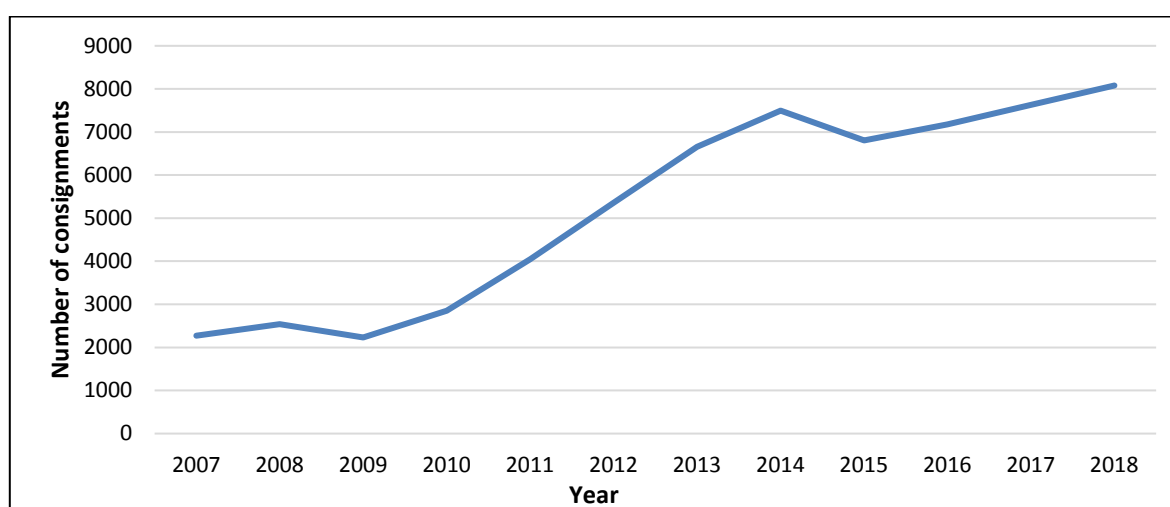
According to Rabobank's World Floriculture Map (van Rijswijk 2016), the source of cut flowers and foliage in the market is continuing to change. Traditionally the major market player, the Netherlands' share of global cut flower exports declined from 50 per cent in 2005 to 43 per cent in 2015. Colombia, Kenya, Ecuador and Ethiopia have increased their global market shares, collectively accounting for 25 per cent in 2005 but 44 per cent of the market in 2015. In 2015, the world's five largest cut flower exporting countries were the Netherlands (holding 43 per cent of the market share), Colombia (15 per cent), Kenya (11 per cent), and Ecuador and Ethiopia (9 per cent each). For the same period, the largest importing countries were the USA (17 per cent of the market share), Germany (15 per cent), the United Kingdom (14 per cent), the Netherlands (11 per cent) and the Russian Federation (7 per cent).

The volume of fresh cut flowers and foliage traded globally almost doubled from 2001 to 2015 (van Rijswijk 2016). The cut flower trade is also changing, with key production areas becoming centred away from points of demand. Production has moved from countries that have traditionally been consumers and growers, such as the Netherlands, to relatively new producing countries such as Colombia, Ecuador, Kenya and Ethiopia (International Trade Centre 2018).

### 5.1.2 Consignment numbers

Cut flower and foliage imports to Australia have increased in recent years. In the twelve year period from 2007 to 2018, the number of consignments of cut flowers arriving in Australia increased more than threefold, from 2,271 consignments in 2007 to 8,097 consignments in 2018 (Figure 1).

Figure 1 Number of consignments arriving in Australia per year: 2007 to 2018



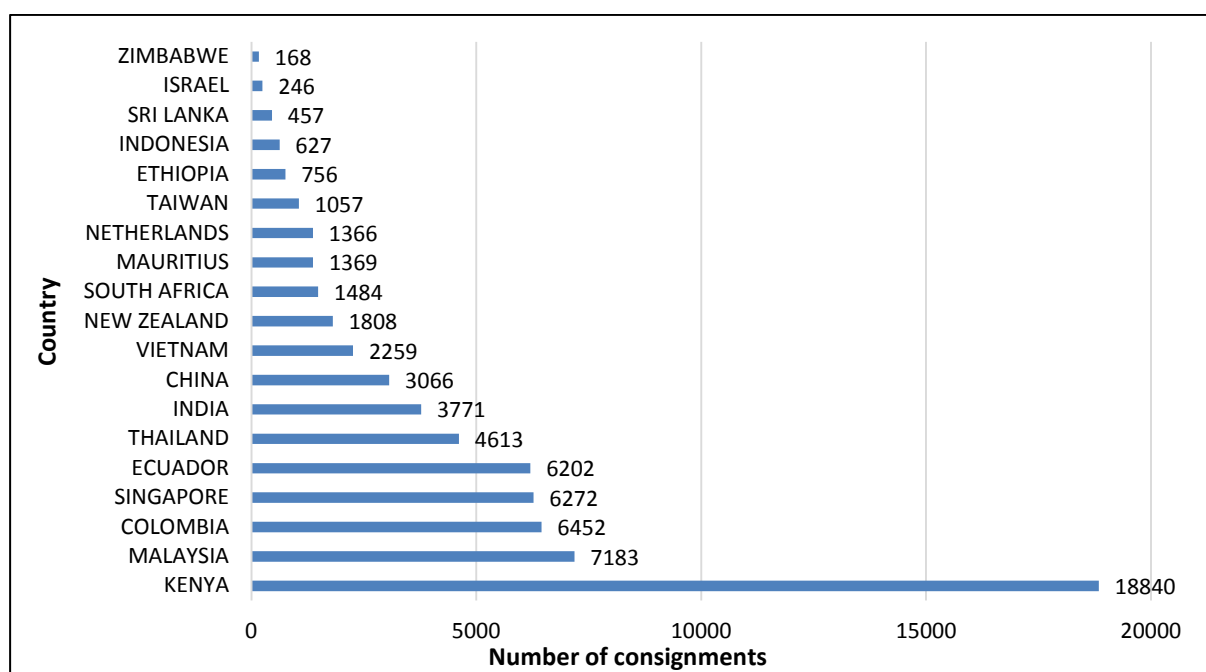
Source: Integrated Cargo System (ICS) data for tariff codes 0603.1 and 0604.2.

### 5.1.3 Countries of origin and consignment numbers

Of the 54 recorded countries of origin of consignments, 19 countries exported more than 150 consignments in total for 2007 to 2018 (Figure 2). These 19 countries are, in order of volume, Kenya, Malaysia, Colombia, Singapore, Ecuador, Thailand, India, China, Vietnam, New Zealand, South Africa, Mauritius, the Netherlands, Taiwan, Ethiopia, Indonesia, Sri Lanka, Israel and Zimbabwe.

Eight countries exported more than 3,000 consignments for the period (Kenya, Malaysia, Colombia, Singapore, Ecuador, Thailand, India, and China), with Kenya being the largest exporter of cut flowers and foliage to Australia. Kenya's exports (18,840 consignments) are more than two times greater than the next largest exporter for that period (Malaysia, with 7,183 consignments).

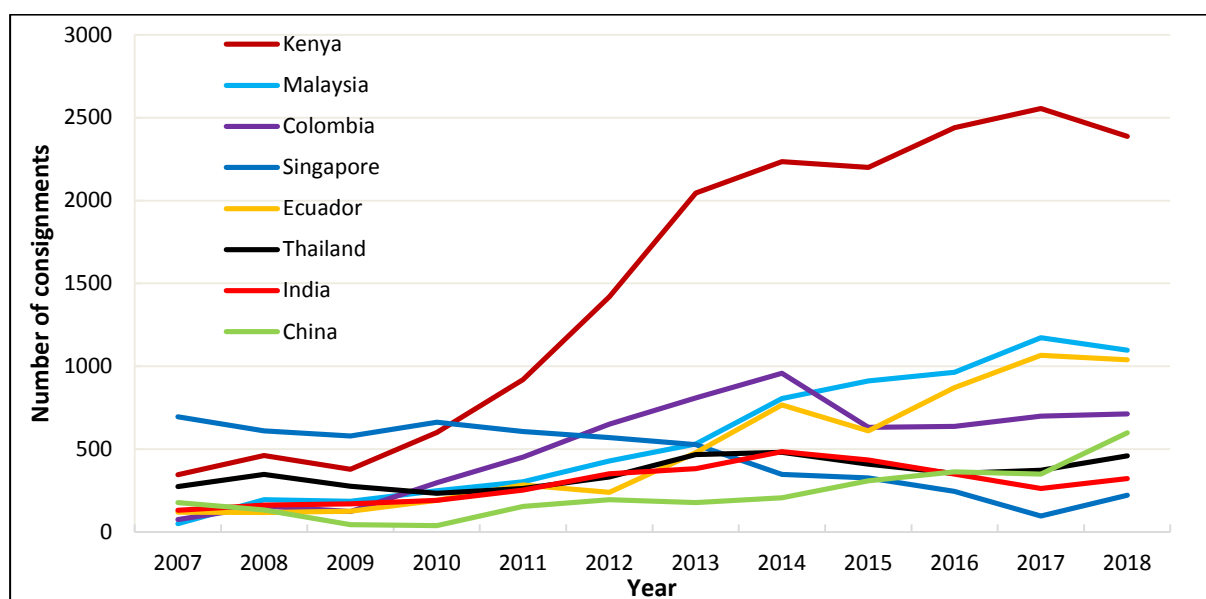
**Figure 2 Countries exporting to Australia by total number of consignments: 2007 to 2018**



Source: Integrated Cargo System (ICS) data for tariff codes 0603.1 and 0604.2.

Numbers of consignments from each country also show trends, both increasing and decreasing, across this period. Figure 3 illustrates these trends for the eight countries with the largest exports to Australia between 2007 and 2018.

**Figure 3 Trend in import quantities for the eight largest exporters to Australia: 2007 to 2018**



Source: Integrated Cargo System (ICS) data for tariff codes 0603.1 and 0604.2.

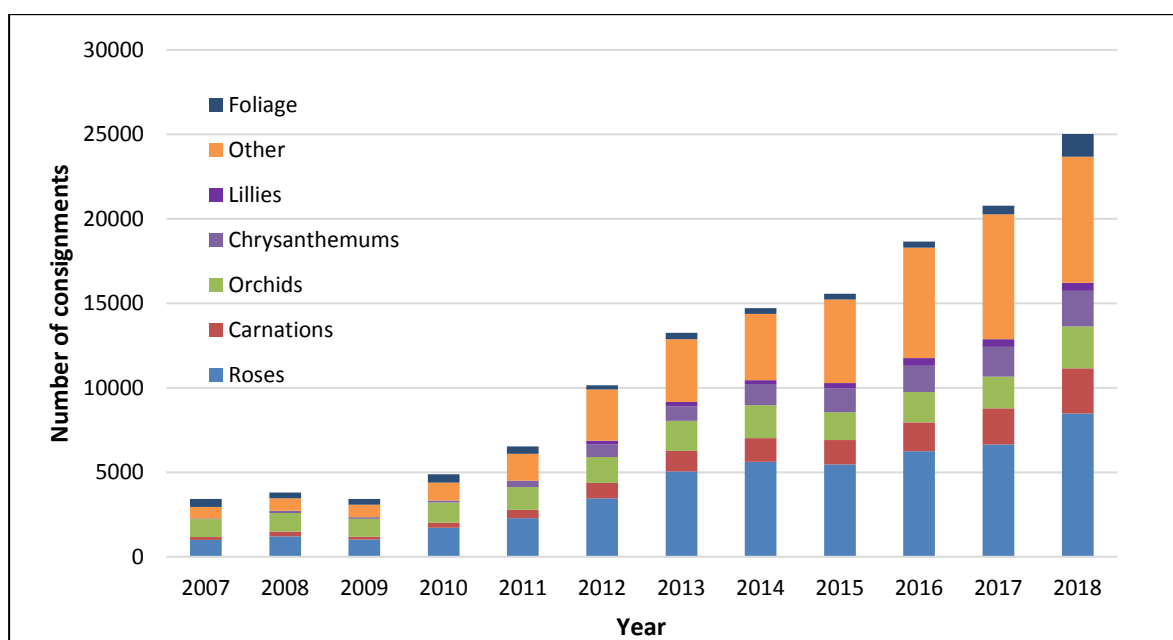


Of these eight countries, imports from Kenya show exceptional growth (from 346 consignments in 2007 to 2,388 consignments in 2018), while those from Singapore have declined (from 695 consignments in 2007 to 222 consignments in 2018). Three other countries have shown strong growth in consignment numbers, namely, Colombia (75 in 2007 to 712 in 2018), Ecuador (119 in 2007 to 1,039 in 2018) and Malaysia (51 in 2007 to 1,097 in 2018).

#### 5.1.4 Flower types imported

Figure 4 illustrates the number of consignments recorded against different tariff codes. Tariff codes are broad descriptions of the associated types of goods, and record the most common flower types (roses, carnations, orchids, chrysanthemums and lilies); all other species are grouped in the tariff code for 'other'.

**Figure 4 Number of consignments recorded against cut flower tariff codes: 2007 to 2018**



**Source:** Integrated Cargo System (ICS) data for tariff codes 0603.1 and 0604.2.

**Note:** A new tariff code for lilies was introduced in 2012. Prior to this lilies would have been recorded as 'other flowers'.

Proportionally, roses are the most frequent consignment recorded against tariff codes (34 per cent of the total), followed by orchids (13 per cent) and carnations (9 per cent). The 'other' flower group contains flowers such as *Gypsophila*, *Anthurium* and *Limonium*, or consignments that are not further identified by flower type. The flower type with the greatest average annual growth rate in imports for this period is chrysanthemums (55 per cent), followed by carnations (33 per cent), roses (24 per cent), and lilies (20 per cent). The 'other flowers' category recorded an increase of 27 per cent for the same period.

## 5.2 Arthropod interceptions by commodity, country and flower type

To determine the most frequently intercepted pest groups associated with pre-1 March 2018 consignments of cut flowers and foliage, the department analysed its interception data. Of the more than 38,000 records of live arthropods intercepted in association with cut flower imports for the period 1 January 2000 to 28 February 2018, 37 per cent were identified to species level. This rate of species-level identification reflects factors such as it often not being possible to provide a species-level identification if the life stage and/or sex of the organism being examined

cannot be fully determined, or if the sample is in poor condition. In addition, given the significant volume of trade in cut flowers and the quarantine pest containment risk associated with some pest groups, it is often not feasible to rear sufficient numbers of specimens to adult stages so as to allow identification. In instances where species-level identification has not been possible, phytosanitary action was taken because a live pest was either exotic to Australia, or could not be identified to a taxonomic level sufficient to exclude the possibility of it being a quarantine pest.

Despite these data constraints, the analysis of importation data for arrivals of cut flowers into Australia and of historic interception rates has highlighted important considerations of relevance to regulating the biosecurity risk that this pathway poses.

### 5.2.1 Historic top ten exporting countries and proportions of arthropod interceptions

Cut flowers are imported in large quantities and are the commodity arriving in Australia with the most arthropod interceptions—between the years 2000 and 2017 approximately 23 per cent of all interceptions of arthropods at the Australian border were on cut flowers and foliage. Flowers exported from different countries have different interception rates. Table 5.1 shows the top 10 countries exporting to Australia (by number of consignments shipped) and the number of instances of live arthropods intercepted, prior to the revised import conditions being implemented on 1 March 2018. These figures do not record non-compliance.

**Table 5.1 Top ten exporting countries and number of live arthropod interceptions: 2007 to 2017**

Exporting country	2007 to 2017		2017 only	
	Number of consignments	Interception rate	Number of consignments	Interception rate
Kenya	15,602	40%	2,555	82%
Malaysia	5,797	8%	1,172	18%
Colombia	5,493	21%	699	78%
Singapore (a)	5,265	4%	97	5%
Ecuador	4,871	19%	1,066	47%
Thailand	3,813	10%	373	24%
India	3,174	23%	262	81%
China	2,150	26%	349	81%
Vietnam	1,886	22%	309	54%
New Zealand	1,657	5%	162	15%
The Netherlands (b)	1,008	34%	243	52%
<b>Total</b>	<b>49,708</b>	<b>24%</b>	<b>7,190</b>	<b>59%</b>

**Source:** Integrated Cargo System (ICS) data for tariff codes 0603.1 and 0604.2 and departmental interception data.

**Note:** (a). Singapore is in the top ten countries by number of consignments for 2007–2017 but not in 2017. (b.) The Netherlands was not a top ten country by number of consignments in 2007–2017.

Imported consignments from some countries have had notably higher historic interception rates of live arthropod pests than have other countries. Compared to the 2007–2017 average, interception rates for the 2017 calendar year show increases in the percentage interception rates for all countries. Multiple factors may have contributed to this increase, including a change in the types of flowers in each consignment, as well as an increase in the number of specimens being submitted for identification and therefore recorded in the department's systems. It is important to note that interception rates recorded in earlier years could have been understated,

as post-2015 the department had a heightened appreciation of the associated risk after release of the Interim Inspector-General of Biosecurity's report on cut flower imports (Section 4.1.6). Accordingly, the 2017 average figures are likely to be a more accurate indication of the approach rate of live arthropods from these sources, and are also relevant in estimating the likelihood that arthropod pests will be associated with this import pathway.

## 5.2.2 Flower type and proportion of interceptions

Different flower types also appear to be correlated with different proportions of interceptions (Table 5.2). In analysing high level tariff code data, roses had the highest proportion of interceptions (45 per cent), while interceptions on lilies were the lowest (2 per cent).

**Table 5.2 Proportion of different flower types with interceptions: 2007 to 2017**

<b>Flower type</b>	Roses	Other flowers	Orchids	Chrysanthemums	Carnations	Foliage	Lilies (a)
<b>Interception rate</b>	45%	28%	20%	16%	13%	10%	2%

**Source:** Tariff code data from the Integrated Cargo System (ICS) and departmental interceptions data.

**Note:** (a). A new tariff code for lilies was introduced in 2012. Prior to this date lilies were recorded as 'other flowers'.

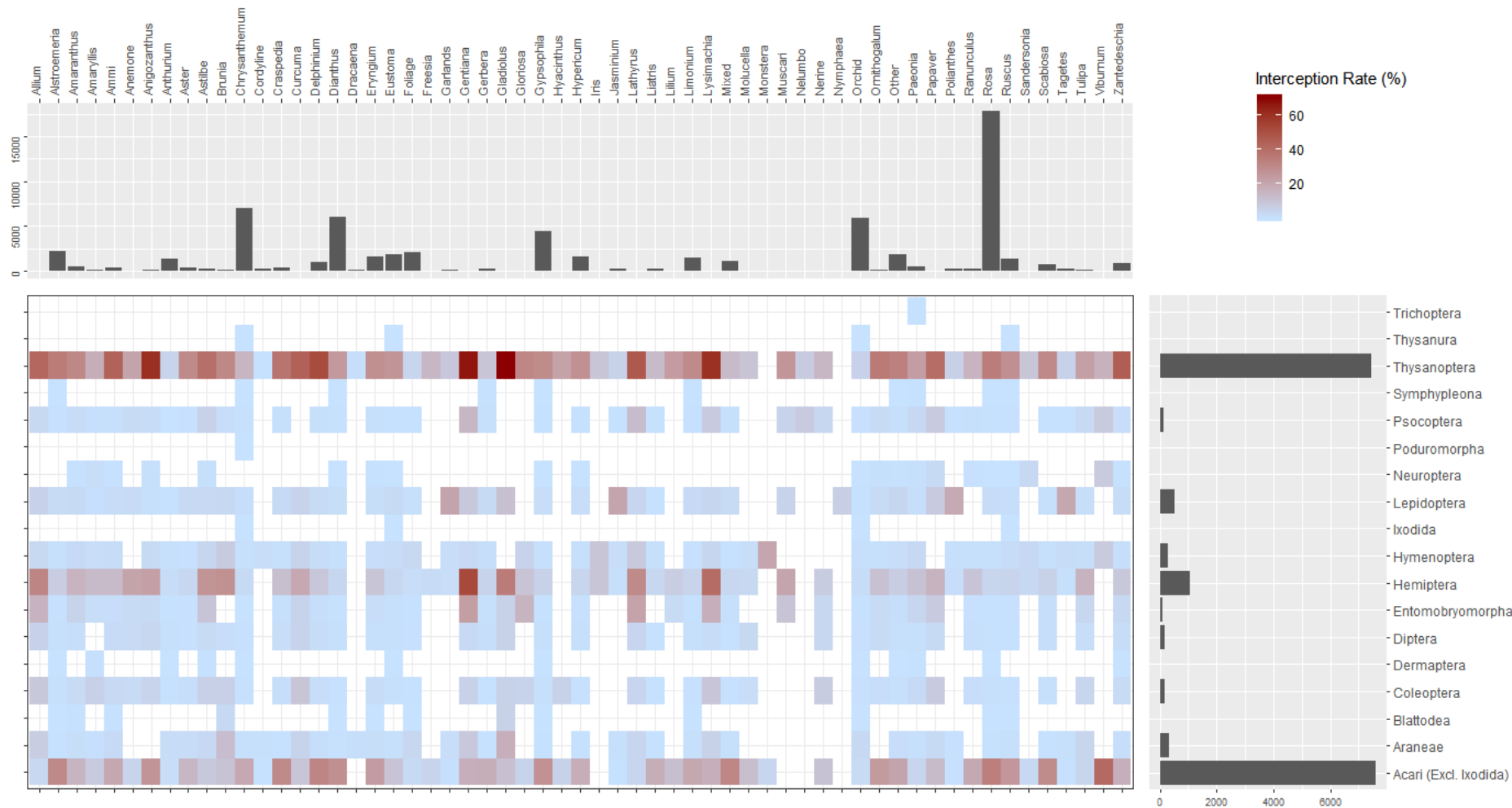
A more detailed breakdown of interceptions by major flower and foliage type was also conducted. The department's analysis used ICS and departmental interception data representing the five year time period from 1 January 2015 to 28 February 2019 for the top 19 countries (as mentioned in Section 5.1.3) exporting cut flowers and foliage to Australia. Data were prepared by standardising the goods description field in ICS for each consignment, or for each line of each consignment where more than one type of goods were recorded per consignment.

Figure 5 presents the percentage interception rate of arthropods grouped by taxonomic Order on specific flower and foliage types on the basis of at least one interception being detected during on-arrival clearance procedures. The figure also presents the total unique count of each flower or foliage type arriving, where more than 10 consignments of that type were recorded for the time period. The total unique arthropod detections at the Order level are also presented—that is, where at least one interception of that pest Order occurred, as distinct from the absolute count of pest load per consignment.

The heatmap analysis in Figure 5 shows that the thrips (Thysanoptera), mites (Trobidiiformes, Sarcoptiformes and Mesostigmata) and true bugs (Hemiptera, which include the aphids (Aphididae)) have the highest percentage unique interception rates (darker red) of all arthropod groups. This correlates with the analysis presented in Section 5.3 of the types of arthropods historically intercepted on the cut flower and foliage pathway.

The analysis also shows that mites, aphids and thrips have been widely intercepted on the majority of the different flower and foliage types being exported to Australia. Exceptions appear in some of the foliage types, such as *Monstera* and *Draceana*, and waterlilies (*Nymphaea*) and lotus (*Nelumbo*). In particular, thrips have been intercepted at higher percentages (depicted as darker red) on all types of goods apart from two (*Monstera* and *Nymphaea*), and with lower interceptions on *Cordyline* and *Draceana*. As foliage is often combined in mixed consignments with cut flowers, this evidence supports the department's approach in grouping all flower and foliage types for the purpose of this PRA.

Figure 5 Heatmap of arthropod interceptions recorded against cut flower/foilage type and arthropod group



**Source:** Tariff code data from the Integrated Cargo System (ICS) and departmental interceptions data for the period 1 January 2015 to 28 February 2019.

**Note:** The upper bar graph shows the unique count of consignments of goods by flower or foliage type. 'Mixed' denotes consignments that contained more than one flower and/or foliage type, 'Foliage' denotes where no further descriptor for foliage type was recorded, and 'Other' denotes where the content of the consignment could not be determined from ICS data. The right hand bar graph shows the total number of unique occurrences of arthropod Order, with Thysanoptera being thrips, and Hemiptera being the true bugs, including aphids. The reference to Acari relates to all mites, excluding the Ixodida (ticks) which are separately listed. The heatmap shows the percentage interception rate of consignments by flower/foilage type on the basis of at least one interception.

### 5.3 Types of arthropods historically intercepted

An analysis of arthropod interceptions for the period 1 January 2000 to 28 February 2018 (Table 5.3) found that of a total of over 38,000 interception events, insects were the dominant Class of arthropods recorded, being 69 per cent of all interceptions on the cut flower and foliage pathway. Arthropods of the Class Arachnida (spiders, scorpions and mites) were the next most commonly found, comprising 30 per cent of total interceptions.

**Table 5.3 Arthropod interceptions (identified to Class, Order and Subclass)**

Class	Proportion of all interception events (a)
Insecta (insects)	69%
Arachnida (spiders, scorpions and mites)	30%
Collembola (springtails)	1%
Chilopoda (centipedes)	Less than 0.01%
Diplopoda (millipedes)	Less than 0.01%

**Note:** (a). Calculated on the basis of interception events recorded over 18 years (1 January 2000 to 28 February 2018).

Table 5.4 provides a breakdown of the three most frequently intercepted groups of arthropods on cut flowers and foliage—mites, thrips and true bugs—and gives further analysis of prominent sub-taxa within these groups.

**Table 5.4 Taxonomic breakdown of the intercepted mites, thrips and true bugs**

Taxa	Proportion of all interception events (a)
<b>Class Arachnida</b>	30%
Subclass Acari (mites and ticks)	25%
<b>Class Insecta</b>	69%
Order Thysanoptera (thrips)	43%
Family Thripidae	39%
Family Phlaeothripidae	3%
Family Aeolothripidae	Less than 1%
Not identified to family	1%
Order Hemiptera (true bugs) <b>(b)</b>	12%
Family Aphididae (aphids)	7%
Family Anthocoridae (flower bugs)	1%
Family Pseudococcidae (mealybugs)	1%
Family Miridae (mirid bugs)	1%
Family Aleyrodidae (white flies)	Less than 0.5%
Family Lygaeidae (seed bugs)	Less than 0.5%
Family Orsillidae	Less than 0.5%
Family Cicadellidae (leafhoppers)	Less than 0.5%

**Note:** Percentages have been rounded and do not total 100 per cent. (a). Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018). (b). A number of other hemipteran families were intercepted, but form less than 0.1 per cent of total interceptions each and are not represented in this table. These are detailed in Appendix D Table VI.

The data summarised in Table 5.4 identifies particular sub-taxa that were most frequently intercepted. Of all interceptions, 25 per cent of the total arthropod interceptions were from the Subclass Acari (mites and ticks). Appendix D Table I contains a further breakdown of the

interceptions of Class Arachnida by sub-taxa, showing the proportions of these taxa being intercepted as a proportion of all interception events.

Of the insect interceptions, two Orders were most frequently intercepted —Thysanoptera (thrips) and Hemiptera (true bugs), making up 43 per cent and 12 per cent of the total respectively (Table 5.4). Appendix D Table V contains a further breakdown of interceptions of Class Insecta by Order, showing the insect Orders being intercepted as a proportion of all interception events. Appendix D also provides more detailed information on the proportions of Hemiptera and Thysanoptera interceptions respectively—by family, genus and species.

## **5.4 Non-compliance with revised import conditions, post 1 March 2018**

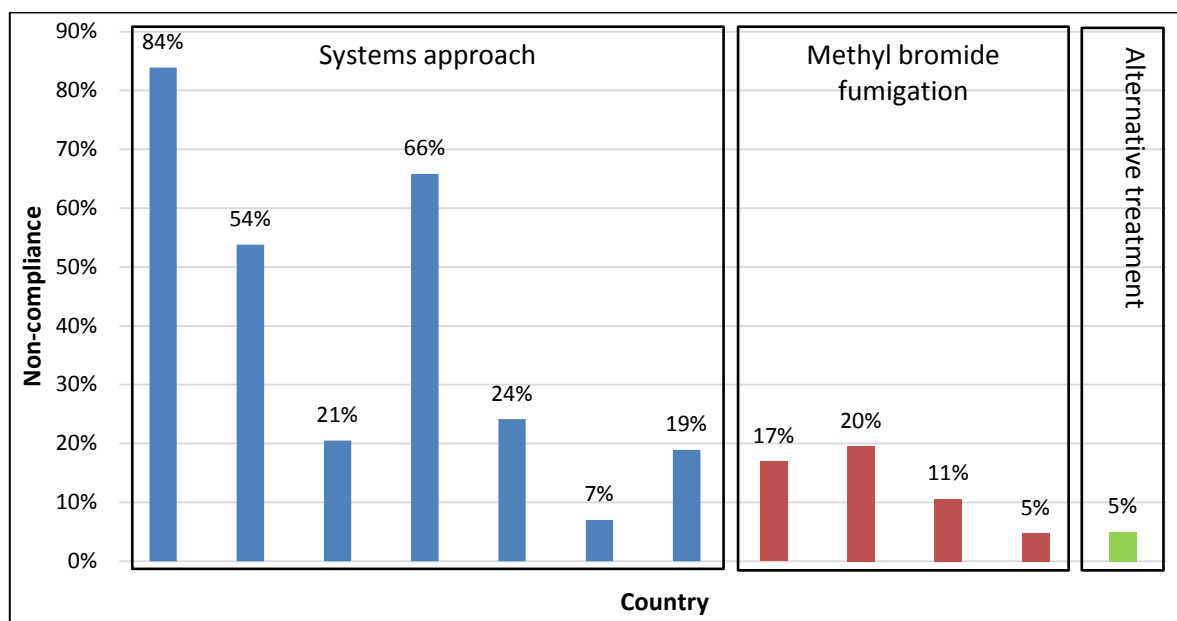
Since the implementation of the revised import conditions, between March 2018 and 30 April 2019, approximately 50 per cent of consignments were subject to remedial onshore fumigation due the presence of arthropod pests of biosecurity concern. The majority of these pests were mites (41 per cent), thrips (39 per cent), and aphids (5 per cent).

The department has continued to conduct verification and inspection processes on arriving consignments of cut flowers and foliage, and has reported instances of non-compliance to countries and to Australian importers. The following section is an analysis of the department's records of non-compliance with import conditions. The data presented in this section have been aggregated, and individual country non-compliance has been de-identified due to the trade sensitivities associated with the implementation period of the revised import conditions, and because the department is continuing to work with countries to improve their compliance rates.

### **5.4.1 Revised import conditions and compliance**

Since 1 March 2018, import conditions have specified that countries must use one of three arthropod pest management options for exporting cut flowers and foliage to Australia: an NPPO-approved systems approach, pre-export methyl bromide fumigation, or an NPPO-approved alternative pre-export disinfestation treatment.

To compare non-compliance rates for the different treatments, Figure 6 presents data for the period 1 March 2018 to 30 April 2019, and shows the average percentage rate of non-compliance of consignments arriving from 12 countries. The majority of countries are certifying exports to Australia under the systems approach or pre-export methyl bromide fumigation options. Only one country has consistently used the alternative disinfestation treatment option over the period.

**Figure 6 Consignment non-compliance by import measure: March 2018 to April 2019**

**Source:** Departmental interception data.

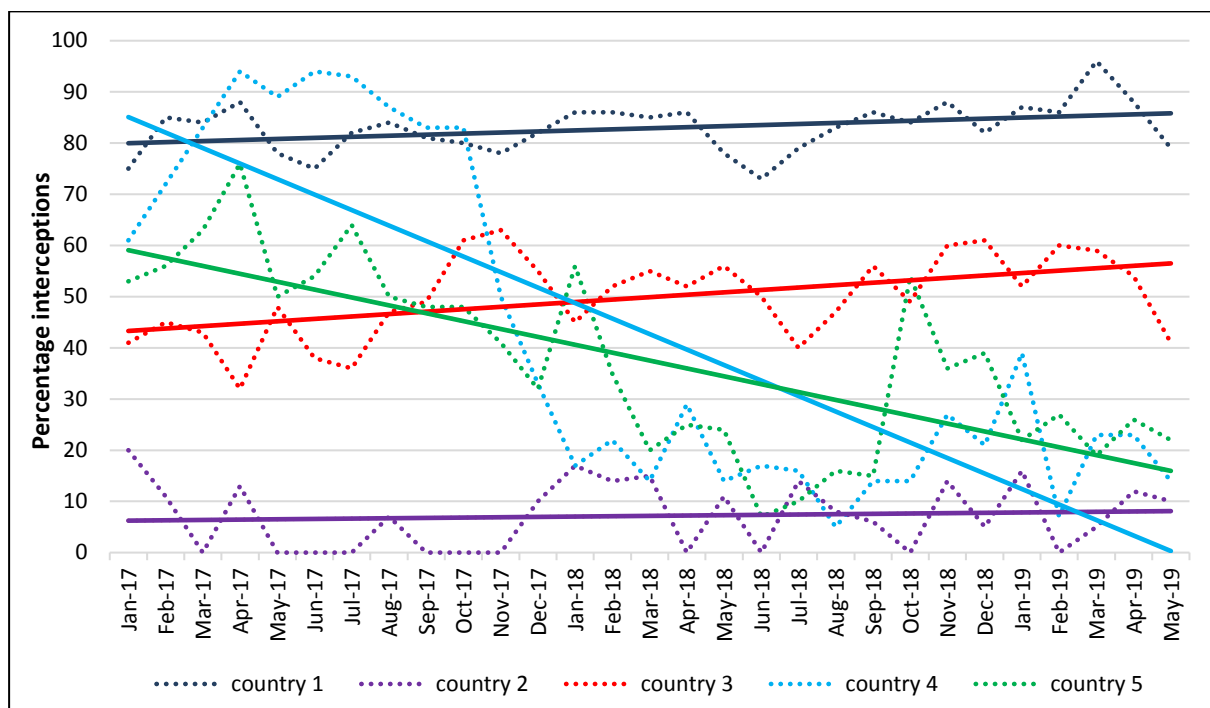
**Note:** Each bar represents one country.

These data show that the revised import conditions have been effective in reducing the arriving live quarantine pest rate in some circumstances and for some countries. Some countries have greater success using the systems approach option than others, but the pre-export methyl bromide fumigation option is giving the best overall results. All arriving consignments are subject to the border procedures described in Section 2.3.1, and if live arthropods of biosecurity concern are detected, the consignment is fumigated (where appropriate) prior to release, or exported or destroyed. The data in Figure 6 also shows that the three measures proposed, if implemented correctly, can reduce the approach rate of those pests.

The compliance rates that countries have been able to achieve can change from month to month, but this data also shows trends over time. Figure 7 presents monthly data for five representative countries. Data prior to March 2018 represents the percentage of consignments recorded with live arthropod interceptions. Data after March 2018 represents the percentage of consignments that were non-compliant due to live arthropod interceptions. The dotted lines represent actual percentage rates, and the solid line is the trend in that data over time.

Overall, these data show the variability of monthly results from different countries. Some countries have not shown improvement over time, continuing to record high interception rates (country 1 and country 3). Other countries have had good compliance that has continued, with an occasional peak that could be seasonal (country 2). Importantly, some countries have been able to improve over time (country 4 and country 5).

Figure 7 Consignment non-compliance by month: January 2017 to May 2019



**Source:** Departmental interception data.

**Note:** Each colour represents one country. The dotted line is the actual percentage rate for that month, and the solid line is the trend in that country's data over time.

Since March 2018, country 1, 2, 3 and 5 have all been using the systems approach measure, whereas country 4 has used the pre-export methyl bromide measure. In the case of countries 4 and 5, these data also confirm that it is possible to improve compliance rates, reducing the arriving live quarantine pest rate.

The actions being taken by the department in response to continued high levels of non-compliance are discussed in Section 7.1.1.

## 5.5 Conclusion

The patterns of global cut flower and foliage trade as they relate to Australia have changed. In the recent past changes have encompassed a combination of increased import volumes, different countries of origin, and a high arrival rate of live arthropods in Australia. All of these factors contribute to a change in biosecurity risk associated with this importation pathway, and have led to the department's decision to revise import conditions and conduct this PRA. Analysis of departmental interception data confirms the association of arthropods with the cut flower and foliage pathway, and also identifies the three groups of arthropods most frequently intercepted on cut flowers and foliage as being mites, thrips and true bugs.

The analysis of interception data after 1 March 2018 is also important, because it shows that the revised import conditions are having their intended effect in some instances, that is, reducing the arrival rate of live quarantine pests on this pathway.



## 6 Pest risk assessment

This chapter identifies and assesses the pests of biosecurity concern to Australia that are associated with commercially produced imports of cut flowers and foliage from all sources, and, as previously noted, this first part of the PRA focuses on the most frequently intercepted arthropods—mites, aphids and thrips.

Information on the biology of these groups is presented, and the results of the department's analysis of interceptions on the cut flower and foliage pathway is discussed. An analysis of the risk ratings assigned to those quarantine pests assessed in previous departmental policies is also presented. A pest risk assessment has been conducted in accordance with ISPM 11: *Pest Risk Analysis for Quarantine Pests* (FAO 2016d), to determine the quarantine pests associated with the pathway and estimate the level of unrestricted risk they pose.

### 6.1 Biology of mites, aphids and thrips

#### 6.1.1 Subclass Acari (mites)

Mites form 25 per cent of all arthropod interceptions on the imported cut flower and foliage pathway (Table 5.4). Over 50,000 species of mites have been described and it is estimated that a million or more species may exist. The most recent and widely accepted system of acarine classification is presented in *A Manual of Acarology* (Krantz & Walter 2009). This source recognises about 500 families of Acari.

Interception analysis identified 46 species of mites on the cut flower and foliage pathway from 24 genera (Appendix D Table IV). Of these, 18 species are quarantine pests for Australia. It is conceivable that more species of mites are on this pathway, as 57 individual genera were recorded from interceptions (Table I), indicating that 33 additional genera were represented where specimens were not identified to species level.

#### Biology

The biology of mites is extremely diverse, with mites being found in nearly every environment on the planet, and living and feeding in nearly every imaginable niche, including as predators, parasites and herbivores (Krantz & Walter 2009). However, only a few families of mites contain species that feed on plants, and even fewer of these species are known as plant pests. In addition, a number of species are used as BCAs, either as predators of other organisms, or as herbivorous agents for weeds.

The most frequently intercepted families of mites on the imported cut flower and foliage pathway, in order of the number of interceptions, are the Tetranychidae, Phytoseiidae, Parasitidae, Acaridae and Tydeidae (Appendix D Table II). The most frequently intercepted genera are *Tetranychus*, *Neoseiulus*, *Phytoseiulus*, *Tyrophagus* and *Parasitus*. The most frequently intercepted species in these taxa are present in Australia (for example, *Tetranychus urticae*, *Neoseiulus californicus* and *Phytoseiulus persimilis*), and are non-quarantine pests for Australia (Appendix D Table IV). However, there are a number of species closely related to these that are quarantine pests for Australia, as they have the potential to cause economic consequences. The diversity of mite biology means that the cut flower and foliage pathway is a suitable environment for numerous different taxa of mites with different life strategies. This diversity also means that there are multiple possible dispersal mechanisms for these organisms, including

their own ability to disperse (Walter & Proctor 2013). Passive dispersal by means of air currents is a common strategy for some taxa of mites (Krantz & Walter 2009). Mites can also be dispersed with human assistance, such as with movement of nursery stock or other commodities, attaching on clothing and farm machinery, or by hitchhiking on insects, birds and animals (Learmonth 2018).

By way of example, the Tetranychidae, members of which are commonly known as spider mites, forms the largest proportion of interceptions on the imported cut flower and foliage pathway—being 16.9 per cent of all arthropod interception events over the 18 year period from 1 January 2000 to 28 February 2018. The family has 65 recorded species in Australia and over 1,300 worldwide (ABRS 2009; Migeon & Dorkeld 2017), and is probably the most important of the mite taxa that attack plants (Krantz & Walter 2009).

Spider mites get their common name from their ability to produce silk strands/webbing. The silk webbing allows spider mites to construct shelters from predators and weather, to manipulate their environment to create favourable microclimates, to aid dispersal by ballooning (Clotuche et al. 2011) and to serve as a 'lifeline' to stay attached to a host plant if they are momentarily dislodged (Tehri 2014).

Members of this family have modified mouthparts which form a stylet. Feeding is done by stabbing individual plant cells with the stylet and sucking out the cell contents (Walter & Proctor 2013). This mode of feeding can lead to necrosis of tissue and to leaf drop. Because spider mites can build up to large numbers quickly (a generation time is about 1-2 weeks), they are capable of killing their host plants (Walter & Proctor 2013). Many spider mite pests have a broad host range, so are capable of readily finding new hosts. *Tetranychus piercei* has a recorded host range of over 88 host plants, including major horticultural crops such as beans, capsicum, corn and tomato (NAPPO 2014). The species is recorded as an important economic pest for a number of crop types (CABI 2018a).

The most frequently intercepted species of spider mite on the imported cut flower and foliage pathway is *T. urticae*, which is a non-quarantine pest for Australia, and intercepted on average between 10 and 50 times per year (Appendix D Table IV).

Another life history strategy, predation on other species, is seen in the family Phytoseiidae. These mites are commonly arboreal predators, but some members feed on pollen, nectar, honeydew, and fungi (Walter & Proctor 2013). Members of the Phytoseiidae have been used extensively as BCAs, especially against thrips, Tetranychidae members and other pest mites (Gerson, Smiley & Ochoa 2003). To support dispersal activities, predatory mites require only to find a suitable environment with prey species available.

Within this family, mites in the genus *Neoseiulus* are commonly used BCAs, and one of these, *N. californicus*, is intercepted with a yearly average of between 10 and 50 events per year (Appendix D Table IV). *N. californicus* is not a quarantine pest for Australia, but two other species intercepted in this genus, *N. bicaudus* and *N. longisiphonulus*, are quarantine pests for Australia. As discussed in Section 3.1.3 and Appendix B, BCAs are subject to additional requirements before they can be released into the Australian environment—including a separate risk analysis undertaken by the department.

### 6.1.2 Order Hemiptera: Aphididae (Aphids)

The family Aphididae (aphids) has about 4,000 species placed by various authors in about 23-24 subfamilies. Aphid species are most numerous in temperate regions and comparatively rare in tropical climates (Stadler & Dixon 2005). Aphids constitute a major global plant pest group, causing serious economic damage to many food and commodity crops in most parts of the world (van Emden & Harrington 2017).

Interception analysis identified 41 species of aphids from 23 genera on the cut flower and foliage pathway (Appendix D Table VIII). Of these, 12 species are quarantine pests for Australia. Table VII lists a total of 24 genera identified from interceptions, indicating that two additional genera were intercepted for which specimens were not identified to species level.

#### Biology

Aphids are soft-bodied and slow-moving, and relatively defenceless as individuals (Berenbaum 1996). However, the ability to very rapidly reach high population densities and to transmit diseases has made aphids significant pests of many crop plants worldwide (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009).

One common and key adaptation of aphid species is to maximise their reproductive rates, through adoption of a complex life cycle which includes sexual and asexual reproductive phases. Aphids characteristically have several parthenogenetic generations during summer, a single sexual generation in autumn, and overwinter as eggs.

Aphids may be dispersed by animals, machinery, aircraft and humans. Depending on the climate and weather patterns, winged aphids may travel hundreds of kilometres (van Emden & Harrington 2017). Depending on the season, some aphids will produce offspring with wings, and disperse to other host plants, and host plants may vary seasonally.

Aphids feed on the sugar-rich but nitrogen-poor plant phloem, and excrete large quantities of honeydew, a sugary waste fluid (Stadler & Dixon 2005). The honeydew secreted by aphids can promote the growth of sooty mould fungi which can affect the quality of the host crop (DPIRD 2018). Some aphid species also have well-documented mutualisms with ants, in which the ants tend, protect and assist dispersal, in order to have access to the honeydew (Stadler & Dixon 2005). Another consequence of feeding on the abundantly available phloem, and being small and soft-bodied, is that aphids are able to survive for only relatively short periods without food (Stadler & Dixon 2005). However, some aphids species can restrict their growth when food is limited or the quality is diminished (Blackman & Eastop 2000). In these circumstances, winged morphs can be produced, to facilitate movement to other host plants (van Emden & Harrington 2017).

Aphids that are known pests of agricultural crops usually have a wide range of plant hosts (Blackman & Eastop 2000). Economic damage caused by aphid infestations can vary, and the following examples are given to illustrate economic damage caused by the feeding of four species that are quarantine pests for Australia. *Diuraphis noxia* can reduce growth and yields in crops such as wheat, barley, triticale, oats, rye and many species of cool season grasses (CABI 2018a). *Diuraphis noxia* (sexual form) is a quarantine pest for Australia because only the asexual, form is present, and only in limited regions of Australia.

*Diuraphis noxia* rarely reproduces sexually outside of its natural range (Puterka et al. 2012), which is central Asia, the Middle East and southern Russia (Yazdani et al. 2017). Invasive populations of *Diuraphis noxia* outside of this range usually reproduce asexually, the females giving birth to live nymphs (Perry & Kimber 2016). The asexual form of the pest is found in various countries throughout Africa, Asia, North America, South America, Europe (CABI 2018b). The asexual form is also found in Australia, but has limited distribution (South Australia, New South Wales, Victoria and Tasmania—see further information in Appendix F). Recent research has identified that the *Diuraphis noxia* present in Australia is a single biotype (named RWAau1) (Watt 2017). The sexual form and/or other biotypes may cause additional damage to cereal crops if they were to establish in Australia.

*Aphis fabae* (black bean aphid) affects agricultural crops such as *Allium*, asparagus, capsicum and lupins, roses, cotton and soybean. *Aphis fabae* damage can vary from wilted leaves, stunted plant growth, and loss in seed yield to plant death under heavy infestation, with younger plants being most vulnerable (CABI 2018a). *Acyrtosiphon gossypii* can reduce yields in cotton plants by up to forty percent (Khamraev & Davenport 2004). *Toxoptera odinae* (mango aphid) infestations can result in symptoms such as wilting of the stem and leaves, sooty mould damage and folded leaves on crops such as mangoes, rhododendrons and coffee (Plantwise 2018).

Aphids are the most common vectors of plant viruses (Ng & Perry 2004). Their success as vectors is contributed to by (i) polyphagy—feeding on and spreading viruses to a wide range of plant hosts, (ii) the ability to undergo parthenogenetic reproduction—facilitating rapid population growth, and (iii) possession of a needle-like stylet capable of piercing plant cell walls and delivering viruses into a host cell (Ng & Perry 2004). An important characteristic of aphid feeding behaviour is that aphids ‘probe’ new hosts to taste the tissues to determine if the host is suitable, before piercing the phloem to start feeding (Mukhopadhyay 2017). This probing action can pick up non-persistent and persistent plant viruses within seconds, and these viruses can be immediately transmitted if the aphid subsequently moves to another plant (Howell, Wick & Hazzard 2013). These actions and behaviours are of critical importance to the spread and transmission of aphid-vectored plant viruses.

Aphids are recorded as transmitting at least 33 genera of plant pathogenic viruses (King et al. 2012). *Myzus persicae*, a non-quarantine pest and present in Australia, has been found to transmit over 100 different plant viruses (Harris, Smith & Duffus 2001). Some aphid-transmitted viruses have devastating effects on their host plants. For example, *M. persicae* and at least 14 other aphid species are vectors of ‘sharka’ or *Plum pox virus* (PPV), a disease of great economic importance to the stone fruit industry which is rated a top 40 national priority plant pest for Australia (DAWR 2018; Douglas 2000).

Some quarantine pest viruses are capable of being transmitted by aphids in a persistent mode. Under these conditions, the virus is retained in the aphid for its entire life, even persisting through moults. Therefore, an aphid living on a particular plant may be carrying viruses from other plants that it acquired earlier in its life. These persistently transmitted viruses include several serious exotic pathogens of legumes such as *Pea enation mosaic virus*, *Chickpea chlorotic stunt virus* and *Faba bean necrotic stunt virus* (Abraham et al. 2006; Ortiz et al. 2006; Skaf & de Zoeten 2000). In these examples many of the aphids that vector these viruses are already found in Australia, and are often intercepted on the cut flower pathway. These include *M. persicae*, *Aphis craccivora* and *A. gossypii*.

*Macrosiphum euphorbiae* and *M. persicae* were the most frequently intercepted aphid species, at a yearly average for *M. euphorbiae* of between 10 and 50 times, and *M. persicae* between 5 and 10 times (Appendix D Table VIII). Both of these species are non-quarantine pests for Australia, but both are capable of transmitting plant viruses that are not present in Australia, such as *Plum pox virus*.

It is important to also note that BCAs are often used against pest aphids in horticultural systems, and that some hymenopterans (wasps) exclusively parasitise aphids (Stary 1969). Parasitised aphids can be difficult to recognise until the parasitising wasps have matured and left the aphid's body. There is the possibility that these parasitoid species might not be present in Australia, and therefore could pose a potential biosecurity risk.

### 6.1.3 Order Thysanoptera (Thrips)

Interception analysis conducted for this PRA identified that 81 species of thrips from 28 genera were on the cut flower and foliage pathway (Appendix D Table XI). Of these, 54 species are quarantine pests for Australia, and/or are regulated articles for Australia. Table X lists a total of 37 genera identified from interceptions, indicating that nine additional genera were identified for which specimens were not identified to species level. In addition, only 57 per cent of all the thrips intercepted were identified to species level (Appendix D).

For readability and completeness, this document replicates some content that was previously published in the *Group pest risk analysis for thrips and orthospoviruses on fresh fruit, vegetable, cut-flower and foliage imports* (Group Thrips PRA) (Australian Government Department of Agriculture and Water Resources 2017). Key content that is reproduced in this document includes material relating to the biology of thrips, the pest categorisation of thrips (Chapters 2 and 3 of that document), and relevant components of the methodology (Appendix A of that document).

The Group Thrips PRA considered the biosecurity risk posed by all plant-feeding thrips that may be associated with commercial consignments of those products. In addition, that group policy assessed the emerging risks posed by all members of the virus genus *Orthospovirus* that are transmitted by some thrips (Australian Government Department of Agriculture and Water Resources 2017). The Group PRA approach was developed by the department to improve the effectiveness and consistency of the PRA process by considering the biosecurity risk posed by groups of pests that share common biological characteristics across numerous import pathways.

The Group Thrips PRA determined that thrips and the orthospoviruses they transmit can cause considerable economic consequences across a wide range of fruit, vegetable, legume and ornamental crops by reducing yield, quality and marketability (Australian Government Department of Agriculture and Water Resources 2017).

Key thrips pests of biosecurity concern to Australia were analysed. These are the phytophagous (that is, plant-feeding) thrips in the Thripidae and Phlaeothripidae families. Within these families, at least 79 thrips species were confirmed as quarantine pests for Australia. The PRA also analysed departmental interceptions data and presented this information for the fresh plant pathway (including cut flowers and foliage, but excluding nursery stock).

An important consideration of the Group Thrips PRA (in Section 7.6, p. 135 of that document) is that a number of thrips species, including some that are quarantine pests and three species

(*Frankliniella schultzei*, *Scirtothrips dorsalis* and *Thrips tabaci*) that are not quarantine pests, are known to naturally transmit orthotospoviruses that are of biosecurity concern to Australia. As a result, these thrips species are ‘regulated articles’, which are defined by the IPPC (FAO 2016b) as ‘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’.

## Biology

The Order Thysanoptera includes more than 6,000 described thrips species (ThripsWiki 2017), which possess a diverse range of feeding strategies—herbivores, fungivores and predators. Thrips are small, slender insects that are a few millimetres long. Adults of most species have band-like, delicately-fringed wings with long cilia, from which the name Thysanoptera is derived (Lewis 1997).

Reproduction of most thrips species requires mating. However, females are able to lay both fertilised and unfertilised eggs, with fertilised eggs producing females and unfertilised eggs producing males (Moritz 1997). Sexual and asexual populations can also exist for some species, such as *Thrips tabaci* (Moritz 1997). Additionally, some species only reproduce parthenogenetically.

Thrips lay between 30 and 300 eggs depending on the identity of the species and the quality of food available (Lewis 1997). Their life cycle usually takes between 10 and 30 days, depending largely on environmental temperature. A maximum of 12 to 15 generations per year is feasible under optimal conditions, but this reduces considerably to one or two generations in cooler regions. Thrips can overwinter as larvae in soil or as adults among dead plant litter, tree bark or crop debris (Lewis 1997).

Some thrips are known to transmit viruses, and the Group Thrips PRA provides information on the thrips species known to exhibit this biological characteristic, as well as on the viruses that are known to be transmitted. These include members of the virus genus *Orthotospovirus*, which have been demonstrated to cause substantial economic impacts across an extensive range of crops. The PRA also identified viruses in the genera *Ilarvirus*, *Carmovirus*, *Sobemovirus* and *Machlomovirus* known to be transmitted by thrips (Jones 2005).

## Scoping assessment

The Group Thrips PRA contains a scoping assessment of all thrips families (Chapter 2 of that document); this assessment reviewed the biological characteristics of all thrips families and eliminated from further consideration thrips families (or sub-groups within these families) that are not phytophagous and therefore unlikely to have the potential to (i) be on the plant import pathway and/or (ii) cause economic (including environmental) consequences. It also took into account Australian and international interception records for thrips on the plant import pathway, and excluded from pest categorisation assessment those species that were intercepted with an average frequency of less than 0.5 events per year.

The outcome of the scoping assessment excluded from further consideration the families Aeolothripidae, Fauriellidae, Heterothripidae, Melanthripidae, Merothripidae, fungivorous and predatory Phlaeothripidae, Stenurothripidae, obligate predatory Thripidae and Uzelothripidae. Those taxa were considered unlikely to be associated with the plant import

pathway, except occasionally as contaminants, and/or unlikely to have potential economic consequences for Australia. This finding is reproduced in this PRA, as the analysis of thrips families that have been intercepted on the cut flower and foliage pathway (Appendix D Table IX) found that of all the excluded families, only thrips in the family Aeolothripidae were intercepted. The three intercepted Aeolothripidae species (*Aeolothrips fasciatus*, *Desmothrips propinquus* and *Rhipidothrips brunneus*) were each intercepted at a yearly average of less than 0.5 instances (Table XI).

Only members of the phytophagous Thripidae and the phytophagous Phlaeothripidae were considered further in the Group Thrips PRA, and these were assessed as having the potential to be quarantine pests for Australia, and as a result requiring further consideration. Pest categorisations are replicated in this PRA, and are referenced in Appendix F of this document.

The Group Thrips PRA categorised species of the phytophagous Thripidae and Phlaeothripidae that are quarantine pests for Australia according to criteria related to biosecurity importance. The outcome of the PRA was that the species identified as quarantine pests were all estimated to have an indicative unrestricted risk estimate of 'Low', which does not achieve the ALOP for Australia, and therefore to require risk management measures.

The information on the biological characteristics of the Thripidae and Phlaeothripidae is summarised below.

### Thripidae

Most members of the Thripidae feed on flowers or leaves, with members of the two largest genera *Thrips* (275 spp.) and *Frankliniella* (175 spp.) able to exploit both (Mound 1997). These two genera contain most of the significant pest taxa within the Thysanoptera (Mound 1997). Many Thripidae feed only on grasses, with *Chirothrips* and *Limothrips* species feeding mainly on florets, and *Aptinothrips* and *Stechaetothrips* species feeding mainly on leaves (Mound 1997). A small number of Thripidae, such as species of the genus *Scolothrips*, are obligate predators of mites (Mound & Tree 2012).

There is a large body of scientific evidence indicating that many members of the Thripidae are plant pests of economic consequence, and this PRA's analysis of interception data found that large numbers have also been identified on the cut flower and foliage import pathway. The Thripidae form 39 per cent of all arthropods intercepted over the 18 year period from 1 January 2000 to 28 February 2018 (Table 5.4 and Appendix D Table IX).

Interception analysis conducted for this PRA identified 66 species from 22 genera of Thripidae on the cut flower and foliage pathway. *Frankliniella occidentalis*, *Thrips tabaci* and *F. schultzei* were the most frequently intercepted species, at yearly average ranges of greater than 250, between 100 and 250, and between 10 and 50 instances respectively (Appendix D Table XI). All three of these species are present in Australia, but *F. occidentalis* is under official control in the Northern Territory and therefore is a regional quarantine pest for Australia. All three species are also known to transmit orthotospoviruses; as such, *F. occidentalis*, *T. tabaci* and *F. schultzei* are considered to be regulated articles for Australia.

## Phlaeothripidae

The family Phlaeothripidae displays three separate feeding behaviours, with members being fungivorous, predatory or phytophagous. Only a small proportion of the known Phlaeothripidae species are considered to be pests of economic consequence (Lewis 1997; Mound & Morris 2007). For this reason, the Group Thrips PRA excluded a large number of genera in this family, and determined that only those with phytophagous member species with assessed potential economic consequences would be considered further. Those genera are *Haplothrips*, *Liothrips*, *Pseudophilothrips* and *Gynaikothrips*.

When this criterion is used to identify thrips associated with the cut flowers and foliage pathway, and with potential economic consequences, the three intercepted genera of biosecurity concern are *Haplothrips*, *Liothrips* and *Gynaikothrips* (Appendix D Table X). Of these, Table XI lists one *Gynaikothrips* interception identified to species level (*Gynaikothrips ficorum*), eight species of *Haplothrips* intercepted at a yearly average range of less than 0.5 instances, and a ninth *Haplothrips* species, *Haplothrips gowdeyi*, that was intercepted at a yearly average range of between 10 and 50 instances. No *Liothrips* species were identified to species level in the data analysed for this PRA, although this taxon was identified at the genus level (Table X).

Thrips from the genus *Haplothrips* feed mainly on pollen, while those from the large genus *Liothrips* feed mainly on leaves (Mound 1997; Mound, Paris & Fisher 2009). About 300 thrips species are able to form galls on their host plants, and most of these species are found within the *Liothrips* genus (Crespi, Carmean & Chapman 1997).

*Haplothrips* are generally not considered to be important plant pests, however, some are known to live on weeds associated with crops (Mound 1997). Examples of plant pest *Haplothrips* species that are absent from Australia include *H. aculeatus*, *H. chinensis*, *H. tritici* and *H. ganglbaueri* (ThripsWiki 2017), with the former three species reported as being abundant on cereal crops (Mound 1997).

Leaf-feeding *Liothrips* can be serious pests, but are generally associated with a single plant host species (Mound 2005). Particular species of *Liothrips* are known to damage several horticulturally-important crops including pepper vines (*L. piperinus*, *L. karynyi*), wasabi (*L. wasabiae*) and greenhouse-grown *Liliacaea* (*L. vaneckei*, present in Australia) (Mound 1997; Mound & Morris 2007).

## 6.2 Risk ratings assigned in previous pest risk assessments

The department has previously undertaken PRAs on five of the mite species, two of the aphid species and all of the thrips species considered in this PRA. The outcomes of previous assessments provide indicative unrestricted risk estimates and therefore indicate whether the species are likely to require phytosanitary measures to manage the associated risks in order to achieve ALOP for Australia. These assessments are summarised in Table 6.1.



**Table 6.1 Summary of risk ratings assigned in previous pest risk assessments**

Pest name	Policy (commodity and origin)	Likelihood of			Establishment	Spread	EES	Consequences	URE
		Entry							
		Importation	Distribution	Overall					
<b>Mites</b>									
<i>Brevipalpus chilensis</i>	Grapes (Chile)	High	Low	<b>Low</b>	High	Moderate	Low	Moderate	<b>Low</b>
<i>Lorryia formosa</i>	Sweet Orange (Italy)	High	Low	<b>Low</b>	High	Moderate	Low	Low	<b>Very low</b>
<i>Tetranychus kanzawai</i>	Grapes (China)	High	Moderate	<b>Moderate</b>	High	Moderate	Low	Moderate	<b>Low</b>
	Grapes (Japan)	High	Moderate	<b>Moderate</b>	High	Moderate	Low	Moderate	<b>Low</b>
	Grapes (Korea)	Moderate	Moderate	<b>Low</b>	High	Moderate	Low	Moderate	<b>Low</b>
	Strawberries (Korea)	Moderate	Moderate	<b>Low</b>	High	Moderate	Low	Moderate	<b>Low</b>
<i>Tetranychus piercei</i>	Banana (Philippines)	High	High	<b>High</b>	High	High	High	Low	<b>Low</b>
<i>Tetranychus</i> spp.	Mangosteen (Indonesia)	High	Moderate	<b>Moderate</b>	High	Moderate	Low	Moderate	<b>Low</b>
<b>Aphids</b>									
<i>Aphis fabae</i>	Truss Tomato (Netherlands)	Low	Moderate	<b>Low</b>	Moderate	High	Low	Moderate	<b>Low</b>
<i>Toxoptera odinae</i>	Mango (Taiwan)	Low	Low	<b>Very low</b>	High	High	Very low	Low	<b>Negligible</b>
<b>Thrips</b>									
Thrips spp.	Groups Thrips PRA (plant import pathway)	High*	Moderate*	<b>Moderate</b>	High	High	Moderate	Low	<b>Low</b>
Orthospoviruses	Groups Thrips PRA (plant import pathway)	Moderate*	Moderate*	<b>Low</b>	Moderate	High	Low	Moderate	<b>Low</b>

**EES:** Overall likelihood of entry, establishment and spread. **URE:** Unrestricted risk estimate. This is expressed in an ascending scale from negligible to extreme. \* Indicative rating.

## 6.3 Pest risk assessment

This section assesses the likelihood of entry (importation and distribution), establishment and spread, and estimates the economic, including environmental, consequences that the quarantine pests identified in the pest categorisation process may cause if they were to enter, establish and spread in Australia. The methodology used for this assessment is consistent with the methodology used for the Group Thrips PRA, with some modification, and is presented in Appendix E of this document.

In conducting this pest risk assessment, some general considerations have been taken into account. With the exception of the thrips, all the risk assessments summarised in Table 6.1 were conducted for commodities on the fresh fruit pathway. It is likely that many of the aphid and mite species identified in Appendix F have a higher likelihood of entry on the cut flower and foliage pathway than the fresh fruit pathway, for two reasons. Firstly, as many cut flowers (such as roses) consist of complex arrays of petals that form good cryptic cover, which differs from the smooth surface of many fruits on which pests can be more readily detected during inspection. Secondly, a number of these species are already proven to be on the pathway, and sometimes in high numbers, as shown in the departmental interception data presented in Appendix D. These high rates of pest entry will then increase the likelihood that these pests may be successfully distributed to suitable hosts in Australia.

The likelihood of establishment and of spread of an identified pest in the Pest Risk Analysis (PRA) area (defined as all of Australia) is largely unrelated to the commodity/country pathway through which the pest is imported into Australia, as these likelihoods relate specifically to events that occur in the PRA area. The consequences associated with the continuing presence of a pest are also independent of the importation pathway.

Despite these considerations, all the previous risk assessments determined that the unrestricted risk estimates for the listed *Tetranychus* species and the genus were **Low**, and as such, would not meet Australia's ALOP without application of one or more phytosanitary measures.

The same considerations of higher than previously recorded likelihood of importation are relevant to the two aphid assessments for *Aphis fabae* and *Toxoptera odinae* (Table 6.1). Departmental interception data show that these species were intercepted with a yearly average of between 1 and 5 instances, and less than 0.5 instances respectively (Appendix D Table VIII). Only 34 per cent of aphids intercepted were identified to species level. In the context of the current analysis, it is reasonable to conclude that higher numbers of aphid species of biosecurity concern to Australia have been arriving than are recorded as interceptions on the cut flower and foliage pathway.

The biosecurity risk posed by thrips, and the orthotospoviruses they transmit, from all countries was previously assessed in the Group Thrips PRA. The Group Thrips PRA has been adopted in this PRA.

### 6.3.1 Mites

All mites on the fresh cut flowers and foliage pathway are considered here to share common biological characteristics (small size, cryptic behaviour and non-specific host range), such that their ratings for entry, establishment, spread and consequences on this pathway are considered to be similar.

There are a wide range of mite species of biosecurity concern found on fresh cut flowers and foliage and in many cases this commodity represents the primary entry pathway for these mites. Tetranychid mites are the most frequently intercepted families of mites (Appendix D, Table II) on the imported cut flower and foliage pathway. Internal departmental analysis has determined that 93 per cent of all interceptions of tetranychid mites are on cut flowers and foliage, with only a small number of these species being recorded on imported fresh fruits and vegetables. Two species relevant to this PRA have been previously assessed, *Tetranychus kanzawai* and *T. piercei*, and the genus *Tetranychus* has also been assessed (Table 6.2). Previous pest risk assessments rated mites with a 'Moderate' or 'High' likelihood of entry on fresh fruit.

In summary, many pest species of mites feed and live on flowers and foliage at all stages of their life cycle and therefore have a high degree of association with fresh cut flowers and foliage. The harvesting and processing of flowers does not remove all mites from the commodity. The department's interception records of mites is consistent with this assessment. Therefore, this information supports an importation likelihood rating for mites of '**High**' on this pathway.

Decorative bunches of flowers and foliage are displayed inside buildings, but also outdoors (for example, funerals and weddings), and dead flowers can be disposed of in household compost (as discussed in Section 3.1.1). Cut flowers and foliage are a perishable commodity, and deterioration is likely to cause some mite mortality before they are able to reach a host. Mites are capable of spreading from plant to plant, and some mite species can balloon in wind currents using silken threads, but these circumstances are reliant on wind currents being present.

The polyphagous nature of the plant-feeding species increases the likelihood of them finding a susceptible host in Australia. The predatory species are also likely to be able to find new environments with prey species, as many of these predators are adaptable to a range of environments and prey items. A distribution rating of '**Moderate**' for mites is supported on this pathway, and aligns with ratings assigned in previous risk assessments for these species, which were predominantly between 'Low' to 'Moderate'.

The overall likelihood of entry is determined by combining the likelihood of importation with the likelihood of distribution (Appendix E Table XIII). The likelihood that mites will enter Australia as a result of trade in the commodity and be distributed in a viable state to a susceptible host is assessed as **Moderate**.

Australia's climate is similar to the climate in many of the source countries of mites on this pathway, and there have already been establishments of exotic species of mites in Australia. Many pest species of mites have a broad host range, and this increases the likelihood of them finding and establishing on a suitable host plant in Australia. Previous assessments have all considered mite establishment to be 'High'. This information supports an establishment likelihood rating of '**High**'.

Apart from their own ability to disperse, such as ballooning in wind currents, mites have other dispersal mechanisms, including human assistance with movement of nursery stock and other commodities, attaching on clothing and farm machinery, or by hitchhiking on insects, birds and animals. Tetranychid mites, for example, are known to disperse by aerial ballooning, increasing their likelihood of spread. Imported cut flowers and foliage arrive in major Australian capital cities, are distributed to florists and flower sellers throughout Australia, and are further distributed to buyers. This increases the potential for long distance dispersal of mites with the

commodity. Previous pest risk assessments predominantly rated mites with a 'Moderate' likelihood of spread once they had entered Australia. However, the information presented in this chapter indicates that mites not only can disperse by their own ability including using wind currents, but also can be assisted by other means such as movement with the commodity. This supports a spread likelihood rating of **'High'**.

The overall likelihood of entry, establishment and spread is determined by combining the likelihoods of entry, of establishment and of spread using the matrix of rules shown in Appendix E, Table XIII. The overall likelihood for the entry, establishment and spread of mites on this pathway in Australia is estimated to be **'Moderate'**.

Plant-feeding mite species are known to cause economic consequences. Some species are recorded as important economic pests of a broad range of crop plants and cause severe damage to these plants. Predatory mite species are potentially capable of causing damage to the Australian environment, by feeding on native arthropods and disrupting complex ecosystems. The introduction of exotic pest species of mites to Australia increases the likelihood of trade implications for Australia. The six of the eight previous PRAs rated mites with 'Moderate' economic consequences, and the remaining two PRAs rated mites with 'Low' economic consequences. The information provided in this chapter supports a consequences rating range of **'Low'** to **'Moderate'** on this pathway.

Unrestricted risk is the result of combining the likelihoods of entry, establishment and spread with the outcomes of the overall consequences. Likelihoods and consequences are combined using the risk estimation matrix (Appendix E, Table XVI) and the outcomes are summarised in Table 6.2.

The unrestricted risk estimate for exotic mites on fresh cut flowers and foliage arriving in Australia has been assessed as **'Low' to 'Moderate'**. A **'Low' to 'Moderate'** rating does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for these pests on fresh cut flowers and foliage arriving in Australia.

## Aphids

All aphids on the fresh cut flowers and foliage pathway are considered here to share common biological characteristics (feeding on plant phloem, complex life cycle of sexual and asexual reproductive phases that maximises reproduction rates and wide host range) such that their ratings for entry, establishment, spread and consequences on this pathway are considered to be similar.

Aphids feed on the phloem of living plant material, and are frequently found on the fresh cut flower and foliage pathway. For example, aphids were the third most frequently intercepted group of arthropods on this pathway on arrival in Australia, being 7 per cent of all arthropods intercepted (Table 5.4). Departmental analysis has determined that the largest proportion of aphid interceptions, 57 per cent, are on cut flowers and foliage, compared with 18 per cent recorded on imported fresh fruits and vegetables. Two species of aphids relevant to this PRA have been previously assessed, *Aphis fabae* and *Toxoptera odinae* (Table 6.1), and both were assessed as having a likelihood of importation on fresh fruit (truss tomato and mango) of 'Low'.

In summary, many pest species of aphids feed and live on flowers and foliage at all stages in their life cycle and therefore have a high degree of association with fresh cut flowers and foliage. The harvesting and processing of flowers does not remove all aphids from the commodity, and the nature of the commodity (flowers and foliage) provides good cryptic cover for pests such as aphids. The department's interception records of aphids is consistent with this assessment. Therefore, an importation likelihood rating for aphids of **'High'** is supported on this pathway.

As discussed above for mites, decorative bunches of flowers and foliage are displayed inside buildings, but also outdoors (for example, funerals and weddings), and dead flowers can be disposed of in household compost systems (as discussed in Section 3.1.1). Cut flowers and foliage are a perishable commodity, and deterioration is likely to cause some aphid mortality before they are able to reach a host. Aphids are capable of spreading from plant to plant, and winged aphid morphs can form as a result of food stress, and are capable of moving larger distances through wind dispersal. The polyphagous nature of many of the aphid species increases the likelihood of them finding a susceptible part of a host in Australia, although aphids are only able to survive for short periods without food. This information supports a distribution likelihood rating of **'Moderate'** for aphids on this pathway. Distribution ratings for aphids in previous risk assessments were 'Low' to 'Moderate'.

The overall likelihood of entry is determined by combining the likelihood of importation with the likelihood of distribution (Appendix E, Table XIII). The likelihood that aphids will enter Australia as a result of trade in the commodity and be distributed in a viable state to a susceptible host is assessed as **Moderate**.

Australia's climate is similar to the climate in many of the source countries of aphids on this pathway, and there have already been establishments of exotic species of aphids in Australia. Many pest species of aphids have a broad host range, including common and widespread plant species used in horticulture, and this increases the likelihood of them finding a suitable host plant in Australia. Some aphid species are capable of parthenogenetic reproduction, increasing the likelihood that they can reproduce and therefore establish. Previous assessments have considered aphid establishment to be 'Moderate' or 'High'. The information provided in this chapter supports an establishment likelihood rating of **'High'**.

As discussed above for mites, imported cut flowers and foliage arrive in major Australian capital cities, are distributed to florists and flower sellers throughout Australia and are further distributed to buyers. This increases the potential for aphids to move with the commodity. Winged aphids are known to disperse by wind currents, increasing their likelihood of spread. Previous pest risk assessments predominantly rated aphids with a 'High' likelihood of spread once they had entered Australia. A spread likelihood rating of **'High'** is supported.

The overall likelihood of entry, establishment and spread is determined by combining the likelihoods of entry, of establishment and of spread using the matrix of rules shown in Appendix E, Table XIII. The overall likelihood for the entry, establishment and spread of aphids on this pathway in Australia is estimated to be **'Moderate'**.

Aphids are known to cause economic consequences. Some species are recorded as important economic pests of a broad range of crop plants and to cause yield reduction and damage to these plants. Aphids are also capable of transmitting a large number of plant viruses, some of which may be exotic to Australia. Previous pest risk assessments rated aphids with 'Moderate' or 'Low'

economic consequences. Given the range of quarantine pest aphid species identified on imported cut flowers and foliage, a consequences rating range of **‘Low’** to **‘Moderate’** is supported.

Unrestricted risk is the result of combining the likelihoods of entry, establishment and spread with the outcomes of the overall consequences. Likelihoods and consequences are combined using the risk estimation matrix (Appendix E, Table XVI) and the outcomes are summarised in Table 6.2.

The unrestricted risk estimate for aphids on fresh cut flowers and foliage arriving in Australia has been assessed as **‘Low’** to **‘Moderate’**, and does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for these pests on fresh cut flowers and foliage arriving in Australia.

There is a level of uncertainty about whether arriving aphid species may be transmitting viruses and, if so, which viruses they potentially are transmitting. However, there is the potential that aphids arriving in Australia on fresh cut flowers and foliage could transmit exotic plant viruses to other host plants. Available evidence is limited, therefore all aphid species, regardless of whether they are already present in Australia, are considered as potential regulated articles.

## Thrips

The Group Thrips PRA summarised the previous risk assessments for thrips (in Appendix B of that document), then determined risk ratings for all thrips and orthospoviruses on the plant import pathway, including for cut flowers and foliage (see Table 6.1 of this document). That policy concluded that the indicative unrestricted risk estimates for thrips and the orthospoviruses they can transmit was Low in both instances. Indicative ratings were given for the likelihood of entry (importation and distribution), as these likelihoods can be influenced by a range of pathway-specific factors such as the identity of the commodity, seasonal considerations, or the incidence of pests in specific export production areas.

This PRA verifies that for the fresh cut flowers and foliage pathway, the likelihood of importation of thrips is **‘High’** and the likelihood of distribution of thrips in **‘Moderate’**. The department’s interception records of thrips on this pathway are consistent with this assessment.

In contrast, the risk factors considered in the likelihoods of establishment and spread, and the consequences for a pest are not pathway-specific, and are therefore comparable across all plant import pathways within the scope of the Group Thrips PRA. This is because at these stages of the risk analysis the pest is assumed to have already found a host within Australia at or beyond its point of entry.

The unrestricted risk estimate for quarantine thrips on fresh cut flowers and foliage arriving in Australia has been assessed as **‘Low’**, and does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for these pests on fresh cut flowers and foliage arriving in Australia.

Three species, *Frankliniella schultzei*, *Scirtothrips dorsalis* and *Thrips tabaci* are not quarantine pests, but they are capable of harbouring and spreading (transmitting) emerging orthospoviruses that are quarantine pests for Australia. Consequently, these thrips are assessed as regulated articles (defined in Section 6.1.3). The unrestricted risk estimate for

quarantine orthotospoviruses transmitted by regulated thrips is '**Low**' which does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for regulated thrips on fresh cut flowers and foliage arriving in Australia to mitigate the risk posed by emerging quarantine orthotospoviruses.

**Table 6.2 Summary of unrestricted risk estimates for mites, aphids and thrips on the fresh cut flower and foliage pathway**

Pest name	Likelihood of			Establishment	Spread	EES	Consequences	URE
	Entry							
	Importation	Distribution	Overall					
<b>Mites [Acari]</b>	High	Moderate	<b>Moderate</b>	High	High	Moderate	Low to Moderate	<b>Low to Moderate</b>
<b>Aphids [Hemiptera: Aphididae]</b>	High	Moderate	<b>Moderate</b>	High	High	Moderate	Low to Moderate	<b>Low to Moderate</b>
<b>Thrips [Thysanoptera]</b>								
Thrips spp.	High	Moderate	<b>Moderate</b>	High	High	Moderate	Low	<b>Low</b>
Orthotospoviruses	Moderate	Moderate	<b>Low</b>	Moderate	High	Low	Moderate	<b>Low</b>

**EES:** Overall likelihood of entry, establishment and spread. **URE:** Unrestricted risk estimate. This is expressed in an ascending scale from Negligible to Extreme (see Table XV).



## 6.4 Conclusion

The pest categorisation for all species of mites, aphids and thrips known to occur on the imported commercial cut flower and foliage pathway is presented in Appendix F. The 259 species were identified from sources including departmental interception data, information provided by a number of exporting country NPPOs, and risk analyses conducted by the department and other NPPOs.

A total of 47 mites, 21 aphids and 84 thrips are identified as quarantine pests and/or regulated articles for Australia. A further 32 aphids were identified as potential regulated articles. The unrestricted risk estimate for the mite species is '**Low**' to '**Moderate**'. The unrestricted risk estimate for the thrips species is '**Low**' which does not achieve the ALOP for Australia. The unrestricted risk estimate for the aphid species is '**Low**' to '**Moderate**' which also does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for these arthropods on fresh cut flowers and foliage arriving in Australia to mitigate the risk.

A short-form list of all species identified in this PRA is provided in Appendix G, along with their identified quarantine and/or regulated status.

## 7 Pest risk management

This chapter provides information on the management of mites, aphids and thrips identified as arriving on imported commercially produced fresh cut flowers and foliage and having an unrestricted risk estimate that does not achieve the ALOP for Australia. Risk management measures are required to reduce the risks posed by these pests to an acceptable level for Australia. Those risk management measures are described in this chapter, and information is provided on potential alternative measures for consideration on a case-by-case basis. This chapter also assesses whether the revised import conditions implemented on 1 March 2018 appropriately manage the biosecurity risks identified in Chapter 6 so as to achieve the ALOP for Australia.

### 7.1 Pest risk management measures and phytosanitary procedures

Pest risk management evaluates and selects options for measures to reduce the risk of entry, establishment or spread and associated consequences of quarantine pests and regulated articles where they have been assessed as having an unrestricted risk level that does not achieve the ALOP for Australia. In calculating the unrestricted risk, existing commercial production practices have been considered, as have post-harvest and packing procedures.

In addition to existing commercial production systems and packing house operations for cut flowers and foliage, and specified border procedures in Australia, specific pest risk management measures, including operational systems, are recommended to achieve the ALOP for Australia.

#### 7.1.1 Pest risk management for quarantine pests

The pest risk analysis identified the quarantine pests listed in Table 6.2 (individual species names are listed in the pest categorisation Table XVII and in the summary list of species Table XIX) with an unrestricted risk estimate that does not achieve the ALOP for Australia. Risk management measures are required to manage the risks posed by these pests. The recommended measures are listed in Table 7.1.

**Table 7.1 Pest risk management measures for quarantine and regulated mites, aphids and thrips of cut flowers and foliage from all countries**

Pest	Common name	Measures
Acari	Mites	<u>Pre-export</u> One of three arthropod pest management options delivered pre-export: 1. NPPO-approved systems approach; or 2. Pre-export methyl bromide fumigation; or 3. NPPO-approved alternative pre-export disinfestation treatment. OR In circumstances of continued high level non-compliance: 4. Import permit. <b>(a)</b> AND Consignment freedom from live quarantine arthropod pests verified by NPPO pre-export visual inspection and remedial action if live pests are found. <b>(b)</b>
Hemiptera: Aphididae	Aphids	
Thysanoptera	Thrips	
		AND <u>On arrival in Australia</u> On-arrival visual inspection to verify that the biosecurity status of consignments of cut flowers and foliage meet Australia's import conditions.

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Consignments released if arthropods are non-quarantine or unregulated, subject to freedom from other contaminants and pathogens.

Consignments subject to remedial treatment if arthropods are identified as quarantine or regulated, or if the consignment does not meet Australia's import conditions. (c)

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**Note:** (a). Countries that have exhibited continued high level non-compliance will be notified by the department that exports are required to be conducted under a valid import permit. (b). Pre-export remedial action (depending on the location of the inspection) may include treatment of the consignment to ensure that the pest is no longer viable or withdrawing the consignment from export to Australia. (c). On-arrival remedial action will constitute treatment of the consignment to ensure that the pest is no longer viable, or disposal or export from Australia.

The risk management measures provided here are based on existing policies for the import of *Phalaenopsis* spp. nursery stock from Taiwan (Biosecurity Australia 2010), *Lilium* spp. cut flowers from Taiwan (DAFF 2013), and those discussed in the Group Thrips PRA (Australian Government Department of Agriculture and Water Resources 2017).

It should also be noted that the risk management measures recommended by the department for mites, aphids and thrips in most other fresh plant products (for example, fruit and vegetables) rely on the verification of pest-freedom by visual inspection and, if applicable, pre-export remedial action (for example, by methyl bromide fumigation). Recent policies where these are specified include measures for:

- mites (the hawthorn spider mite *Amphitetranychus viennensis* [Tetranychidae]) and thrips (*Frankliniella intonsa* and *F. occidentalis*) of quarantine concern on imported Chinese nectarines (Department of Agriculture and Water Resources 2016b) (Table 5.1 on page 101 of that document).
- mites (*Tetranychus kanzawai*) and thrips (black vine thrips *Retithrips syriacus* and grapevine thrips *Rhipiphorothrips cruentatus*) of quarantine concern on imported table grapes from India (Australian Government Department of Agriculture and Water Resources 2016) (Table 5.1 on page 112 of that document).
- mites (*T. kanzawai*) and thrips (bean thrips *Caliothrips fasciatus*, grape thrips *Drepanothrips reuteri*, and western flower thrips *F. occidentalis*) of quarantine concern on imported table grapes from Mexico (Department of Agriculture and Water Resources 2016c) (Table 5.1 on page 56 of that document).
- mites (*Eutetranychus palmatus*, *Oligonychus afrasiaticus* and *O. pratensis*) of quarantine concern on imported fresh dates from Middle East and North Africa region (Department of Agriculture and Water Resources 2019).

Visual inspection alone is not considered to be a feasible measure to verify freedom from these pests in fresh cut flowers and foliage (refer to Section 6.3). Therefore, the department has specified the need for use of measures such as an exporting country's NPPO-approved systems approach, or pre-export methyl bromide fumigation, or an NPPO-approved alternative pre-export disinfestation treatment to reduce the risks associated with quarantine and regulated mites, aphids and thrips to achieve the ALOP for Australia.

A significant difference between the current measures listed in Table 7.1 and the previous import conditions (as discussed in Section 4.2) relates to the location on the import pathway where disinfestation treatments for quarantine pests will occur. Previous policy specified that

consignments required an on-arrival verification inspection followed by onshore treatment on arrival in Australia using methyl bromide fumigation unless exempt under compliance-based fumigation exemption or country-managed accreditation pathways (Section 4.2.1). Irrespective of exemptions, reliance on a single phytosanitary measure, that is onshore fumigation, under the previous policy also created the risk of a single point of failure in controls and an increased risk of pests of concern entering Australia. Information provided in Sections 5.1.2 and 5.2.1 and Appendix D has shown that the previous import conditions presented an unacceptable risk of failure to achieve Australia's ALOP as evidenced by the large numbers of interception events of quarantine arthropods on imported cut flowers and foliage pests arriving on these commodities. Among these recorded quarantine species is a national priority plant pest for Australia (the Russian Wheat Aphid, *Diuraphis noxia*) and the second part of this PRA will assess a number of other national priority pests for Australia (see Section 1.2.1).

Consequently, the revised import conditions implemented on 1 March 2018 specify that disinfestation treatments must be applied pre-export (that is, prior to export to Australia), followed by pre-export inspection and certification of freedom from live quarantine arthropod pests, on-arrival inspection and remedial onshore treatment if live quarantine or regulated pests are detected. The change to pre-export management (systems approach or treatment) is justified by the changing risk profile of this pathway, as evidenced by:

- the increased number of consignments of imported cut flowers and foliage arriving in Australia (as discussed in Section 5.1), which increased the risk of quarantine and regulated pests being associated with this pathway. Other authors have previously identified this factor, as discussed in Section 3.1.
- changes over time in the countries of origin of cut flowers and foliage (discussed in Section 5.1.3); such changes can introduce corresponding changes in the pest and disease status of arriving imports.
- the large proportion of consignments of cut flowers and foliage that have failed on-arrival inspection because of detection of live arthropod pests (Section 5.2.1).

The restricted risk of quarantine pests associated with onshore fumigation does not achieve the ALOP for Australia. This is because of the identified increased risk due to increased volumes of consignments and very high rates of pest interception (both frequency and level of infestation). The department is therefore not proposing onshore treatment measures because of concerns about the entry, establishment and spread of these serious quarantine pests.

This PRA recommends that the measures listed in Table 7.1 (and which are the same as the revised import conditions), when applied, should reduce the likelihood of the risks associated with quarantine mites and aphids, and quarantine and regulated thrips, so as to achieve the ALOP for Australia.

At the time of publishing the Draft PRA, the department's verification processes and monitoring of country's compliance with these import conditions showed incremental improvement in reducing the number of interceptions of live quarantine pests found on the pathway (Section 5.4). The rate of compliance improvement varied depending on the country of origin and the pest risk management measure used. The Draft PRA specified that the department may consider recommending the use of other specific phytosanitary measures as a mechanism to address high rates of non-compliance, if these continued.

Since releasing the Draft PRA in November 2018, the department has continued to verify consignments and monitor compliance with import conditions. In circumstances where non-compliance rates continue to be high, the PRA recommends a specific additional phytosanitary measure—import permits.

Import permits could be introduced as an option to manage non-compliance. For example, if a country had continuing high levels of non-compliance using the systems approach measure, the department may inform the NPPO of that country and Australian importers, that imports can only continue using one of the two other measures (pre-export methyl bromide fumigation or an NPPO-approved alternative disinfestation treatment), or by applying for an import permit.

In circumstances of high non-compliance, import permits will provide the department with greater oversight and assurance that the product arriving in Australia is compliant. Before issuing subsequent import permits, the department will review how effective the import permit conditions were in preventing the arrival of live quarantine pests. The outcomes of this review may include refusal to grant another permit or modification of the importer's supply chain control measures.

Countries could apply to re-instate measures, for example the systems approach, by preparing a detailed submission outlining corrective actions with evidence of their success, which would be assessed by the department. The department may also conduct an audit of the particular phytosanitary system prior to decision about reinstatement.

The department will continue to use verification processes and documentation checks, such as phytosanitary inspection on arrival by biosecurity officers, to provide assurance that Australia's import conditions have been met and that Australia's ALOP has been achieved. In the event that cut flower and foliage consignments are repeatedly non-compliant, the department reserves the right to suspend imports (either all imports, or imports from specific pathways) and conduct an audit of the risk management systems. Imports will recommence only when the department is satisfied that appropriate corrective action has been undertaken.

### **7.1.2 NPPO-approved systems approaches**

Where a systems approach option is chosen, the exporting country's NPPO must have approved and certified the systems approach, and must present the following information on a Phytosanitary Certificate:

- the full scientific name of the cut flowers and foliage (including genus and species, or genus level).
- the declaration '*This consignment was produced and prepared for export by [insert name of approved growers and/or packing houses] under an NPPO approved systems approach and was inspected and found free from live quarantine pests*'.
- the declaration '*The consignment is packaged in pest-proof cartons or containers that eliminates the possibility of entry or egress of insect pests*'.

If live quarantine pests are detected by the pre-export inspection, the exporting country must not issue a phytosanitary certificate, and pre-export remedial action must be taken. Remedial action must include management of the consignment to ensure that the pests are no longer viable, unless the consignment is withdrawn from export to Australia. If the consignment is

treated, the exporting country's NPPO must consider the appropriate additional declarations to add to the Phytosanitary Certificate, as treatment details are required (see Section 7.1.3 and 7.1.4 for details on the information required).

Since the implementation of the revised import conditions on 1 March 2018, the highest rates of non-compliance have been linked to NPPO-approved systems approaches. Australia has detected quarantine pests in more than 50 per cent of consignments from some major exporting countries using systems approaches. Should the department introduce import permits due to ongoing non-compliance, the department will only consider reinstatement of a previous measure through a formal submission by the exporting country's NPPO. Australia's evaluation of an NPPO's submission may include an audit to verify the efficacy of the proposed pest management measures and the NPPO's system for monitoring compliance and effectiveness.

If the species of cut flowers and foliage being exported to Australia are propagatable (as listed on BICON on the *Propagatable species list*), the flowers and/or foliage must be devitalised using glyphosate according to the *Imported cut flowers treatment guide* (Department of Agriculture and Water Resources 2018b) (also available on BICON).

To demonstrate compliance with this requirement, the exporting country's NPPO must present the following additional declaration on the Phytosanitary Certificate:

- *'Devitalisation treatment has been carried out under our supervision at [insert name of accredited treatment facility]. The flower stem has been immersed for 20 minutes in glyphosate solution [insert active ingredient concentration and dosage] to a depth of at least 35 cm/ to within 5 cm of the flower head/ within 15 cm of apex [select the dipping method used]'.*

Additional information on systems approaches is discussed in Section 7.3.1.

### **7.1.3 Pre-export methyl bromide fumigation**

Where the pre-export methyl bromide fumigation option is chosen, the exporting country's NPPO must present the following information on a Phytosanitary Certificate:

- the full scientific name of the cut flowers and foliage (including genus and species, or genus).
- the additional declaration *'The consignment was fumigated with methyl bromide as per the attached fumigation certificate and was inspected and found free from live quarantine pests'.*
- the additional declaration *'The consignment is packaged in pest-proof cartons or containers that eliminates the possibility of entry or egress of insect pests'.*

AND

A methyl bromide fumigation certificate that includes a declaration that the goods have been fumigated at one of the rates specified in Table 7.2.

**Table 7.2 Pre-export methyl bromide fumigation rates for cut flowers and foliage**

Temperature	Minimum initial dose rate	Exposure period
21 °C and above	32 g/m <sup>3</sup>	2 hours
16 °C - 20.9 °C	40 g/m <sup>3</sup>	2 hours
11 °C - 15.9 °C	48 g/m <sup>3</sup>	2 hours
10 °C - 10.9 °C	56 g/m <sup>3</sup>	2 hours

**Note:** Fumigation is not permitted if the ambient minimum temperature falls below 10 °C. To ensure an effective fumigation, it is recommended that 80 per cent of the initial dose rate is retained at the end of the exposure period.

Prior to fumigation, the cut flowers and foliage must not be wrapped or coated in impervious materials that may prevent the fumigant from penetrating the target of the fumigation. Impervious materials including plastic must be opened, cut or removed prior to fumigation to allow the methyl bromide to reach the target of the fumigation.

If the species of cut flowers and foliage being exported to Australia are propagatable (as listed on BICON on the *Propagatable species list*), the flowers and/or foliage must be devitalised using glyphosate according to the *Imported cut flowers treatment guide* (Department of Agriculture and Water Resources 2018) (also available on BICON).

To demonstrate compliance with this requirement, the exporting country's NPPO must present the following additional declaration on the Phytosanitary Certificate:

- '*Devitalisation treatment has been carried out under our supervision at [insert name of accredited treatment facility]. The flower stem has been immersed for 20 minutes in glyphosate solution [insert active ingredient concentration and dosage] to a depth of at least 35 cm/ to within 5 cm of the flower head/ within 15 cm of apex [select the dipping method used]*'.

#### **7.1.4 NPPO-approved alternative pre-export disinfestation treatment**

The department will accept any treatments approved by the NPPO of the exporting country that are applied to kill pests on cut flowers for export to Australia. The department does not need to approve the treatment prior to its use unless the NPPO wishes to apply alternative treatments designed only to achieve pest sterility, for example, irradiation.

The NPPO of the exporting country must:

- approve and certify the treatment on a phytosanitary certificate.
- inspect each treated consignment to verify freedom from live quarantine pests.

The NPPO must present the following information on a Phytosanitary Certificate:

- the full scientific name of the cut flowers and foliage (including genus and species, or genus level).
- details of the disinfestation treatment (for example, identify the active constituent, its effective concentration and the duration for which applied).

- the name of the treatment provider.
- the additional declaration '*The consignment was inspected and found free from live quarantine pests*'.
- the additional declaration '*The consignment is packaged in pest-proof cartons or containers that eliminates the possibility of entry or egress of insect pests*'.

If the species of cut flowers and foliage being exported to Australia are propagatable (as listed on BICON on the *Propagatable species list*), the flowers and/or foliage must be devitalised using glyphosate according to the *Imported cut flowers treatment guide* (Department of Agriculture and Water Resources 2018b) (also available on BICON).

To demonstrate compliance with this requirement, the exporting country's NPPO must present the following additional declaration on the Phytosanitary Certificate:

- '*Devitalisation treatment has been carried out under our supervision at [insert name of accredited treatment facility]. The flower stem has been immersed for 20 minutes in glyphosate solution [insert active ingredient concentration and dosage] to a depth of at least 35 cm/ to within 5 cm of the flower head/ within 15 cm of apex [select the dipping method used]*'.

Additional information on alternative disinfestation treatments is discussed in Section 7.3.2.

### 7.1.5 Import permits

The department may introduce import permits as a measure if an exporting country has non-compliance rates that are unacceptably high. The department will inform each exporting country if import permits will be introduced for that pathway. Once available, import permit applications will be accessible from the department's Biosecurity Import Conditions system (BICON) (available from <https://bicon.agriculture.gov.au/BiconWeb4.0>) and further information is available from the department's website ([agriculture.gov.au/cut-flowers](http://agriculture.gov.au/cut-flowers)).

Before issuing subsequent import permits, the department will review how effective the import permit conditions were in preventing the arrival of live quarantine pests. The outcomes of this review may include refusal to grant another permit or modification of the importer's supply chain control measures.

## 7.2 Operational system for the maintenance and verification of phytosanitary status

A system of operational procedures is necessary to maintain and verify the phytosanitary status of imported cut flowers and foliage. This is to ensure that risk management measures are met and maintained.

### 7.2.1 A system of traceability to source farms

This procedure is necessary where the exporting country has chosen the NPPO-approved systems approach as its arthropod pest management option, and where that systems approach includes on-farm controls. The objectives of this procedure are to ensure that:

- cut flowers are sourced only from farms producing commercial export-quality flowers.



- farms from which cut flowers are sourced can be identified so that any investigation and corrective action can be targeted rather than applied to all contributing export farms, in the event that live pests are intercepted.

The exporting country's NPPO must ensure that cut flowers for export to Australia can be traced back to farm level if the NPPO-approved systems approach includes on-farm controls as part of its pest control measures. The exporting country's NPPO is also responsible for ensuring that exporting cut flower growers are aware of the pests of quarantine concern to Australia, and of the agreed risk management measures.

### **7.2.2 Registration of packing houses and treatment providers and auditing of procedures**

The objectives of this procedure are to ensure that:

- export-quality cut flowers are sourced only from packing houses that are approved by the NPPO, if the exporting country has chosen the NPPO-approved systems approach as its arthropod pest management option
- treatment providers are approved by the NPPO and are capable of applying a treatment that suitably manages the target pests.

Export packing houses must be registered with the exporting country's NPPO. A list of registered packing houses must be kept by the exporting country's NPPO. The NPPO of the exporting country is required to ensure that registered packing houses are suitably equipped, and have a system in place to carry out the specified phytosanitary activities. Audit records of the exporting country's NPPO must be made available to the department upon request.

In circumstances where cut flowers and foliage undergo treatment prior to export, such processes must be undertaken by treatment providers that have been registered with and audited by the exporting country's NPPO for that purpose. Records of the exporting country's NPPO registration requirements and audits are to be made available to the department upon request.

Approval for treatment providers must include verified operability of suitable systems to ensure compliance with treatment requirements. These systems should include:

- documented procedures to ensure cut flowers and foliage are appropriately treated and safeguarded post-treatment.
- staff training to ensure compliance with procedures.
- record keeping procedures.
- suitability and operability of facilities and equipment.
- compliance with the exporting country's NPPO system of oversight of treatment application.

### **7.2.3 Packaging and labelling**

The objectives of this procedure are to ensure that cut flowers and foliage proposed for export to Australia, and associated packaging, are not contaminated by quarantine pests or regulated articles (as defined in ISPM 5: Glossary of phytosanitary terms (FAO 2019). Secure, pest-proof

packaging must be used during storage and transport to Australia to prevent re-infestation during storage and transport, and escape of pests during clearance procedures on arrival in Australia.

Export packing houses and treatment providers must ensure that packaging and labelling are suitable to maintain the phytosanitary status of export consignments. The packaged cut flowers and foliage also must be labelled with sufficient identification information for purposes of traceability.

Each consignment must be secured (that is, made arthropod-proof) by one of the following methods:

- packaging in fully-enclosed cartons that have no ventilation holes, with lids that are tightly fixed to the base.
- packaging in cartons with ventilation holes which are covered with mesh or screens to prevent entry of pests. This requirement is currently being reviewed and may be amended if there are continued detections of small-sized pests such as thrips and mites. Alternatively, ventilation holes may be completely taped over.
- packaging in vented cartons with sealed plastic liners or plastic bags. Overlapping folded edges of a liner are considered to be sealed.

Meshed or plastic (shrink) wrapped pallets or Unit Load Devices (ULDs) with open ventilation holes/gaps, or palletised cartons with ventilation holes/gaps must be fully covered or wrapped with polythene/plastic/foil sheet or mesh/screen to prevent entry of pests.

All cartons must be packed in a fully enclosed container.

#### **7.2.4 Specific conditions for storage and movement**

The objective of this procedure is to ensure that the quarantine integrity of the commodity is maintained during storage and movement.

Cut flowers and foliage for export to Australia that have been treated and/or inspected must be kept secure and segregated at all times from any products for domestic or other markets, or untreated/non pre-inspected products, to prevent mixing or cross-contamination.

#### **7.2.5 Freedom from trash**

The objective of this procedure is to ensure that cut flowers and foliage for export are free from trash (for example, fruits, seeds, soil, and animal matter/parts) and foreign matter.

Freedom from trash must be confirmed by pre-export inspection procedures. Export lots or consignments found to contain trash or foreign matter must be withdrawn from export unless approved remedial action such as reconditioning is available, and is applied to the export consignment and verified by re-inspection.

#### **7.2.6 Pre-export phytosanitary inspection and certification by the NPPO of the exporting country**

The objective of this procedure is to ensure that Australia's import conditions have been met.

All consignments must be inspected in accordance with official procedures of the exporting country NPPO for all visually detectable quarantine pests and other regulated articles (including soil, animal and plant debris). Consignments are to be representatively sampled at a standard 600 unit sampling rate or equivalent. If there are several lots (for example, several growers and/or flower types) in the consignment the samples are to be drawn proportionately from each lot. Examination under magnification should be used to detect arthropod pests (for example, mites) that would be difficult to detect with the naked eye. A visual examination with the naked eye can be used to detect biosecurity risk material such as soil, larger insect pests, seeds and symptoms of plant disease.

If live quarantine pests and other regulated articles are found, remedial action must be taken. Pre-export remedial action (depending on the location of inspection) may include treatment of the consignment to ensure that the pest is no longer viable, or withdrawal of the consignment from export to Australia.

A Phytosanitary Certificate is issued for each consignment upon successful completion of pre-export inspection to verify that the required risk management measures have been undertaken pre-export, and that the consignment meets Australia's import requirements.

Each Phytosanitary Certificate must include:

- a description of the consignment (including traceability information)
- details of the pest management measure applied (for example, methyl bromide fumigation, alternative disinfestation treatments or NPPO-approved systems approach), including, as appropriate, date, concentration, temperature, duration, and an attached fumigation or alternative disinfestation treatment certificate, or details of approved growers and/or packing houses (as appropriate)
- details of the devitalisation treatment applied (if relevant)
- an additional declaration attesting to the consignment meeting Australia's insect-proof packaging requirements.

### **7.2.7 On arrival verification**

The objectives of this procedure are to ensure that:

- consignments comply with Australian import requirements
- consignments are as described on the Phytosanitary Certificate and quarantine integrity has been maintained.

On arrival in Australia, the department will:

- assess documentation to verify that the consignment is as described on the Phytosanitary Certificate, that required phytosanitary actions have been undertaken, and that product security has been maintained
- complete an inspection of each consignment to verify that the biosecurity status meets Australia's import conditions, using a representative sample of 600 units per consignment.

Consistent with the principles of ISPM 31: *Methodologies for sampling of consignments* (FAO 2016g), Australia's standard biosecurity sampling protocol requires inspection of 600 units for the presence of quarantine pests and regulated articles using systematically selected random samples from each homogeneous consignment or lot. If live arthropods are found, the department will identify these pests to species where possible, prior to making the decision to subject the consignment to remedial treatment, destruction or export.

If no pests are detected by the inspection, this sample size achieves a confidence level of 95 per cent that not more than 0.5 per cent of the units in the consignment are infested or infected. The level of confidence depends on each unit in the consignment having similar likelihood of being affected by a quarantine or regulated pest, and the inspection technique being able to reliably detect all these pests in the sample. If no live pests are detected in the sample, the consignment is considered to be free from quarantine pests and regulated pests.

Consignments that do not comply with Australia's import conditions will be subject to remedial treatment, or destroyed or exported, as appropriate.

The department reserves the right to suspend imports (either all imports or imports from specific pathways) and to conduct an audit of the risk management system if consignments are repeatedly non-compliant. Imports will recommence only when the department is satisfied that appropriate corrective action has been undertaken.

### **7.2.8 Remedial action(s) for non-compliance**

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

- any quarantine pest or regulated article 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 will be subject to a suitable remedial treatment (if one is available), or disposed of/destroyed or exported to manage the biosecurity risk.

Other actions may be taken depending on the specific pest intercepted and the risk management strategy put in place against that pest.

If cut flower consignments are repeatedly non-compliant, the department reserves the right to suspend imports (either all imports or imports from specific pathways) and to conduct an audit of the risk management systems. Imports will recommence only when the department is satisfied that appropriate corrective action has been undertaken.

### **7.2.9 Uncategorised pests**

If an organism that has not been categorised, including contaminant pests and biocontrol agents, and is detected on cut flowers and foliage either in the exporting country or on arrival in Australia, it will require assessment by the department to determine its quarantine pest and/or regulated article status, and whether phytosanitary action is required.

The detection of any pests of quarantine concern not already identified in this 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 ALOP for Australia.

## 7.3 Consideration of alternative options

Consistent with the principle of equivalence detailed in ISPM 11: *Pest risk analysis for quarantine pests* (FAO 2017c), the department will consider any alternative pre-export measure proposed by the NPPO of the exporting country, providing that the proposed measure demonstrably manages the target pests to achieve the ALOP for Australia.

### 7.3.1 Systems approaches

The concept of systems approaches is defined in ISPM 14: *The use of integrated measures in a systems approach for pest risk management* as ‘A pest risk management option that integrates different measures, at least two of which act independently, with cumulative effect’ (FAO 2016e).

The use of an NPPO-approved systems approach offers an alternative to treatments such as methyl bromide fumigation. A number of ISPMs provide guidance on elements that may offer pest risk management options for an NPPO-approved systems approach. These may be used as appropriate to achieve the objective of freedom from quarantine and regulated pests:

- ISPM 4: *Requirements for the establishment of pest free areas* (FAO 2017b)
- ISPM 10: *Requirements for the establishment of pest free places of production and pest free production sites* (FAO 2016c)
- ISPM 14: *The use of integrated measures in a systems approach for pest risk management* (FAO 2016e)
- ISPM 22: *Requirements for the establishment of areas of low pest prevalence* (FAO 2016f).

For example, countries that grow cut flowers for export in secure greenhouses may base a systems approach on ISPM 10. Other measures might be put in place at both production and post-harvest stages. Possible options at these stages include:

- Production activities—site management, sanitation and hygiene, pest free production sites, production inputs, pest free propagation material, clean growing media, and pest monitoring, for example, visual examination and trapping.
- Pest control activities—chemical and organic pesticides (for example, oils, soaps, plant extracts), physical measures (for example, enclosed production systems such as glasshouses and screen houses), cultural practices (for example, field hygiene and sanitation, planting densities), mechanical measures (for example, the use of sticky traps), and BCAs (for example, the release of predators to suppress pest populations).
- Post-harvest procedures—sorting and grading, post-harvest treatments (for example, chemical, physical, or controlled atmosphere treatments), hygiene and sanitation of packing facilities, temperature control during the packing process, packing in pest-proof containers to prevent re-infestation, and inspection to verify freedom from live quarantine pests.

### 7.3.2 Alternative treatments to methyl bromide fumigation

Various countries are undertaking research on development of alternative treatments to methyl bromide to treat cut flowers and foliage. One example is low temperature phosphine fumigation, and the department’s website ([agriculture.gov.au/cut-flowers](http://agriculture.gov.au/cut-flowers)) and follow the link to ‘managing

invertebrate pests offshore’) provides some examples of research papers describing the effect of phosphine on arthropod pests and flower quality.

## **7.4 Review of processes**

The department reserves the right to review the import policy after a suitable volume of trade has been achieved. In addition, the department reserves the right to review the import policy as deemed necessary, including if there is reason to believe that the pests or phytosanitary status of the countries of origin has changed.

The exporting country’s NPPO must inform the department immediately if any new pests of cut flowers that are of potential biosecurity concern to Australia are detected in the exporting country.

## 8 Conclusion

The findings of Part 1 of this PRA for fresh cut flowers and foliage from all countries are based on scientific analysis of relevant literature and analysis of historic interception data.

The Department of Agriculture considers that the risk management measures proposed in this PRA will provide an ALOP against the pests identified as associated with the trade of fresh cut flowers and foliage from all countries.

## Appendix A Permitted flowers and foliage

The following list summarises the approximately 96 taxa of commercially produced cut flowers and foliage permitted for import into Australia for decorative purposes, current on 25 April 2019. The definitive list of permitted species, and any specific associated import conditions, can be found in the *List of Species of Fresh Cut Flowers and Foliage with Alternative Conditions for Import – Mainland*, available from the department's website ([www.agriculture.gov.au/biosecurity/legislation/fresh-cut-flowers-mainland](http://www.agriculture.gov.au/biosecurity/legislation/fresh-cut-flowers-mainland)).

<i>Agapanthus</i> spp.	<i>Convallaria</i> spp.	<i>Hypericum</i> spp.	<i>Pandanus odoratissimus</i>
<i>Alcea</i> spp.	<i>Cordyline</i> spp.	<i>Iris</i> spp.	<i>Papaver</i> spp.
<i>Allium</i> spp.	<i>Craspedia</i> spp.	<i>Ixia</i> spp.	<i>Philodendron</i> spp.
<i>Alstroemeria</i> spp.	<i>Curcuma alismatifolia</i>	<i>Jasminum sambac</i>	<i>Phormium</i> spp.
<i>Althaea</i> spp.	<i>Cycas</i> spp.	<i>Lathyrus odoratus</i>	<i>Polianthes</i> spp.
<i>Alyxia stellata</i>	<i>Cyclamen</i> spp.	<i>Leucorum</i> spp.	Polypodiopsida (ferns)
<i>Amaranthus</i> spp.	<i>Delphinium</i> spp.	<i>Liatris</i> spp.	<i>Primula</i> spp.
<i>Amaryllis</i> spp.	<i>Dianthus</i> spp.	<i>Lilium</i> spp.	<i>Ranunculus asiaticus</i>
<i>Ammi majus</i>	<i>Digitalis</i> spp.	<i>Limonium</i> spp.	<i>Rosa</i> spp.
<i>Ammi visnaga</i>	<i>Dracaena</i> spp.	<i>Liriope muscari</i>	<i>Ruscus</i> spp.
<i>Anemone</i> spp.	<i>Epipremnum aureum</i>	<i>Lysimachia clethroides</i>	<i>Sandersonia</i> spp.
<i>Anigozanthos</i> spp.	<i>Epipremnum pinnatum</i>	<i>Molucella</i> spp.	<i>Scabiosa</i> spp.
<i>Anthurium</i> spp.	<i>Eryngium</i> spp.	<i>Monstera</i> spp.	<i>Strelitzia</i> spp.
Arecaceae (palm)	<i>Eustoma grandiflorum</i>	<i>Muscari</i> spp.	<i>Symphyotrichum ericoides</i>
<i>Astilbe</i> spp.	<i>Eustoma russellianum</i>	<i>Myrtus</i> spp.	<i>Tagetes</i> spp.
<i>Brunia</i> spp.	<i>Freesia</i> spp.	<i>Narcissus</i> spp.	<i>Thalictrum</i> spp.
<i>Calathea insignis</i>	<i>Galax urceolata</i>	<i>Nelumbo nucifera</i>	<i>Triteleia</i> spp.
<i>Calathea lancifolia</i>	<i>Gentiana triflora</i>	<i>Nerine</i> spp.	<i>Trollius</i> spp.
<i>Callistephus chinensis</i>	<i>Gerbera</i> spp.	<i>Nymphaea</i> spp.	<i>Tropaeolum</i> spp.
<i>Campanula</i> spp.	<i>Gladiolus</i> spp.	<i>Ocimum tenuiflorum</i>	<i>Tulipa</i> spp.
<i>Chelone</i> spp.	<i>Gloriosa</i> spp.	Orchidaceae (orchids)	<i>Viburnum</i> spp.
<i>Chrysanthemum</i> spp.	<i>Gypsophila</i> spp.	<i>Ornithogalum</i> spp.	<i>Viola</i> spp.
<i>Codiaeum variegatum</i>	<i>Hippeastrum</i> spp.	<i>Oxypetalum</i> spp.	<i>Zantedeschia</i> spp.
<i>Consolida</i> spp.	<i>Hyacinthus</i> spp.	<i>Paeonia</i> spp.	<i>Zinnia</i> spp.

**Source:** *List of Species of Fresh Cut Flowers and Foliage with Alternative Conditions for Import – Mainland*, available from [www.agriculture.gov.au/biosecurity/legislation/fresh-cut-flowers-mainland](http://www.agriculture.gov.au/biosecurity/legislation/fresh-cut-flowers-mainland).



## Appendix B Contaminating pests

The risks posed by contaminating pests ('contaminants') on the plant import pathway are addressed by existing standard operational procedures and do not require further consideration in this PRA.

Contamination is the 'Presence of a contaminating pest or unintended presence of a regulated article in or on a commodity, packaging, conveyance, container or storage place', and a contaminating pest is 'A pest that is carried by a commodity, packaging, conveyance or container, or present in a storage place and that, in the case of plants and plant products, does not infest them' (FAO 2019).

All plant import pathway commodities must be free from contaminating material and organisms, including plant trash, seeds, soil, animal matter/parts and other extraneous material and pests of biosecurity concern to Australia. This is confirmed by inspection procedures. Export lots or consignments found to contain contaminating material or organisms should be withdrawn from export unless approved remedial action is available and applied to the export consignment, which must then be re-inspected for compliance.

Contaminating biological control agents (BCAs) and other beneficial organisms on the plant import pathway are subject to additional requirements in Australia. A BCA is an organism, such as an insect or pathogen that is used to manage the impact of a pest species, including insects or weeds, on or in cultivated crops and/or the environment. ISPM 3 *Guidelines for the export, shipment, import and release of biological control agents and other beneficial organisms* (FAO 2005) states that pest risk analysis should be conducted prior to import or release, and possible impacts on the environment, such as impacts on non-target invertebrates, should also be considered.

Before BCAs or beneficial organisms can be released into the Australian environment a separate risk analysis must be undertaken by the Department of Agriculture. In a parallel process, the Department of the Environment and Energy must also make a ruling under the *Environment Protection and Biodiversity Conservation Act 1999*.

The risk analysis for BCAs must demonstrate that the risk associated with release of a BCA achieves the ALOP for Australia. The risk analysis takes account of any negative impact on non-target species and the potential magnitude of consequences. Rigorous host specificity testing is required to ensure that a proposed BCA is appropriately specific to its target pest. This minimises the risk of any significant negative consequences as a result of the organism's release.

## Appendix C Consultation by the department

This appendix contains details of the department's extensive program of international and domestic consultation on changes to import conditions and the PRA.

### International

12 September 2017—Prior to implementing the foreshadowed changes to import conditions for fresh cut flowers and foliage, the department corresponded with the NPPOs of the nineteen leading exporting countries to advise of the changes to conditions, and to provide justification.

14 September 2017—Australia published an SPS Notification, G/SPS/N/AUS/435 *Importing fresh cut flowers and foliage into Australia safely* (WTO 2017b), to inform all trading partners of the revised import conditions to be implemented from 1 November 2017.

2 November 2017—The department corresponded with the NPPOs of the nineteen leading exporting countries to advise that the department intended to delay the implementation of the revised import conditions in order to allow NPPOs, importers and exporters time to transition to the revised requirements. During this transition period Australia continued to accept consignments under the previous import conditions, as well as accepting consignments under the revised import conditions.

6 November 2017—Australia published an addendum to the SPS Notification of 14 September 2017, SPS Notification Addendum G/SPS/N/AUS/435/Add.1. This informed all trading partners the revised conditions for importing fresh cut flowers and foliage into Australia would be implemented from 1 March 2018 to allow the NPPOs, exporters and importers sufficient time to transition to the revised conditions (WTO 2017a).

13 November–17 November 2017—A visit to Kenya was conducted by a departmental contractor to observe and evaluate commercial production practices and processes used to mitigate the biosecurity risk of Kenya's fresh cut flower and foliage production.

18 January 2018—A provisional list of quarantine pests intercepted on consignments of fresh cut flowers and foliage imported into Australia was provided to the NPPOs of the nineteen leading exporting countries. The list was formed to assist these countries to develop systems for management of pests in fresh cut flowers and foliage for export to Australia, to meet Australia's revised import conditions. A list of BCAs used in each country's production systems was also requested.

10 February–25 February 2018—Officers from the department conducted visits to both Colombia and Ecuador to observe and evaluate commercial production practices and processes used to mitigate the biosecurity risks of their fresh cut flower and foliage production.

12 February 2018—The department corresponded with the NPPOs of the 19 leading exporting countries to outline Australia's process for compliance monitoring and reporting.

April 2018—The department corresponded with major fresh cut flower exporting countries with an update on compliance monitoring, and requested they consider appropriate action to address the non-compliance associated with the presence of live quarantine pests.

May 2018—Officers from the department met with Ambassadors from two major exporting countries and provided an update on the compliance performance of imports from these countries.

August 2018—The department corresponded with the NPPOs of the leading exporting countries to provide an update on compliance with the revised import conditions, and requested that countries with high rates of non-compliance investigate and address the causes of non-compliance.

September 2018—The department corresponded with the NPPOs of leading exporting countries acknowledging the actions taken by the NPPOs and clarified their queries regarding the department's data reporting.

October 2018—The department corresponded with the NPPOs of the leading exporting countries to provide an update on compliance.

16 November 2018—The department released the Draft PRA (Part 1) for public consultation, notifying trading partners through SPS Notification Addendum G/SPS/N/AUS/435/Add.2.

November 2018—Officers from the department and the New Zealand Ministry of Primary Industry conducted a joint visit of cut flower and foliage production and export systems with India's NPPO and industry.

December 2018—The department corresponded with the NPPOs of the leading exporting countries to provide an update on compliance with the revised import conditions, requested that countries with high rates of non-compliance investigate and address the instances of non-compliance; and notified them of an extension until 1 July 2019 for disallowing the use of certain measures for highly non-compliant countries.

7 February 2019—The department notified trading partners of an extension to the comment period for Part 1 of the Draft PRA, via SPS Notification Addendum G/SPS/N/AUS/435/Add.3.

March 2019—The department provided an update on compliance with the new import conditions (from mid-November to end of January 2019), and requested that countries with high rates of non-compliance investigate and address the instances of non-compliance. Certain countries with high non-compliance were notified of the potential removal of the systems approach option.

3 April 2019—The department held an embassy briefing with representatives of overseas trading partners. The briefing discussed changes to Australia's import conditions and the pest risk analysis for fresh cut flowers and foliage.

5 April 2019—The department held a forum with domestic industry and representatives of trading partners to inform stakeholders how and why the department is strengthening Australia's biosecurity at the border for the cut flower and foliage pathway.

12 April 2019—The department corresponded with the NPPOs of the leading exporting countries to provide an update on compliance (from February to March 2019).

18 April 2019—The department notified trading partners of the commencement of Part 2 of the PRA for imports fresh cut flowers and foliage, via SPS Notification G/SPS/N/AUS/435/Add.4.

April to June 2019—Officers from the department met individually with representatives from a number of Embassies and High Commissions to discuss the compliance performance of imports and the department's future actions.

## **Domestic industry stakeholders**

30 June 2016—The first meeting was held of the newly-established Imported Cut Flowers and Foliage Regulation Working Group, which was formed to enable engagement across sectors on fresh cut flower and foliage biosecurity risks and their effective and efficient management. The working group consisted of members from the department, state governments (Plant Health Committee), the fresh cut flower and foliage importing industry (Lynch Group, WAFEX, Tony's Flowers), the fresh cut flower and foliage production industry (NSW Flower Council, Flowers Australia, Flower Point, Tamar Valley Roses), florists (Roses Only), the nursery and garden industry (Nursery and Garden Industry Australia), and Plant Health Australia.

12 September 2017—Prior to implementing the changes to import conditions for fresh cut flowers and foliage, the department corresponded with leading Australian importers and domestic stakeholders to advise of the changes to import conditions to manage the biosecurity risks pre-export, and the justification behind those changes.

18 September 2017—An Industry Advice Notice was issued to importers, approved arrangements, freight forwarders and brokers to raise concern with regards to the high rate of pests being detected at the border, and to signal the intention to change import conditions to manage risks pre-export.

6 October 2017—The department met with leading Australian importers who raised concerns about the revised import conditions, including the short timeframe for implementation, arthropod identification issues at the border, and the justification for moving away from onshore fumigation.

20 October 2017—The Imported Cut Flowers and Foliage Regulation Working Group met to discuss details of the revised import conditions, including commencement date and transition arrangements.

30 October 2017—An Industry Advice Notice was issued to importers, approved arrangements, freight forwarders and brokers to notify of the transition arrangements and the 1 March 2018 implementation date for revised import conditions.

30 October 2017—The department corresponded with leading Australian importers to advise of the delay in introducing the revised import conditions to allow importers time to transition to the revised conditions. During this transition period Australia continued to accept consignments under the previous import conditions, as well as accepting consignments under the revised import conditions.

8 February 2018—Leading fresh cut flower and foliage importers were advised that the revised import conditions would apply from 1 March 2018, and were provided with their compliance performance summary (supplier level compliance and arthropod pests intercepted) as measured from 1 November 2017 to 15 January 2018.

12 February 2018—The department corresponded with leading Australian importers to outline the process for compliance monitoring and reporting.

13 February 2018—The Deputy Secretary for Biosecurity met with a leading Australian importer to discuss the concerns that the importer had raised.

21 February 2018—The department met with a leading Australian importer to discuss the revised import conditions and the concerns that the importer had raised.

16 March 2018—The Minister for Agriculture and Water Resources responded to concerns regarding the impacts of weekend clearance delays resulting from the removal of voluntary fumigation.

April 2018—The department corresponded with importers on the performance of their imports from major fresh cut flower exporting countries, and requested them to work closely with their suppliers to ensure consignments be managed, inspected, treated and/or certified prior to export to meet Australia's import conditions.

25 June 2018—The Imported Cut Flowers and Foliage Regulation Working Group met to discuss compliance with the revised import conditions, the upcoming PRA, and the department's progress in developing diagnostic tools for identification of specified arthropods.

11 July 2018—The department publicly announced the first part of the PRA through a Biosecurity Advice notice and factsheet on the department's website. This announcement invited interested stakeholders to subscribe to the department's online subscription service to receive notifications relating to plant biosecurity policy.

13 July 2018—The department met with a leading Australian importer to discuss the revised import conditions, the arthropod pests of biosecurity concern, and potential alternative disinfestation treatments for imports.

8 August 2018—The Deputy Secretary for Biosecurity met with a leading Australian importer to discuss progress on the implementation of pre-export measures to manage the risks of arthropod pests.

August 2018—The department corresponded with importers on the performance of their imports since commencement of revised import conditions, and requested they work with their suppliers to address on-going high levels of non-compliance.

October 2018—The department provided an update to importers on compliance for imports from 1 July to 31 August.

14 November 2018—The department released the Draft PRA (Part 1) for public consultation, notifying domestic stakeholders via its website, automated emails to registered stakeholders, and an email to the members of the Imported Cut Flowers and Foliage Regulation Working Group.

December 2018—The department provided an update to importers on compliance with the new import conditions (from 1 September to mid-November), and requested that countries with high rates of non-compliance investigate and address the instances of non-compliance; and notified

them of an extension until 1 July 2019 for disallowing the use of certain measures for highly non-compliant countries.

4 February 2019—the department extended the comment period for the Draft PRA (Part 1) from 31 January to 15 March, notifying stakeholders through its website, an automated email to registered stakeholders, and by individual emails to all stakeholders who had already commented, or who had asked for extensions.

January and February 2019—An Industry Advice Notice was issued to importers, approved arrangements, freight forwarders and brokers to notify stakeholders of clearance systems of fresh cut flowers and foliage consignments on the Australia Day long weekend and Valentine's Day.

6 March 2019—The department held a teleconference briefing on the Draft PRA (Part 1) with interested domestic stakeholders.

15 and 22 March 2019—An Industry Advice Notice was issued to importers, approved arrangements, freight forwarders and brokers to notify stakeholders of clearance systems of fresh cut flowers and foliage consignments on long weekends in the lead up to Mother's Day.

March 2019—The department provided updates to importers on compliance with the new import conditions (from mid-November to end of January 2019), and requested that countries with high rates of non-compliance investigate and address the instances of non-compliance; and notified them of the potential to disallow the use of the systems approach option for certain countries from 1 July 2019.

5 April 2019—The department held a forum with industry and overseas trading partners to inform stakeholders of how and why the department is strengthening Australia's biosecurity at the border for the cut flower and foliage pathway.

12 April 2019—The department provided an update to importers on compliance for imports from February to March 2019.

17 May 2019—The department met with a group of Australian importers about the PRA, importing processes and the proposed introduction of import permits.

30 May 2019—an Industry Advice Notice was issued to importers, approved arrangements, freight forwarders and brokers to notify that permits will be required from 1 September 2019 for imports of cut flowers and foliage from countries with high non-compliance and high volumes of trade.

## Appendix D Arthropod interception analysis

### Class Arachnida interception analysis

Of the over 38,000 arthropod interception events over the 18 year period between 1 January 2000 and 28 February 2018, 30 per cent were in the Class Arachnida. Of these, 25 per cent were positively identified to the subclass Acari (mites and ticks). The Order Mesostigmata were seven per cent of all interceptions, and Order Trombidiformes were 17 per cent of all interception events. Order Ixodida (ticks) were less than 0.01 per cent of all interception events. This clearly shows that the Acari (mites) are the most frequently intercepted arachnid taxon on the cut flower and foliage pathway. The breakdown of higher classification Arachnid interceptions is considered in Table I.

This information will be updated in conjunction with the release of part 2 of the PRA to incorporate other arthropod pests, and to differentiate data collected since 1 March 2018.

**Table I Arachnid interceptions (higher classifications)**

<b>Taxa</b>	<b>Proportion of all interception events (a)</b>
<b>Class Arachnida</b>	29.92%
(Not identified further)	0.36%
Order Araneae	4.21%
Order Pseudoscorpiones	0.02%
Order Opiliones	0.01%
<b>Subclass Acari</b>	25.32%
<b>Superorder Parasitiformes</b>	0.08%
Order Ixodida	0.01%
Order Mesostigmata	6.66%
<b>Superorder Acariformes</b>	0.14%
Order Trombidiformes	16.66%
Suborder Prostigmata	0.95%
Order Sarcoptiformes	0.73%
Suborder Oribatida	0.07%
Cohort Astigmatina	0.03%

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018).

### Acari (mites) interception analysis

The breakdown of the Subclass Acari (mite) interception events that were positively assigned to family is considered in Table II. Of the approximately 9,700 mite interceptions recorded by the department, 93 per cent were positively identified to family level, with 39 families

recorded. This analysis clearly shows that the Tetranychidae followed by the Phytoseiidae are the most frequently intercepted families intercepted on the cut flower and foliage pathway.

**Table II Mite interceptions (identified to family)**

<b>Family</b>	<b>Proportion of all interception events (a)</b>
Tetranychidae	16.92%
(Not identified further)	7.07%
Phytoseiidae	4.65%
Parasitidae	0.67%
Acaridae	0.29%
Tydeidae	0.27%
Bdellidae	0.17%
Anystidae	0.08%
Ascidae	0.07%
Blattisociidae	0.07%
Laelapidae	0.04%
Erythraeidae	0.03%
Tarsonemidae	0.03%
Ameroseiidae	0.02%
Cunaxidae	0.02%
Eupodidae	0.02%
Histiostomatidae	0.02%
Oribatulidae	0.02%
Stigmaeidae	0.02%
Tenuipalpidae	0.02%
Galumnidae	0.01%
Glycyphagidae	0.01%
Iolinidae	0.01%
Macrochelidae	0.01%
Macronyssidae	0.01%
Melicharidae	0.01%
Smarididae	0.01%
Veigaiidae	0.01%



Winterschmidtidae	0.01%
Acarophenacidae	<0.01%
Cheyletidae	<0.01%
Cymbaeremaeidae	<0.01%
Ereynetidae	<0.01%
Ologamasidae	<0.01%
Oribatellidae	<0.01%
Penthaleidae	<0.01%
Suidasiidae	<0.01%
Trematuridae	<0.01%
Tuckerellidae	<0.01%
Uropodidae	<0.01%

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018).

The breakdown of mite interception events that were positively assigned to genus is considered in Table III. Of the approximately 9,700 mite interceptions recorded by the department, 75 per cent were positively identified to genus level, with 54 genera recorded. *Tetranychus* is the most frequent genus identified as an interception on the cut flower and foliage pathway.

**Table III Mite interceptions (identified to genus)**

Genus	Proportion of all interception events (a)
<i>Tetranychus</i>	15.92%
(Not identified further)	6.46%
<i>Neoseiulus</i>	1.50%
<i>Phytoseiulus</i>	0.54%
<i>Tyrophagus</i>	0.21%
<i>Parasitus</i>	0.18%
<i>Tydeus</i>	0.08%
<i>Bdellodes</i>	0.07%
<i>Anystis</i>	0.04%
<i>Lasioseius</i>	0.04%
<i>Amblyseius</i>	0.03%
<i>Rhizoglyphus</i>	0.03%

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<i>Phorytocarpais</i>	0.02%
<i>Tarsonemus</i>	0.02%
<i>Acarus</i>	0.01%
<i>Ameroseius</i>	0.01%
<i>Bdella</i>	0.01%
<i>Biscirus</i>	0.01%
<i>Brevipalpus</i>	0.01%
<i>Cosmolaelaps</i>	0.01%
<i>Cyta</i>	0.01%
<i>Eupodes</i>	0.01%
<i>Eustigmaeus</i>	0.01%
<i>Galumna</i>	0.01%
<i>Gymnolaelaps</i>	0.01%
<i>Histiostoma</i>	0.01%
<i>Neocalvolia</i>	0.01%
<i>Oligonychus</i>	0.01%
<i>Ornithonyssus</i>	0.01%
<i>Sancassania</i>	0.01%
<i>Spinibdella</i>	0.01%
<i>Tenuipalpus</i>	0.01%
<i>Typhlodromus</i>	0.01%
<i>Abrolophus</i>	<0.01%
<i>Adactylidium</i>	<0.01%
<i>Aleuroglyphus</i>	<0.01%
<i>Blattisocius</i>	<0.01%
<i>Brachytydeus</i>	<0.01%
<i>Bryobia</i>	<0.01%
<i>Fessonina</i>	<0.01%
<i>Glycyphagus</i>	<0.01%
<i>Hemicheyletia</i>	<0.01%
<i>Laelaps</i>	<0.01%

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<i>Lorryia</i>	<0.01%
<i>Macrocheles</i>	<0.01%
<i>Mypongia</i>	<0.01%
<i>Neoseiulella</i>	<0.01%
<i>Pergamasus</i>	<0.01%
<i>Phytoseius</i>	<0.01%
<i>Proctolaelaps</i>	<0.01%
<i>Proctolaelaps</i>	<0.01%
<i>Proprioseiopsis</i>	<0.01%
<i>Rubroscirus</i>	<0.01%
<i>Scapheremaeus</i>	<0.01%
<i>Schizotetranychus</i>	<0.01%
<i>Smaris</i>	<0.01%
<i>Tetranychopsis</i>	<0.01%
<i>Trichouropoda</i>	<0.01%

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018).

The breakdown of mite interception events that were positively assigned to species is considered in Table IV. Of the approximately 9,700 mite interceptions recorded by the department, 11 per cent were positively identified to species level, with 46 species recorded. *Tetranychus urticae*, followed by *Neoseiulus californicus* and *Phytoseiulus persimilis* are the most frequently occurring species identified as interceptions on the cut flower and foliage pathway. None of these three species are quarantine pests for Australia. This table also indicates the current quarantine pest status of the species for Australia.

Interception events are averaged over 18 years (1 January 2000 to 28 February 2018), expressed as a range and grouped within seven cohorts A to G. These ranges are not contiguous, as for example, there were no interceptions of between 50 and 100 per year:

- A = greater than 250 events per year
- B = 100 to 250 events per year
- C = 10 to 50 events per year
- D = 5 to 10 events per year
- E = 1 to 5 events per year
- F = 0.5 to 1 events per year
- G = less than 0.5 events per year.

For the purpose of this appendix, the quarantine pest status of the species has been included according to the pest categorisation presented in Appendix F.

**Table IV Mite interceptions (identified to genus and species)**

Genus and species	Group	Yearly average range (a)	Present in Australia	Quarantine pest
<i>Aleuroglyphus ovatus</i>	G	<0.5	Yes	Yes (WA)
<i>Amblyseius largoensis</i>	G	<0.5	Yes	No
<i>Amblyseius sinuatus</i>	G	<0.5	No	Yes
<i>Amblyseius tamatavensis</i>	G	<0.5	Yes	No
<i>Anystis baccharum</i>	F	0.5-1	Yes	No
<i>Bdella distincta</i>	G	<0.5	No	Yes
<i>Bdellodes haramotoi</i>	E	1-5	No	Yes
<i>Bryobia vasiljevi</i>	G	<0.5	Yes	Yes (WA)
<i>Glycyphagus domesticus</i>	G	<0.5	Yes	No
<i>Histiostoma humiditatus</i>	G	<0.5	Yes	No
<i>Lasioseius lindquisti</i>	G	<0.5	No	Yes
<i>Lasioseius subterraneus</i>	G	<0.5	No	Yes
<i>Lasioseius sugawarai</i>	G	<0.5	No	Yes
<i>Lasioseius youcefi</i>	G	<0.5	No	Yes
<i>Neoseiulus barkeri</i>	E	1-5	Yes	No
<i>Neoseiulus bicaudus</i>	G	<0.5	No	Yes
<i>Neoseiulus californicus</i>	C	10-50	Yes	No
<i>Neoseiulus cucumeris</i>	G	<0.5	Yes	No
<i>Neoseiulus fallacis</i>	E	1-5	Yes	No
<i>Neoseiulus longisiphonulus</i>	G	<0.5	No	Yes
<i>Neoseiulus longispinosus</i>	E	1-5	Yes	No
<i>Ornithonyssus bacoti</i>	G	<0.5	Yes	No
<i>Phorytocarpais americanus</i>	E	1-5	Yes	No
<i>Phytoseiulus persimilis</i>	D	5-10	Yes	No
<i>Pneumolaelaps minutissima</i>	G	<0.5	No	Yes
<i>Proctolaelaps bickleyi</i>	G	<0.5	Yes	No
<i>Proctolaelaps pygmaeus</i>	G	<0.5	Yes	No

<i>Rhizoglyphus echinopus</i>	G	<0.5	Yes	No
<i>Rhizoglyphus minutus</i>	G	<0.5	No	Yes
<i>Rhizoglyphus robini</i>	G	<0.5	Yes	Yes (WA)
<i>Rubroscirus africanus</i>	G	<0.5	No	Yes
<i>Schizotetranychus asparagi</i>	G	<0.5	No	Yes
<i>Spinibdella cronini</i>	G	<0.5	Yes	No
<i>Tarsonemus bilobatus</i>	G	<0.5	No	Yes
<i>Tarsonemus confusus</i>	G	<0.5	No	Yes
<i>Tenuipalpus pacificus</i>	G	<0.5	Yes	Yes (WA)
<i>Tetranychus kanzawai</i>	G	<0.5	Yes	Yes (WA)
<i>Tetranychus lambi</i>	G	<0.5	Yes	No
<i>Tetranychus urticae</i>	C	10-50	Yes	No
<i>Tydeus californicus</i>	G	<0.5	Yes	No
<i>Tydeus caudatus</i>	G	<0.5	No	Yes
<i>Tyrophagus curvipenis</i>	G	<0.5	Yes	No
<i>Tyrophagus neiswanderi</i>	G	<0.5	Yes	Yes (WA)
<i>Tyrophagus putrescentiae</i>	G	<0.5	Yes	No
<i>Tyrophagus similis</i>	G	<0.5	Yes	No

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018). Each interception event is based on the presence of at least a single mite on a consignment. The number of mites present per event is not generally recorded, and multiple mite taxa can infest the same commodity.

### Class Insecta interception analysis

Of the over 38,000 arthropod interception events over the 18 year period between 1 January 2000 and 28 February 2018, 69 per cent were in the Class Insecta. Of these, 43 per cent were positively identified to Order level as Thysanoptera and 12 per cent as Hemiptera. The Lepidoptera were 5 per cent of all interceptions, Hymenoptera and Diptera 3 per cent each, Coleoptera 2 per cent and Psocoptera 1 per cent. All other insect orders were less than 0.5 per cent of all interception events. This clearly shows that Thysanoptera and Hemiptera are the most frequently occurring insect orders intercepted on the cut flower and foliage pathway. The breakdown of these interceptions is considered in Table V.

**Table V Insect interceptions (identified to Order)**

Order	Proportion of all interception events (a)
Thysanoptera	43%
Hemiptera	12%
Lepidoptera	5%
Hymenoptera	3%
Diptera	3%
Coleoptera	2%
Psocoptera	1%
Neuroptera	Less than 0.5%
(not identified further)	Less than 0.5%
Blattodea	Less than 0.5%
Collembola	Less than 0.1%
Dermaptera	Less than 0.1%
Orthoptera	Less than 0.1%
Embioptera	Less than 0.05%
Isoptera	Less than 0.05%
Mantodea	Less than 0.05%
Odonata	Less than 0.05%
Thysanura	Less than 0.05%
Trichoptera	Less than 0.05%

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018).

### Order Hemiptera (true bugs) interception analysis

The breakdown of Hemipteran interception events identified to family is considered in Table VI. Approximately 4,500 interceptions were identified to family level, with 36 families recorded,

representing 93 per cent of all recorded Hemiptera interception events on cut flowers and foliage. This clearly shows that the Aphididae (aphids) are the most frequently occurring hemipteran family intercepted on the cut flower and foliage pathway.

**Table VI Hemiptera interceptions (identified to family)**

<b>Family</b>	<b>Proportion of all interception events (a)</b>
Hemiptera	11.71%
Aphididae	7.02%
Anthocoridae	1.11%
(Not identified further)	0.84%
Pseudococcidae	0.66%
Miridae	0.58%
Aleyrodidae	0.38%
Lygaeidae	0.25%
Orsillidae	0.17%
Cicadellidae	0.15%
Diaspididae	0.08%
Psyllidae	0.08%
Pentatomidae	0.07%
Oxycarenidae	0.06%
Coreidae	0.05%
Reduviidae	0.05%
Coccidae	0.04%
Cydnidae	0.02%
Geocoridae	0.02%
Rhyparochromidae	0.02%
Delphacidae	0.01%
Acanthosomatidae	<0.01%
Aphrophoridae	<0.01%
Aradidae	<0.01%
Berytidae	<0.01%
Blissidae	<0.01%
Cercopidae	<0.01%

Cimicidae	<0.01%
Corixidae	<0.01%
Margarodidae	<0.01%
Membracidae	<0.01%
Monophlebidae	<0.01%
Nabidae	<0.01%
Plataspidae	<0.01%
Pyrrhocoridae	<0.01%
Thaumastocoridae	<0.01%
Tingidae	<0.01%
Saldidae	<0.01%

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018).

### Family Aphididae (aphids) interception analysis

The breakdown of Aphididae (aphid) interception events that were positively assigned to genus is considered in Table VII. Of the approximately 2,700 aphid interceptions recorded by the department, 39 per cent were positively identified to genus level, with 22 genera recorded. *Macrosiphum* is the most frequently occurring aphid genus identified on the cut flower and foliage pathway.

**Table VII Aphid interceptions (identified to genus)**

Genus	Proportion of all interception events (a)
(Not identified further)	4.31%
<i>Macrosiphum</i>	1.12%
<i>Aphis</i>	0.68%
<i>Myzus</i>	0.39%
<i>Aulacorthum</i>	0.22%
<i>Rhodobium</i>	0.10%
<i>Brachycaudus</i>	0.03%
<i>Pseudaphis</i>	0.03%
<i>Rhopalosiphum</i>	0.03%
<i>Chaetosiphon</i>	0.02%
<i>Dysaphis</i>	0.02%
<i>Metopolophium</i>	0.02%



<i>Rhopalosiphoninus</i>	0.02%
<i>Brevicoryne</i>	0.01%
<i>Lipaphis</i>	0.01%
<i>Myzaphis</i>	0.01%
<i>Toxoptera</i>	0.01%
<i>Wahlgreniella</i>	0.01%
<i>Acyrtosiphon</i>	<0.01%
<i>Amphorophora</i>	<0.01%
<i>Cavariella</i>	<0.01%
<i>Diuraphis</i>	<0.01%
<i>Idiopterus</i>	<0.01%
<i>Pseudomegoura</i>	<0.01%
<i>Sitobion</i>	<0.01%

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018).

Of the approximately 2,700 interceptions of aphids recorded by the department, 34 per cent were identified to species level. There were 41 species of aphid positively identified and the breakdown of aphid interceptions that were positively assigned to species is considered in Table VIII. The most frequently intercepted species was *Macrosiphum euphorbiae*, followed by *Myzus persicae*, both of which are present in Australia. For the purpose of this appendix, the quarantine pest status of the species has been included according to the pest categorisation assessment presented in Appendix F.

**Table VIII Aphid interceptions (identified to genus and species)**

Genus and species	Group	Yearly average range (a)	Present in Australia	Vectoring potential	Quarantine pest/Potential Regulated article
<i>Acyrtosiphon gossypii</i>	G	<0.5	No	Potential	Yes/potential
<i>Amphorophora catharinae</i>	G	<0.5	No	Potential	Yes/potential
<i>Aphis alstromeriae</i>	G	<0.5	No	Potential	Yes/potential
<i>Aphis craccivora</i>	E	1-5	Yes	Potential	No/potential
<i>Aphis fabae</i>	E	1-5	No	Potential	Yes/potential
<i>Aphis gossypii</i>	E	1-5	Yes	Potential	No/potential
<i>Aphis nerii</i>	G	<0.5	Yes	Potential	No/potential
<i>Aphis spiraecola</i>	F	0.5-1	Yes	Potential	No/potential

<i>Aulacorthum circumflexum</i>	G	<0.5	Yes	Potential	Yes (WA)/potential
<i>Aulacorthum rufum</i>	G	<0.5	No	Potential	Yes/potential
<i>Aulacorthum solani</i>	E	1-5	Yes	Potential	No/potential
<i>Brachycaudus helichrysi</i>	F	0.5-1	Yes	Potential	No/potential
<i>Brevicoryne brassicae</i>	G	<0.5	Yes	Potential	No/potential
<i>Cavariella aegopodii</i>	G	<0.5	Yes	Potential	No/potential
<i>Chaetosiphon tetrarhodum</i>	G	<0.5	Yes	Potential	No/potential
<i>Chaetosiphon thomasi</i>	G	<0.5	No	Potential	Yes/potential
<i>Diuraphis noxia</i>	G	<0.5	Yes	Potential	Yes/potential
<i>Dysaphis apiifolia</i>	G	<0.5	Yes	Potential	No/potential
<i>Dysaphis foeniculus</i>	G	<0.5	Yes	Potential	No/potential
<i>Idiopterus nephrolepidis</i>	G	<0.5	Yes	Potential	No/potential
<i>Macrosiphum euphorbiae</i>	C	10-50	Yes	Potential	No/potential
<i>Macrosiphum pallidum</i>	G	<0.5	No	Potential	Yes/potential
<i>Macrosiphum rosae</i>	F	0.5-1	Yes	Potential	No/potential
<i>Metopolophium dirhodum</i>	G	<0.5	Yes	Potential	Yes (WA)/potential
<i>Myzaphis rosarum</i>	G	<0.5	Yes	Potential	No/potential
<i>Myzus ascalonicus</i>	G	<0.5	Yes	Potential	Yes (WA)/potential
<i>Myzus cymbalariae</i>	G	<0.5	Yes	Potential	Yes (WA)/potential
<i>Myzus ornatus</i>	F	0.5-1	Yes	Potential	No/potential
<i>Myzus persicae</i>	D	5-10	Yes	Potential	No/potential
<i>Pseudaphis abyssinica</i>	F	0.5-1	No	Potential	Yes/potential
<i>Pseudomegoura magnoliae</i>	G	<0.5	No	Potential	Yes/potential
<i>Rhodobium porosum</i>	E	1-5	Yes	Potential	No/potential
<i>Rhopalosiphoninus staphyleae</i>	G	<0.5	Yes	Potential	No/potential
<i>Rhopalosiphum maidis</i>	G	<0.5	Yes	Potential	No/potential
<i>Rhopalosiphum nymphaeae</i>	G	<0.5	Yes	Potential	No/potential
<i>Rhopalosiphum padi</i>	G	<0.5	Yes	Potential	No/potential
<i>Sitobion luteum</i>	G	<0.5	Yes	Potential	No/potential
<i>Toxoptera aurantii</i>	G	<0.5	Yes	Potential	No/potential
<i>Toxoptera citricidus</i>	G	<0.5	Yes	Potential	No/potential

<i>Toxoptera odinae</i>	G	<0.5	No	Potential	Yes/potential
<i>Wahlgreniella nervata</i>	G	<0.5	No	Not assessed	Yes/potential

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018). Each interception event is based on the presence of at least a single aphid on a consignment. The number of aphids present per event is not generally recorded, and multiple aphid taxa can infest the same commodity.

### Order Thysanoptera (thrips) interception analysis

The breakdown of the Thysanoptera (thrips) interception events that were positively assigned to family is considered in Table IX. Of the approximately 16,500 thrips interceptions recorded by the department, 97 per cent were positively identified to family level, with three families recorded. Thripidae was the most frequently intercepted thrips family.

**Table IX Thrips interceptions (identified to family)**

Family	Proportion of all interception events (a)
Thripidae	39.27%
Phlaeothripidae	2.52%
(not identified further)	1.06%
Aeolothripidae	0.03%

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018).

The breakdown of thrips interception events that were positively assigned to genus is considered in Table X. Of the approximately 16,500 thrips interceptions recorded by the department, 76 per cent were positively identified to genus level, with 39 genera recorded. *Frankliniella*, followed by *Thrips*, are the most frequently occurring thrips genera identified as interceptions on the cut flower and foliage pathway.

**Table X Thrips interceptions (identified to genus)**

Genus	Proportion of all interception events (a)
<i>Frankliniella</i>	21.75%
(Not identified further)	10.29%
<i>Thrips</i>	9.50%
<i>Haplothrips</i>	1.92%
<i>Scirtothrips</i>	0.24%
<i>Megalurothrips</i>	0.09%
<i>Aeolothrips</i>	0.03%
<i>Anaphothrips</i>	0.02%
<i>Apterothrips</i>	0.01%
<i>Caliothrips</i>	0.01%

<i>Ceratothripoides</i>	0.01%
<i>Chaetanaphothrips</i>	0.01%
<i>Chirothrips</i>	0.01%
<i>Dichromothrips</i>	0.01%
<i>Elaphrothrips</i>	0.01%
<i>Hoplandrothrips</i>	0.01%
<i>Hydatothrips</i>	0.01%
<i>Limothrips</i>	0.01%
<i>Liothrips</i>	0.01%
<i>Microcephalothrips</i>	0.01%
<i>Neohydatothrips</i>	0.01%
<i>Nesothrips</i>	0.01%
<i>Podothrips</i>	0.01%
<i>Tenothrips</i>	0.01%
<i>Aleurodothrips</i>	<0.01%
<i>Aptinothrips</i>	<0.01%
<i>Arorathrips</i>	<0.01%
<i>Desmothrips</i>	<0.01%
<i>Echinothrips</i>	<0.01%
<i>Elaphothrips</i>	<0.01%
<i>Elixothrips</i>	<0.01%
<i>Gynaikothrips</i>	<0.01%
<i>Hoplothrips</i>	<0.01%
<i>Mycterothrips</i>	<0.01%
<i>Odontothrips</i>	<0.01%
<i>Oxythrips</i>	<0.01%
<i>Rhipidothrips</i>	<0.01%
<i>Rhipiphorothrips</i>	<0.01%

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018).

The breakdown of thrips interception events that were positively assigned to species is considered in Table XI. A total of approximately 11,000 thrips interceptions were identified to

species level, with 79 species recorded, representing 67 per cent of all recorded thrips interception events on cut flowers and foliage. About 96 per cent of thrips identified to species level were Thripidae. For the Phlaeothripidae, *Haplothrips gowdeyi*, which is not a quarantine pest for Australia, was the most frequently intercepted species. For the Thripidae, *Frankliniella occidentalis*, followed by *Thrips tabaci*, and *Frankliniella schultzei* were the most frequently intercepted species. These three species are present in Australia, but *F. occidentalis* is under official control in the Northern Territory and therefore is a quarantine pest for Australia. All three species are also known to transmit orthotospoviruses; as such, *F. occidentalis*, *T. tabaci* and *F. schultzei* are considered to be regulated articles.

For the purpose of this appendix, the quarantine pest status of the species has been included according to the pest categorisation assessment presented in Appendix F.

**Table XI Thrips interceptions (identified to genus and species)**

Genus and species	Group	Yearly average range (a)	Present in Australia	Known to transmit orthotospoviruses	Quarantine pest/Regulated article
<b>Aeolothripidae</b>					
<i>Aeolothrips fasciatus</i>	G	<0.5	Yes	No	No
<i>Desmothrips propinquus</i>	G	<0.5	Yes	No	No
<i>Rhipidothrips brunneus</i>	G	<0.5	Yes	No	No
<b>Phlaeothripidae</b>					
<i>Aleurodothrips fasciapennis</i>	G	<0.5	Yes	No	No
<i>Gynaikothrips ficorum</i>	G	<0.5	Yes	No	No
<i>Haplothrips aculeatus</i>	G	<0.5	No	No	Yes
<i>Haplothrips chinensis</i>	G	<0.5	No	No	Yes
<i>Haplothrips clarisetis</i>	G	<0.5	No	No	Yes
<i>Haplothrips collyerae</i>	G	<0.5	Yes	No	No
<i>Haplothrips ganglbaueri</i>	G	<0.5	No	No	Yes
<i>Haplothrips gowdeyi</i>	C	10-50	Yes	No	No
<i>Haplothrips kurdjumovi</i>	G	<0.5	No	No	Yes
<i>Haplothrips leucanthemi</i>	G	<0.5	Yes	No	Yes (WA)
<i>Haplothrips nigricornis</i>	G	<0.5	No	No	Yes
<i>Haplothrips tenuipennis</i>	G	<0.5	No	No	Yes
<b>Thripidae</b>					
<i>Anaphothrips dubius</i>	G	<0.5	Yes	No	No

<i>Anaphothrips sudanensis</i>	G	<0.5	Yes	No	No
<i>Apterothrips apteris</i>	G	<0.5	Yes	No	No
<i>Arorathrips mexicanus</i>	G	<0.5	Yes	No	No
<i>Caliothrips fasciatus</i>	G	<0.5	No	No	Yes
<i>Ceratothripoides brunneus</i>	G	<0.5	No	No	Yes
<i>Chaetanaphothrips orchidii</i>	G	<0.5	Yes	No	Yes (WA)
<i>Dichromothrips corbetti</i>	G	<0.5	Yes	No	Yes (WA)
<i>Echinothrips americanus</i>	G	<0.5	Yes	No	Yes (WA)
<i>Elixothrips brevisetis</i>	G	<0.5	Yes	No	Yes (WA)
<i>Frankliniella borinquen</i>	G	<0.5	No	No	Yes
<i>Frankliniella cephalica</i>	G	<0.5	No	Yes	Yes
<i>Frankliniella fusca</i>	G	<0.5	No	Yes	Yes and regulated article
<i>Frankliniella intonsa</i>	D	5-10	No	Yes	Yes and regulated article
<i>Frankliniella occidentalis</i>	A	>250	Yes	Yes	Yes (NT) and regulated article
<i>Frankliniella panamensis</i>	F	0.5-1	No	No	Yes
<i>Frankliniella schultzei</i>	C	10-50	Yes	Yes	Regulated article
<i>Frankliniella tenuicornis</i>	G	<0.5	No	No	Yes
<i>Frankliniella williamsi</i>	G	<0.5	Yes	No, but is a vector of MCMV (c)	Yes (WA)
<i>Hydatothrips adolfifriderici</i>	G	<0.5	No	No	Yes
<i>Limothrips cerealium</i>	G	<0.5	Yes	No	No
<i>Megalurothrips sjostedti</i>	E	1-5	No	No	Yes
<i>Microcephalothrips abdominalis</i>	G	<0.5	Yes	No	No
<i>Mycterothrips chaetogastra</i>	G	<0.5	No	No	Yes
<i>Mycterothrips laticauda</i>	G	<0.5	No	No	Yes
<i>Neohydatothrips samayunkur</i>	G	<0.5	Yes	No	No
<i>Nesothrips propinquus</i>	F	0.5-1	Yes	No	No
<i>Oxythrips uncinatus</i>	G	<0.5	No	No	Yes
<i>Podothrips lucasseni</i>	G	<0.5	Yes	No	No

<i>Scirtothrips aurantii</i>	F	0.5-1	Yes	No	Yes (WA)
<i>Scirtothrips dorsalis</i>	E	1-5	Yes	Yes	Regulated article
<i>Scirtothrips fuller</i>	G	<0.5	No	No	Yes
<i>Scirtothrips kenyensis</i>	G	<0.5	No	No	Yes
<i>Scirtothrips oligochaetus</i>	G	<0.5	No	No	Yes
<i>Scirtothrips spinosus</i>	G	<0.5	No	No	Yes
<i>Tenothrips frici</i>	G	<0.5	Yes	No	No
<i>Thrips abyssiniae</i>	G	<0.5	No	No	Yes
<i>Thrips acaciae</i>	G	<0.5	No	No	Yes
<i>Thrips alatus</i>	G	<0.5	No	No	Yes
<i>Thrips angusticeps</i>	G	<0.5	No	No	Yes
<i>Thrips australis</i>	G	<0.5	Yes	No	No
<i>Thrips bourbonensis</i>	G	<0.5	No	No	Yes
<i>Thrips brevicornis</i>	G	<0.5	No	No	Yes
<i>Thrips cacuminis</i>	F	0.5-1	No	No	Yes
<i>Thrips coloratus</i>	G	<0.5	Yes	No	No
<i>Thrips flavus</i>	F	0.5-1	No	No	Yes
<i>Thrips florum</i>	G	<0.5	Yes	No	No
<i>Thrips fuscipennis</i>	F	1-5	No	No	Yes
<i>Thrips gowdeyi</i>	G	<0.5	No	No	Yes
<i>Thrips hawaiiensis</i>	E	1-5	Yes	No	No
<i>Thrips imaginis</i>	F	0.5-1	Yes	No	No
<i>Thrips major</i>	F	0.5-1	No	No	Yes
<i>Thrips microchaetus</i>	G	<0.5	No	No	Yes
<i>Thrips nigropilosus</i>	G	<0.5	Yes	No	No
<i>Thrips obscuratus</i>	G	<0.5	No	No	Yes
<i>Thrips palmi</i>	D	5-10	Yes	Yes	Yes (NT, SA, Vic., WA) and regulated article
<i>Thrips parvispinus</i>	F	0.5-1	Yes	No	No
<i>Thrips pretiosus</i>	G	<0.5	No	No	Yes
<i>Thrips priesneri</i>	G	<0.5	No	No	Yes

<i>Thrips pusillus</i>	E	1-5	No	No	Yes
<i>Thrips setosus</i>	G	<0.5	No	Yes	Yes and regulated article
<i>Thrips simplex</i>	G	<0.5	Yes	No	No
<i>Thrips solari</i>	G	<0.5	No	No	Yes
<i>Thrips tabaci</i>	B	100-250	Yes	Yes	Regulated article
<i>Thrips trehernei</i>	G	<0.5	Yes	No	No
<i>Thrips vulgatissimus</i>	G	<0.5	Yes	No	Yes (WA)

**Note: a.** Calculated on the basis of interception events recorded by Australia over an 18 year period (1 January 2000 to 28 February 2018). Each interception event is based on the presence of at least a single thrips on a consignment. The number of thrips present per event is not generally recorded, and multiple thrips taxa can infest the same commodity.



## Appendix E Group pest risk analysis method

This appendix sets out the method used for the group pest risk analysis (Group PRA) in this report, as also used in the Group Thrips PRA, with some modification. This method is consistent with the principles of 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 2016d), and the requirements of the SPS Agreement (WTO 1995).

The International Plant Protection Convention (IPPC) defines PRA as ‘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 2019). A pest is ‘any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products’ (FAO 2019).

International Standard for Phytosanitary Measures Number 2: Framework for pest risk analysis (FAO 2016a) states that ‘Specific organisms may ... be analysed individually, or in groups where individual species share common biological characteristics.’ This is the basis for the Group PRA, in which organisms are grouped if they share common biological characteristics, and as a result also have similar likelihoods of entry, establishment and spread and comparable consequences—thus posing a similar level of biosecurity risk.

The department recognises there may be exceptional circumstances where risk(s) posed by specific pests differ significantly from those of the other members of the group. If technically justified, a specific risk assessment would be undertaken where such exceptions exist.

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

This Group PRA was undertaken in three consecutive stages: initiation, pest risk assessment and pest risk management.

### Stage 1: Initiation

Initiation identifies the pest(s) and pathway(s) that are of potential quarantine concern and should be considered for risk analysis in relation to the identified PRA area. For this PRA, the ‘PRA area’ is defined as all of Australia.

This group pest risk analysis was initiated by the department to review the biosecurity risks associated with the fresh cut flowers and foliage pathway. The department has previously conducted pest categorisation (multiple risk analyses) for some of the arthropods on this pathway, including the *Group pest risk analysis for thrips and orthospoviruses on fresh fruit, vegetable, cut-flower and foliage imports* (Group Thrips PRA) (Australian Government Department of Agriculture and Water Resources 2017). These risk analyses determined that some arthropods on this pathway are quarantine pests for Australia.

### Stage 2: Pest risk assessment

A pest risk assessment (for quarantine pests) is the ‘evaluation of the probability of the introduction and spread of a pest and of the magnitude of associated potential economic consequences’ (FAO 2019).

In this PRA, the pest risk assessment was undertaken in several interrelated phases, using the Group PRA approach. Where the department has conducted a previous risk assessment for a quarantine pest determined to be associated with the fresh cut flower and foliage pathway, these assessments were incorporated into the pest risk assessment.

### **Pest categorisation**

Pest categorisation in this Group PRA was undertaken on the mites, aphids and thrips on the fresh cut flowers and foliage pathway which have the potential to be quarantine pests for Australia. A quarantine pest is 'a pest of potential economic importance to the area endangered thereby and not yet present there, or present and not widely distributed and officially controlled' (FAO 2019).

The process of pest categorisation is summarised by the IPPC in the five elements outlined below:

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

The results of pest categorisation are given in Appendix F, Table XVII. The quarantine pests identified during pest categorisation were carried forward for pest risk assessment.

### **Assessment of the likelihood 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 (FAO 2016d). The SPS Agreement (WTO 1995) uses the term 'likelihood' rather than 'probability' for these estimates. In qualitative PRAs, the department uses the term 'likelihood' for the descriptors it uses for its estimates of the likelihood of entry, establishment and spread. The use of the term 'probability' is limited to the direct quotation of ISPM definitions.

A summary of this process is given in this Appendix, followed by a description of the qualitative methodology used in this pest risk analysis.

#### **Likelihood of entry**

The likelihood of entry describes the likelihood that a quarantine pest will enter Australia as a result of trade associated with the plant import pathway, be distributed in a viable state in the PRA area and be transferred to a susceptible host.

Entry is defined as the movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO 2019).

For the purpose of considering the likelihood of entry, the department divides this step into two components:

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

The overall likelihood of entry is determined by combining the likelihood of importation with that of likelihood of distribution.

Factors considered in the likelihood of importation include:

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

Factors considered in the likelihood of distribution include:

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

### **Likelihood of establishment**

Establishment is defined as the ‘perpetuation for the foreseeable future, of a pest within an area after entry’ (FAO 2019). In order to estimate the likelihood of establishment of a pest, reliable biological information (for example, life cycle, host range, epidemiology and survival) is obtained from the areas where the pest currently occurs. The situation in the PRA area can then be compared with that in the areas where it occurs and expert judgement used to assess the likelihood of establishment.

Factors considered in the likelihood of establishment include:

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

### **Likelihood of spread**

Spread is defined as ‘the expansion of the geographical distribution of a pest within an area’ (FAO 2019). The likelihood of spread considers the factors relevant to the movement of the pest, after establishment on a host plant or plants, to other susceptible host plants of the same or different species in other areas. In order to estimate the likelihood of spread of the pest, reliable biological information is obtained from areas where the pest currently occurs. The situation in the PRA area is then compared with that in the areas where the pest currently occurs and expert judgement used to assess the likelihood of spread in the PRA area.

Factors considered in the likelihood of spread include:

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

### **Assigning likelihoods for entry, establishment and spread**

Likelihoods are assigned to each step of entry, establishment and spread. Six descriptors are used: High, Moderate, Low, Very low, Extremely low and Negligible (Table XII). Descriptive definitions for these descriptors and their indicative ranges are given in Table XII. The indicative ranges are only provided to illustrate the boundaries of the descriptors and are not used beyond this purpose in qualitative PRAs. These indicative ranges provide guidance to the risk analyst and promote consistency between different pest risk assessments.

**Table XII Nomenclature for likelihoods**

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

## Combining likelihoods

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

For example, if the likelihood of importation is assigned a descriptor of 'Low' and the likelihood of distribution is assigned a descriptor of 'Moderate', then they are combined to give a likelihood of 'low' for entry. The likelihood for entry is then combined with the likelihood assigned for establishment of 'High' to give likelihood for entry and establishment of 'Low'. The likelihood for entry and establishment is then combined with the likelihood assigned for spread of 'Very low' to give the overall likelihood for entry, establishment and spread of 'Very low'. This can be summarised as:

Importation x distribution = entry [E]                      Low x Moderate = Low

[E] x establishment = [EE]                                      Low x High = Low

[EE] x spread = [EES]    Low x Very low = Very low

**Table XIII Matrix of rules for combining likelihoods**

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

## Time and volume of trade

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

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

The use of a one year volume of trade has been taken into account when setting up the matrix that is used to estimate the risk and therefore any policy based on this analysis does not simply

apply to one year of trade. Policy decisions that are based on the department's method that uses the estimated volume of one year's trade are consistent with Australia's policy on appropriate level of protection and meet the Australian Government's requirement for ongoing quarantine protection. Of course if there are substantial changes in the volume and nature of the trade in specific commodities then the department has an obligation to review the risk analysis and, if necessary, provide updated policy advice.

In assessing the volume of trade in this risk analysis the department assumed that a substantial volume of trade is occurring. Trade volumes are discussed in Chapter 5.

### **Assessment of potential consequences**

The objective of the consequences assessment is to provide a structured and transparent analysis of the potential consequences if the pests were to enter, establish and spread in Australia. The assessment considers direct and indirect pest effects and their economic and environmental consequences. The requirements for assessing potential consequences are given in Article 5.3 of the SPS Agreement (WTO 1995), ISPM 5 (FAO 2019) and ISPM 11 (FAO 2016d).

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

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

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

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

For the previous PRAs conducted by the department (and discussed in Section 6.2), the consequences were estimated over four geographic levels for each of these six criteria, defined as:

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

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

- *Indiscernible*: pest impact unlikely to be noticeable.

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

The estimates of the magnitude of the potential consequences over the four geographic levels were translated into a qualitative impact score (A–G) using Table XIV.

**Table XIV Decision rules for determining consequences impact score**

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

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

**Table XV Decision rules for determining the overall consequences rating for each pest**

Rule	The impact scores for consequences of direct and indirect criteria	Overall consequences rating
1	Any criterion has an impact of 'G'; or more than one criterion has an impact of 'F'; or a single criterion has an impact of 'F' and each remaining criterion an 'E'.	Extreme
2	A single criterion has an impact of 'F'; or all criteria have an impact of 'E'.	High
3	One or more criteria have an impact of 'E'; or all criteria have an impact of 'D'.	Moderate
4	One or more criteria have an impact of 'D'; or all criteria have an impact of 'C'.	Low
5	One or more criteria have an impact of 'C'; or all criteria have an impact of 'B'.	Very low
6	One or more but not all criteria have an impact of 'B', and all remaining criteria have an impact of 'A'.	Negligible

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

### Estimation of the unrestricted risk

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

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

**Table XVI Risk estimation matrix**

Likelihood of pest entry, establishment and spread	Consequences of pest entry, establishment and spread					
	Negligible	Very low	Low	Moderate	High	Extreme
<b>High</b>	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
<b>Moderate</b>	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
<b>Low</b>	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk	High risk
<b>Very low</b>	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk
<b>Extremely low</b>	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk
<b>Negligible</b>	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk

### Appropriate level of protection (ALOP) for Australia

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

Like many other countries, Australia expresses its ALOP in qualitative terms. The ALOP for Australia reflects community expectations through government policy, and is currently expressed as providing a high level of sanitary or phytosanitary protection aimed at reducing risk to a very low level, but not to zero. The band of cells in Table XVI marked ‘Very low risk’ represents the ALOP for Australia.



## Stage 3: Pest risk management

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

The conclusions from pest risk assessments are used to decide whether risk management is required and if so, the appropriate measures to be used. Where the unrestricted risk estimate does not achieve the ALOP for Australia, risk management measures are required to reduce this risk to a very low level. The guiding principle for risk management is to manage risk to achieve Australia's ALOP. The effectiveness of any proposed phytosanitary measure (or combination of measures) is evaluated, using the same approach as used to evaluate the unrestricted risk, to ensure the restricted risk achieves the ALOP for Australia.

ISPM 11 (FAO 2016d) provides details on the identification and selection of appropriate risk management options and notes that the choice of measures should be based on their effectiveness in reducing the likelihood of entry of the pest.

Examples given of measures commonly applied to traded commodities include:

- options for consignments, include inspection or testing for freedom from pests, prohibition of parts of the host, a pre-entry or post-entry quarantine system, specified conditions on preparation of the consignment, specified treatment of the consignment, restrictions on end-use, distribution and periods of entry of the commodity
- options preventing or reducing infestation in the crop, including treatment of the crop, restriction on the composition of a consignment so it is composed of plants belonging to resistant or less susceptible species, harvesting of plants at a certain age or specified time of the year, production in a certification scheme
- options ensuring that the area, place or site of production or crop is free from the pest, including pest-free area, pest-free place of production or pest-free production site
- options for other types of pathways, including consider natural spread, measures for human travellers and their baggage, cleaning or disinfestation of contaminated machinery
- options within the importing country, including surveillance and eradication programs
- prohibition of commodities, if no satisfactory measure can be found.

Risk management measures are identified for each quarantine pest where the unrestricted risk estimate does not achieve the ALOP for Australia. These are presented in the 'Pest Risk Management' chapter of this report.

## Appendix F Mites, aphids and thrips associated with cut flowers and foliage

This pest categorisation (Table XVII) is for the following pathway: commercially produced fresh cut flower and foliage imports from all sources to Australia. The table does not represent a comprehensive list of all the pests associated with this pathway, and also only represents the mites, aphids and thrips. Key information sources were used to generate the list of mites, aphids and thrips and these sources are identified in the potential to be on the pathway column (and these sources are provided in Table XVIII). Information presented in the geographical distribution column concentrates on known trading partner countries for this commodity.

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

Some pests identified in this table have been recorded in some regions of Australia, but due to interstate quarantine regulations and enforcement procedures, are considered under official control. The acronym for the state or territory for which the regional pest status is considered, such as 'WA' (Western Australia), is supplied for each of these organisms. Some pests have also been recorded in Australia, but due to their ability to transmit plant pathogens that have not been recorded in Australia, are regarded as potentially regulated articles.

Throughout the table acronyms are used for the Australian state or territory for which regional pest status is considered, such as 'ACT' (Australian Capital Territory), 'Qld' (Queensland), 'NSW' (New South Wales), 'NT' (Northern Territory), 'SA' (South Australia), 'Tas.' (Tasmania), 'WA' (Western Australia) or 'Vic.' (Victoria). These acronyms identify organisms that have been recorded in some regions of Australia, and if used in the quarantine pest column, due to interstate quarantine regulations are considered to be under official control.

**Table XVII Mites, aphids and thrips pest categorisation**

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<b>MITES</b>						
<b>Acari: Astigmata</b>						
<i>Histiostoma humiditatis</i> (Vitzthum, 1927) [Histiostomatidae]	India (Menon 2012), Japan (Morikawa 1959) and Taiwan (Zhang, Hong & Fan 2010).	Present, NSW (ABRS 2009; Tagami & Halliday 2013).	1	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<b>Acari: Mesostigmata</b>						
<i>Amblydromalus limonicus</i> (Garman & McGregor, 1956) [Phytoseiidae]	Ecuador (Ma, Fan & Zhang 2018) Colombia, Mexico, New Zealand, Spain and USA (Demite et al. 2018).  This species is used as a BCA by Ecuador (Letter from Agrocalidad on 15/02/2018). In addition, in Europe literature indicates its wide usage as a BCA in greenhouses in Belgium, France, the Netherlands and UK for research (CABI 2018).	Present, WA (Government of Western Australia 2017; Plant Health Australia 2018).	2, Ecuador	Assessment not required	Assessment not required	No
<i>Amblyseius largoensis</i> (Muma, 1955) [Phytoseiidae]	China, Taiwan, Tanzania, Colombia, USA (CABI 2018a), Fiji, India, Indonesia, Iran, Israel, Japan, Kenya, Malaysia, Mexico, New Caledonia, New Zealand, Papua New Guinea, Peru, Philippines, Saudi Arabia, Singapore, Sri Lanka, Thailand, American Samoa and Vanuatu (Demite et al. 2018).	Present, Qld, NT, NSW, SA and WA (ABRS 2009; Demite et al. 2018; Government of Western Australia 2017).	1	Assessment not required	Assessment not required	No
<i>Amblyseius sinuatus</i> De Leon, 1961 Synonym: <i>Amblyseius sinuatus</i> Zhu & Chen, 1980 [Phytoseiidae]	Mexico (Demite et al. 2018).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> <i>Amblyseius</i> spp. are present in Australia (ABRS 2019).	<b>Yes.</b> Members of the family Phytoseiidae are not regarded as plant pests of economic consequence (Zhang 2003). However, they are regarded as a predatory arthropod (Gerson, Smiley & Ochoa 2003) and therefore has	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					the potential for negative consequences such as environmental impact.	
<i>Amblyseius swirskii</i> Athias-Henriot, 1962 [Phytoseiidae]	Israel and Egypt (CABI 2018a), Argentina, Italy, Kenya, Saudi Arabia, Spain and USA (Demite et al. 2018).  This species is used as a BCA by the Netherlands, Kenya (Letter from KEPHIS on 29/01/2018), Ecuador (letter from Agrocalidad on 15/02/2018), Vietnam (letter from PPD on 28/02/2018) and Ethiopia (letter from MANR on 06/03/2018).	No records found (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	2, Kenya, Vietnam, Ecuador and Ethiopia	<b>Yes.</b> Assessed in Extension of Existing Policy for Sweet Oranges from Italy (Biosecurity Australia 2005a).	<b>Yes.</b> Assessed in Extension of Existing Policy for Sweet Oranges from Italy (Biosecurity Australia 2005a).	Yes
<i>Amblyseius tamatavensis</i> Blommers, 1974 [Phytoseiidae]	Papua New Guinea (CABI 2018a), Fiji, Indonesia, Japan, Kenya, Madagascar, Malawi, Malaysia, Philippines, Singapore, South Africa, Sri Lanka, Thailand and Uganda (Demite et al. 2018).	Present, NSW and Qld (ABRS 2009; Demite et al. 2018; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Androlaelaps casalis</i> (Berlese, 1887) Synonym: <i>Haemolaelaps casalis</i> [Laelapidae]	Egypt, USA, Chile, Greece and Italy (CABI 2018a).	Present, south-east Australia and WA (ABRS 2019; Domrow 1980)	1	Assessment not required	Assessment not required	No
<i>Asca spicata</i> Hurlbutt, 1963 [Ascidae]	Indonesia, Philippines, Taiwan and USA (Santos, Demite & de Moraes 2018a).	No record found (ABRS 2009; Plant Health Australia 2018).	3 & 4	<b>Yes.</b> It is known to be present in the USA and some countries across	<b>Yes.</b> Members of the family Ascidae are not regarded as plant pests of economic	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				Asia (Santos, Demite & de Moraes 2018a).	consequence. However, they are regarded as a predatory arthropod of nematodes and small arthropods. They also feed on pollen and fungi (Gerson, Smiley & Ochoa 2003). Therefore has the potential for negative consequences such as environmental impact.	
<i>Blattisocius dentriticus</i> (Berlese 1918) [Blattisociidae]	China, United Kingdom, Hawaii, India, Indonesia, Israel, Italy, Japan, Netherlands, Sri Lanka, USA (Hagstrum et al. 2013) and Brazil (Britto, Lopes & de Moraes 2012).	Present (ABRS 2019; Halliday, Walter & Lindquist 1998).	1	Assessment not required	Assessment not required	No
<i>Blattisocius keegani</i> Fox 1947 [Blattisociidae]	Canada, China, Czech Republic, Egypt, United Kingdom, Greece, Hawaii, India, Indonesia, Iraq, Israel, Malaysia, North America, Philippines, Poland, Puerto Rico, Senegal (Hagstrum et al. 2013) and Brazil (Britto, Lopes & de Moraes 2012).	Present (ABRS 2019; Halliday, Walter & Lindquist 1998).	1	Assessment not required	Assessment not required	No
<i>Lasioseius lindquisti</i> (Tseng, 1978) Synonym: <i>Lasioseius lindquisti</i> Nasr & Abou-Awad, 1987, <i>Lasioseius lindquist</i> [Blattisociidae]	Egypt (CABI 2018a), India, Saudi Arabia and Taiwan (de Moraes et al. 2016; Santos, Demite & de Moraes 2018b).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> It is known to be present in some countries across Africa (CABI 2018a) and Asia (Santos, Demite & de Moraes 2018b).	<b>Yes.</b> Members of the genus <i>Lasioseius</i> are not regarded as plant pests of economic consequence. However, they are regarded as a predatory arthropods of Collembola, soil inhabiting mites and	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					nematodes (Christian & Karg 2012). Therefore has the potential for negative consequences such as environmental impact.	
<i>Lasioseius subterraneus</i> Chant, 1963 Synonym: <i>Platyseius queenslandicus</i> Womersley, 1956 [Blattisociidae]	Egypt and Japan (Santos, Demite & de Moraes 2018b), Mexico and Central America (Walter & Lindquist 1997).	Present (Walter & Lindquist 1997).	1	Assessment not required	Assessment not required	No
<i>Lasioseius sugawarai</i> Ehara, 1964 [Blattisociidae]	Iran, Japan, Malaysia, Republic of Korea, Taiwan and USA (Santos, Demite & de Moraes 2018b).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> It is known to be present in some countries across North America and Asia (Santos, Demite & de Moraes 2018b).	<b>Yes.</b> Members of the genus <i>Lasioseius</i> are not regarded as plant pests of economic consequence. However, they are regarded as a predatory arthropod of Collembola, soil inhabiting mites and nematodes (Christian & Karg 2012). Therefore has the potential for negative consequences such as environmental impact.	Yes
<i>Lasioseius youcefi</i> Athias-Henriot, 1959 [Blattisociidae]	Egypt, France, Iran, Italy, Japan, South Africa, Republic of Korea, Switzerland, Taiwan, UAE and USA (Santos, Demite & de Moraes 2018b).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> It is known to be present in some countries across Africa, Asia, Europe and North America	<b>Yes.</b> Members of the genus <i>Lasioseius</i> are not regarded as plant pests of economic	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				(Santos, Demite & de Moraes 2018b).	consequence. However, they are regarded as a predatory arthropod of Collembola, soil inhabiting mites and nematodes (Christian & Karg 2012). Therefore has the potential for negative consequences such as environmental impact.	
<i>Macrocheles robustulus</i> (Berlese, 1904) [Macrochelidae]	New Zealand (ITIS 2018), Chile, Italy, Mexico, Portugal and USA (GBIF Secretariat 2017).  This species is used as a BCA by Ecuador (Letter from Agrocalidad on 15/02/2018).  France and the Netherlands (CABI 2018a) may use this mite as a BCA in greenhouse crops.	Present, excluding Tas. (ABRS 2009; Plant Health Australia 2018; Wallace 1986).	2, Ecuador	Assessment not required	Assessment not required	No
<i>Neoseiulus barkeri</i> Hughes, 1948 Synonym: <i>Amblyseius masiaka</i> Blommers & Chazeau, 1974, <i>Neoseiulus masiaka</i> (Blommers & Chazeau, 1974) [Phytoseiidae]	Argentina, Chile, China, Egypt, England, Greece, Iran, Israel, Italy, Japan, Kenya, Malawi, Morocco, Netherlands, Portugal, Saudi Arabia, South Africa, Republic of Korea, Spain, Thailand and USA (Demite et al. 2018).	Present, NSW, Vic., Qld, NT, Tas. and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Neoseiulus bicaudus</i> (Wainstein, 1962) [Phytoseiidae]	Egypt, France, Greece, Iran, Israel, Italy, Mexico, Portugal, Saudi Arabia, Spain, Switzerland and USA (Demite et al. 2018).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> It is known to be present in some countries across Africa, Asia, Europe, Central America and North America (Demite et al. 2018).	<b>Yes.</b> Members of the family Phytoseiidae are not regarded as plant pests of economic consequence. However, they are regarded as a predatory arthropod of nematodes, fungal spores, pollen, pest mites and exudates from plants (Zhang 2003). Therefore has the potential for negative consequences such as environmental impact.	Yes
<i>Neoseiulus californicus</i> (McGregor, 1954) Synonym: <i>Neoseiulus chilensis</i> (Dosse, 1958), <i>Neoseiulus mungeri</i> (McGregor, 1954), <i>Amblyseius californicus</i> Schuster & Pritchard (1963) [Phytoseiidae]	Argentina, Chile, France, Greece, Italy, Japan, Mexico, Morocco, Peru, Portugal, South Africa, Republic of Korea, Spain, Taiwan, USA (Demite et al. 2018), and Switzerland (CABI 2018a).  This species is used as a BCA by Kenya and the Netherlands (letter from KEPHIS on 29/01/2018), Ecuador (letter from Agrocalidad on 15/02/2018), Vietnam (letter from PPD on 28/02/2018), Ethiopia (letter from MANR on 06/03/2018), Colombia (letter from MANR on 06/03/2018).	Present, Qld and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).  This species is used as commercial BCA in Australia.	1, 2, Kenya, Ecuador, Vietnam, Ethiopia and Colombia	Assessment not required	Assessment not required	No



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Neoseiulus cucumeris</i> (Oudemans, 1930) Synonym: <i>Amblyseius cucumeris</i> (Oudemans, 1930) Misspelling: <i>Neoseilus cucumeris</i> [Phytoseiidae]	Belgium, Chile, Egypt, England, Greece, India, Iran, Israel, Italy, Mexico, Morocco, New Zealand, Portugal, Saudi Arabia, Spain, Switzerland and USA (CABI 2018a; Demite et al. 2018).  This species is used as a BCA by Kenya, the Netherlands (Letter from KEPHIS on 29/01/2018), and Ethiopia (letter from MANR on 06/03/2018).	Present, NSW, SA, ACT, Tas. and WA (ABRS 2009; Demite et al. 2018; Government of Western Australia 2017; Plant Health Australia 2018).  This species is used as commercial BCA in Australia.	1, 2 Kenya and Ethiopia	Assessment not required	Assessment not required	No
<i>Neoseiulus fallacis</i> (Garman, 1948) [Phytoseiidae]	Chile, China, India, New Zealand, Republic of Korea, USA (Demitte et al. 2018), Japan, Taiwan and Switzerland (CABI 2018a).	Present, NSW, Vic., Tas. and SA (ABRS 2009; Demite et al. 2018; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Neoseiulus longisiphonulus</i> (Wu & Lan, 1989) [Phytoseiidae]	China (Demitte et al. 2018; Wu & Lan 1989; Zhang, Hong & Fan 2010).	No record found (ABRS 2009; Demite et al. 2018).	1	<b>Yes.</b> <i>Neoseiulus</i> spp. are present in Australia.	<b>Yes.</b> Members of the family Phytoseiidae are not regarded as plant pests of economic consequence. However, they are regarded as a predatory arthropod of nematodes, fungal spores, pollen, pest mites and exudates from plants (Zhang 2003). Therefore has the potential for negative	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					consequences such as environmental impact.	
<i>Neoseiulus longispinosus</i> (Evans, 1952) Synonym: <i>Neoseiulus womersleyi</i> (Schicha, 1975) [Phytoseiidae]	China, Egypt, India, Indonesia, Japan, Malaysia, New Zealand, Pakistan, Papua New Guinea, Philippines, Republic of Korea, Sri Lanka, Taiwan, USA, Vietnam (Demite et al. 2018), and Thailand (CABI 2018a).	Present, NT NSW and Qld (ABRS 2009; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Ornithonyssus bacoti</i> (Hirst, 1913) [Macronyssidae]	Species distribution is worldwide on domestic and wild mammal and bird species, including UK (Fox et al. 2004), China (Wei et al. 2010), Israel (Rosen, Yeruham & Braverman 2002), USA (Phillis, Cromroy & Denmark 1976), and Iran (Pakdad et al. 2012).	Present, NSW, WA and SA (ABRS 2009; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Proprioseiopsis lenis</i> (Corpuz & Rimando, 1966) [Phytoseiidae]	Philippines and Australia (Corpuz-Raros 2005).	Present (ABRS 2019; Corpuz-Raros 2005).	1	Assessment not required	Assessment not required	No
<i>Phorytocarpais americanus</i> (Berlese, 1906) Synonym: <i>Parasitus americanus</i> (Berlese, 1906), <i>Gamasus americanus</i> Berlese, 1906 [Parasitidae]	South Africa (ABRS 2009), Belgium, UK, Spain (CABI 2018a), Paraguay, South America, USA, Israel, Iran, China, Mongolia, Russia, Germany, Ireland, Bulgaria and Hungary (Hrúzová & Fend'a 2017).	Present (ABRS 2009; Government of Western Australia 2017).	1	Assessment not required	Assessment not required	No
<i>Phytoseius hongkongensis</i> Swirski & Shechter, 1961 [Phytoseiidae]	China, Indonesia, Japan, Kenya, Madagascar, Malawi, Malaysia, Papua New Guinea, Republic of Korea,	Present, Qld, NT and NSW (ABRS 2009; Demite et al.	3 & 4	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Taiwan and Thailand (Demite et al. 2018).	2018; Plant Health Australia 2018).				
<i>Phytoseiulus persimilis</i> Athias-Henriot, 1957 Misspelling: <i>Phytoseilus persimilis</i> [Phytoseiidae]	Chile, China, Egypt, France, Greece, Iran, Israel, Italy, Japan, Morocco, New Caledonia, Peru, Philippines, Portugal, South Africa, Republic of Korea, Spain, USA (Demite et al. 2018), Taiwan, Belgium, Netherlands, Switzerland, UK and New Zealand (CABI 2018a).  This species is used as a BCA by Kenya and the Netherlands (Letter from KEPHIS on 29/01/2018), Ecuador (letter from Agrocalidad on 15/02/2018), Vietnam (letter from PPD on 28/02/2018), Ethiopia (letter from MANR on 06/03/2018), Colombia (letter from ICA on 07/05/2018).	Present, ACT, NSW, Qld, SA, Tas., Vic., WA and NT (ABRS 2009; Demite et al. 2018; Government of Western Australia 2017; Plant Health Australia 2018).  This species is used as commercial BCA in Australia.	1, 2 Kenya, Ecuador, Vietnam, Ethiopia and Colombia	Assessment not required	Assessment not required	No
<i>Pneumolaelaps marginalis</i> (Willman, 1953) [Laelapidae]	Europe (Evans & Till 1966).	No records found (ABRS 2019).	1	<b>Yes.</b> It is known to be present across Europe (Evans & Till 1966).	<b>Yes.</b> <i>Pneumolaelaps</i> species are parasites of primarily bumble bees (Evans & Till 1966), recent evidence also shows they are capable of infecting other bee and wasp species in New Zealand (Fan et al. 2016). Therefore has the potential for negative	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					consequences such as environmental impact.	
<i>Pneumolaelaps minutissima</i> (Evans & Till, 1961) Synonym: <i>Hypoaspis minutissima</i> Evans & Till, 1961 [Laelapidae]	Britain (Fan et al. 2016).	No record found (ABRS 2009).	1	<b>Yes.</b> It is known to be present across Britain (Fan et al. 2016).	<b>Yes.</b> <i>Pneumolaelaps</i> species are parasites of primarily bumble bees (Evans & Till 1966), recent evidence also shows they are capable of infecting other bee and wasp species in New Zealand (Fan et al. 2016). Therefore has the potential for negative consequences such as environmental impact.	Yes
<i>Proctolaelaps bickleyi</i> (Bram, 1956) [Melicharidae]	Colombia, France, Iran, Israel, Lebanon, Mexico, Netherlands, Peru, Portugal, Thailand and USA (Santos, Demite & De Moraes 2018c).	Present, Qld (ABRS 2009; Halliday, Walter & Lindquist 1998).	1	Assessment not required	Assessment not required	No
<i>Proctolaelaps pygmaeus</i> (Müller, 1859) [Melicharidae]	China, Egypt, England, India, Indonesia, Iran, Israel, Italy, Japan, the Netherlands, New Zealand, South Africa, Republic of Korea, Spain, Switzerland and USA (Santos, Demite & De Moraes 2018c).	Present, NSW, Qld, Vic. and WA (ABRS 2009; Government of Western Australia 2017; Halliday, Walter & Lindquist 1998; Santos, Demite & De Moraes 2018c).	1 & 3	Assessment not required	Assessment not required	No
<i>Rhabdocarpais consanguineus</i> (Oudemans and Voigts 1904)	Europe, North America and Israel (Hennessey & Farrier 1988), India (Bhattacharyya 1968).	No records found (ABRS 2019).	1	<b>Yes.</b> It is known to be present in some countries across Europe, North	<b>Yes.</b> Members of the family Parasitidae are not regarded as plant	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
Synonym: <i>Parasitus consanguineus</i> Oudemans and Voigts 1904 [Parasitidae]				America, Middle east and Asia (Bhattacharyya 1968; Hennessey & Farrier 1988).	pests of economic consequence. However, they are regarded as a predatory to others arthropods and nematodes (Gerson, Smiley & Ochoa 2003). Therefore has the potential for negative consequences such as environmental impact.	
<b>Acari: Trombidiformes</b>						
<i>Acaropsella volgini</i> (Gerson, 1967) [Cheyletidae]	Saudi Arabia (Al-Shammery 2014), Turkey (Koç 1998), Israel (Fain & Bochkov 2001) and Egypt (Negm & Mesbeh 2014).	No records found (ABRS 2019; Gerson 1994).	1	<b>Yes.</b> It is known to be present in some countries across the middle east (Al-Shammery 2014; Koç 1998; Negm & Mesbeh 2014).	<b>Yes.</b> Cheyletid mites are known to be predatory and parasitic, found in bird nests, manure, cotton seeds, fallen citrus fruits and debris (Negm & Mesbeh 2014). Therefore, <i>A. volgini</i> has the potential for negative consequences such as environmental impact.	Yes
<i>Aceria paradianthi</i> (Keifer, 1952) Synonym: <i>Eriophyes paradianthi</i> [Eriophyidae]	Italy (Bestagno 1962), USA (Dowell et al. 2016), and Japan (Huang 1971).	Present, SA and Vic. (ABRS 2009; Plant Health Australia 2018).	5 & 6	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Anystis baccharum</i> Linnaeus, 1758 [Anystidae]	China, Indonesia, Republic of Korea, Egypt, South Africa, USA, France, UK and New Zealand (CABI 2018a).	Present Vic., NSW, ACT and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Bakerdania operosus</i> (Rack, 1985) Synonym: <i>Cochlodispus operosus</i> Rack, 1985 [Microdispidae]	Africa and Belgium (Rack & Kaliszewski 1985).	No record found (ABRS 2009; Plant Health Australia 2018).	3 & 4	<b>Yes.</b> <i>Bakerdania operosus</i> was introduced into Belgium from soil found in an imported greenhouse ornamental plant native of tropical Africa— <i>Dracaena fragrans</i> (Rack & Kaliszewski 1985). Therefore, it has the potential to move on import plant commodities associated with soil or leaf litter from tropical regions such as Central America, Africa, and South-east Asia (Den Heyer 1979).	<b>Yes.</b> <i>Bakerdania</i> species and other Microdispids are not regarded as a plant pests of economic consequence. However, they are primitively fungivorous and some species display parasitoid associations with other arthropods (Krantz & Walter 2009). Therefore, <i>Bakerdania</i> species have the potential for negative consequences such as environmental impact.	Yes
<i>Bdella distincta</i> (Barker & Bullock, 1944) [Bdellidae]	USA, Philippines, Indonesia, Japan, China, Thailand and Taiwan (Hernandes et al. 2016).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> It is known to be present in some countries across Asia and USA (Carrillo et al. 2011; Hernandez et al. 2016).	<b>Yes.</b> <i>Bdella distincta</i> is not regarded as a plant pest of economic consequence. However, they are regarded as a predatory arthropod of <i>Raoiella indica</i> —a polyphagous plant pest with a wide host range	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					(Carrillo et al. 2011). Therefore, <i>B. distanca</i> has the potential for negative consequences such as environmental impact.	
<i>Brevipalpus californicus</i> (Banks, 1904) [Tenuipalpidae]	India (limited distribution), Israel, Japan, Malaysia (limited distribution), Nepal, Philippines, Sri Lanka, Thailand, Egypt, South Africa, Zimbabwe, Mexico, USA (limited distribution), Greece, Italy, Portugal, New Zealand, Papua New Guinea (CABI 2018a; EPPO 2018).	Present, NSW, NT, Qld, SA, Vic., WA, and Tas. (ABRS 2009; EPPO 2018; Government of Western Australia 2017; Plant Health Australia 2018).	3	Assessment not required	Assessment not required	No
<i>Brevipalpus chilensis</i> (Baker, 1949) [Tenuipalpidae]	Chile (CABI 2018a).	No record found (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	6	<b>Yes.</b> Assessed in the Import Risk Analysis for Table Grapes from Chile (Australian Government Department of Agriculture and Water Resources 2017; Biosecurity Australia 2005b).	<b>Yes.</b> Assessed in the Import Risk Analysis for Table Grapes from Chile (Biosecurity Australia 2005b).	Yes
<i>Brevipalpus obovatus</i> Donnadieu, 1875 [Tenuipalpidae]	Sri Lanka (Biosecurity Australia 2010), China, India, Iran, Israel, Japan, Lebanon, Nepal, Pakistan, Philippines, Sri Lanka, Taiwan, Egypt, Kenya, Malawi, Mauritius, South Africa, Uganda, Zimbabwe, Mexico, USA, Argentina, Belgium, France,	Present, widespread (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	3	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Greece, Italy, Portugal, Spain, Fiji, New Zealand and Vanuatu (CABI 2018a).					
<i>Brevipalpus phoenicis</i> (Geijskes, 1936) [Tenuipalpidae]	Costa Rica and the Netherlands (Beard et al. 2015).	No. Previous records are mis-identifications; present evidence suggests that <i>B. phoenicis</i> does not occur in Australia (ABRS 2009; Beard et al. 2015).	3	<b>Yes.</b> It is known to be present in some countries across Central America, and Europe (Beard et al. 2015).	<b>Yes.</b> Confirmed known pest of citrus, camphor and Canary Island date palm, however is likely to have larger host range (Beard et al. 2015).	Yes
<i>Bryobia vasiljevi</i> Reck, 1953 Synonym: <i>Bryobia repensi</i> Reck, 1953, <i>Bryobia repensi</i> Manson, 1967 [Tetranychidae]	Chile, France, Greece, Italy and New Zealand (Migeon & Dorkeld 2017).	Present, Vic. (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2018).	1	<b>Yes.</b> It is known to be present in some countries across Europe and New Zealand (Migeon & Dorkeld 2017).	<b>Yes.</b> Known pest of 22 different plant hosts including strawberry and apple (Vacante 2015).	Yes (WA)
<i>Callyntrotus schlechtendali</i> (Nalepa 1894) [Eriophyidae]	USA (Otera-Colina et al. 2018) and Germany (Druciarek & Lewandowski 2016).	No record found (ABRS 2019).	17	<b>Yes.</b> It is known to be present in some countries across the middle-east and USA (Otera-Colina et al. 2018)	<b>Yes.</b> Causes browning and rusting of leafs on roses (Druciarek & Lewandowski 2016).	Yes
<i>Cheletogenes ornatus</i> (Canestrini & Fanzago, 1876)	India, Egypt, (CABI 2018a), Colombia, Italy, Russia, Israel, South Africa, USA, Cuba (Volgin 1987).	Present, NSW (ABRS 2009).	3 & 4	Assessment not required	Assessment not required	No



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
Synonym: <i>Cheyletus ornatus</i> Canestrini & Fanzago, 1876 [Cheyletidae]						
<i>Cheletomorpha lepidopterorum</i> (Shaw, 1794) [Cheyletidae]	Cosmopolitan worldwide distribution, Russia, England, France, the Netherlands, Germany, Italy, Portugal, China, Japan, India, Indonesia, Philippines, Israel, South Africa, USA and Mexico (Volgin 1987).	Present (ABRS 2019; Gerson 1994)	1	Assessment not required	Assessment not required	No
<i>Eotetranychus lewisi</i> (McGregor, 1943) Synonym: <i>Tetranychus lewisi</i> [Tetranychidae]	Europe (unconfirmed), Mexico, Portugal, South Africa and USA (CABI 2018a), Ecuador (Molina & Chiriboga 2013; Vásquez et al. 2017; Vásquez & Dávila 2018).	No record found (ABRS 2009; Plant Health Australia 2018).	3	<b>Yes.</b> It is known to be present in some countries across Europe, North America, Central America, Asia and Africa (Vacante 2016).	<b>Yes.</b> Known to be a pest of Papaya, castor beans, figs, olives, strawberries, peaches, lemons, sweet oranges and the ornamental plant Poinsettia (Vacante 2016).	Yes
<i>Eriophyes eremus</i> Druciarek & Lewandowski, 2016 [Eriophyidae]	Israel (Druciarek & Lewandowski 2016) and USA (Otera-Colina et al. 2018).	No record found (ABRS 2019).	17	<b>Yes.</b> It is known to be present in some countries across the middle-east and USA (Druciarek & Lewandowski 2016; Otera-Colina et al. 2018).	<b>Yes.</b> As a recently described species little is known about this species. This species has been shown to inhabit roses and other species in the family are known vectors of plant viruses (Otera-Colina et al. 2018).	Yes
<i>Lorryia formosa</i> (Cooreman, 1958)	Italy (Vacante & Nucifora 1986), Florida, Spain (Aguilar & Childers 2000), Argentina, Brazil, Chile,	No records found (ABRS 2009; Plant	3	<b>Yes.</b> Assessed in Extension of Existing Policy for Sweet Oranges	<b>Yes.</b> Assessed in Extension of Existing Policy for Sweet Oranges	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
Synonym: <i>Tydeus formosa</i> Cooreman, 1958 [Tydeidae]	Ecuador, Morocco, Portugal and Uruguay (Jeppson, Keifer & Baker 1975).	Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).		from Italy (Biosecurity Australia 2005a).	from Italy (Biosecurity Australia 2005a).	
<i>Odontoscirus haramotoi</i> (Swift & Goff, 1978) Synonym: <i>Bdellodes haramotoi</i> Swift & Goff, 1978 [Bdellidae]	USA (Hernandes et al. 2016).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Mites in the Bdellidae family are known to be present in countries across Asia, Africa, America and Oceania (Carrillo et al. 2011; Hernandez et al. 2016).	<b>Yes.</b> Bdellids are not regarded as a plant pest of economic consequence. However, they are regarded as predatory arthropods of Collembola (Gerson, Smiley & Ochoa 2003). Therefore, Bdellids have the potential for negative consequences such as environmental impact.	Yes
<i>Oligonychus yothersi</i> (McGregor, 1914) Synonym: <i>Tetranychus yothersi</i> McGregor, 1914, <i>Paratetranychus yothersi</i> (McGregor), Banks, 1915 [Tetranychidae]	Hawaii (Garrett & Haramoto 1967), Iran (CABI 2018a), Ecuador, Colombia, Peru, Argentina, Chile, USA, Mexico and China (Migeon & Dorkeld 2019).	No record found (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	3	<b>Yes.</b> It is known to be present in some countries across North America, Central America, South America and Asia (Vacante 2016).	<b>Yes.</b> This pest has a broad host plant range which includes 66 species from 38 families. Some of the host plants are cashews, papaya, pomegranate, banana, guava and tea (Vacante 2016).	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Phyllocoptes fructiphilus</i> Keifer, 1940 [Eriophyidae]	USA (Allington, Staples & Viehmeyer 1968; CABI 2019; Laney et al. 2011).	No record found (ABRS 2019)	17	<b>Yes.</b> It is known to be widespread across USA (Allington, Staples & Viehmeyer 1968; CABI 2019; Laney et al. 2011)	<b>Yes.</b> Is a serious pest of roses and vector of rose rosette virus (RRV) (Allington, Staples & Viehmeyer 1968; Laney et al. 2011)	Yes
<i>Polyphagotarsonemus latus</i> Banks, 1904 [Tarsonemidae]	South Africa (ABRS 2009), China, India, Indonesia, Iran, Japan, Republic of Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Ethiopia, Kenya, Mauritius, Morocco, Uganda, USA, Panama, Argentina, Colombia, Peru, Belgium, France, Greece, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, Fiji, New Zealand and Papua New Guinea (CABI 2018a).	Present, Qld, Vic., SA, NSW, NT and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	3	Assessment not required	Assessment not required	No
<i>Rubroscirus africanus</i> Den Heyer, 1979 Synonym: <i>Cunaxa africanus</i> (Den Heyer, 1979) [Cunaxidae]	China (CABI 2018a) and South Africa (Den Heyer 1979).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Species from the family Cunaxidae are found on every continent, except Antarctica, and are also often intercepted at ports of entry (Skvarla, Fisher & Dowling 2014). <i>Rubroscirus africanus</i> was also recorded as a new species in China recently. Therefore, this species has the potential for establishment and spread.	<b>Yes.</b> Cunaxids, including <i>Rubroscirus</i> species are not regarded as a plant pest of economic consequence. However, they are regarded as opportunistic predatory arthropods of microarthropods present on live plants, soil, plant debris, moss or straw (Krantz & Walter 2009; Skvarla, Fisher & Dowling 2014). Therefore, <i>Rubroscirus</i>	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					species have the potential for negative consequences such as environmental impact.	
<i>Schizotetranychus asparagi</i> (Oudemans, 1928) [Tetranychidae]	Italy (Baraldi & Baraldi 1996), Philippines (Dayan 1988), the Netherlands, Spain, Portugal, Israel, Morocco, South Africa (de Jong 2013), Malawi, Zimbabwe, USA, and India (Migeon & Dorkeld 2017).	Not present, this species has not been recorded in Australia since the first report in 1968 and are regarded as unconfirmed (Halliday 2000).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1	<b>Yes;</b> It is known to be present in some countries across North America, Europe, Asia and Africa (Vacante 2016).	<b>Yes.</b> Known to be a pest of asparagus, pineapple and the ornamental common asparagus fern (Vacante 2016). It causes severe damage on some of its host plants. Small populations of <i>Schizotetranychus asparagi</i> cause host plants to remain small or not produce fruit; serious infestations kill the plant (Jeppson, Keifer & Baker 1975). Infested plantations or greenhouses must be completely replanted with mite-free plants to produce healthy plants and fruit again, thus causing economic consequences to the industry (Jeppson, Keifer & Baker 1975).	Yes
<i>Schizotetranychus kaspari</i> Manson, 1967	New Zealand and China (Migeon & Dorkeld 2017).	No record found (ABRS 2009; Plant	3	<b>Yes.</b> <i>Schizotetranychus kaspari</i> is native to New	<b>Yes.</b> <i>Schizotetranychus kaspari</i> is a pest of	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
[Tetranychidae]		Health Australia 2018).		Zealand, but has also been found in China, suggesting movement, establishment and spread is possible if imported. Other species in this genus have also been known to move between continents such as Europe, Asia, Africa and Oceania (Jeppson, Keifer & Baker 1975).	<i>Cordylone obtecta</i> and <i>Calopogonium mucunoides</i> (Migeon & Dorkeld 2017). Other species in the genus <i>Schizotetranychus</i> are known injurious mites to plants (Jeppson, Keifer & Baker 1975). Therefore, <i>S. kaspari</i> has the potential to cause economic consequences and negative environmental impact in Australia.	
<i>Siteroptes cerealium</i> (Kirchner, 1864) Synonym: <i>Pediculopsis graminum</i> Reuter; <i>Pediculoides graminum</i> Reuter, 1900; <i>Siteroptes graminum</i> (Reuter, 1900); <i>Siteroptes (Siteroptes) cerealium</i> (Kirchner, 1864). [Siteroptidae]	Egypt (CABI 2018a), Europe, including England (Jeppson, Keifer & Baker 1975), Poland (de Jong 2013) and Switzerland, and the USA (Massee 1944).	No record found (ABRS 2009; Plant Health Australia 2018).	6	<b>Yes.</b> <i>Siteroptes cerealium</i> has spread and established across several continents—Asia, Europe and North America (Jeppson, Keifer & Baker 1975; Massee 1944).	<b>Yes.</b> <i>Siteroptes cerealium</i> are a pest of over 30 grass species and cereal such as wheat, barley and rye (Jeppson, Keifer & Baker 1975). They have been found in cereal growing fields across North America and Eurasia causing silver top disease due to its feeding behavior (Jeppson, Keifer & Baker 1975; Krantz & Walter 2009). <i>S. cerealium</i> is also a vector of <i>Fusarium poae</i> , a fungal pathogen which causes	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					carnation bud rot (Jeppson, Keifer & Baker 1975; Krantz & Walter 2009; Massee 1944). Both situations would cause economic consequences if the pest was to be introduced into Australia.	
<i>Spinibdella cronini</i> (Baker & Balock, 1944) [Bdellidae]	USA, Mexico, Bulgaria, Egypt, Syria, Ukraine, Hungary, China, Brazil, Slovakia (Hernandes et al. 2016) and Iran (Beyzavi & Ostovan 2012).	Present, WA, SA, Vic., NSW, Qld and NT (ABRS 2009; Wallace & Mahon 1972).	1	Assessment not required	Assessment not required	No
<i>Tarsonemus bilobatus</i> Suski, 1965 Synonym: <i>Tarsonemus hungaricus</i> Schaarschmidt, 1967, <i>Lupotarsenopus bilobatus</i> [Tarsonemidae]	Japan, Republic of Korea and Egypt (CABI 2018a), Italy, Hungary, Costa Rica (Nucifora & Vacante 2004), Iran (Lotfollahi & Irani-Nejad 2010) and China (Lin & Zhang 2010).	No record found (ABRS 2009; Plant Health Australia 2018). Declared pest, prohibited in WA (Government of Western Australia 2017).	1	<b>Yes.</b> Known to be present in some countries across Central America, Europe, Asia and Africa (Zhang 2003).	<b>Yes.</b> Has been recorded as a pest of plants of economic crops such as melon, watermelon, cucumber and Chinese cabbage (Zhang 2003).	Yes
<i>Tarsonemus confusus</i> Ewing, 1939 [Tarsonemidae]	Japan, Republic of Korea (CABI 2018a), Italy, Germany, Poland, USA (Nucifora & Vacante 2004) and China (Lin & Zhang 2010).	No record found (ABRS 2009; Plant Health Australia 2018).	1 & 3	<b>Yes.</b> Known to be present in some countries across North America, Europe and Asia (Zhang 2003).	<b>Yes.</b> Has been recorded as a pest of plants of economic crops such as bulbs, citrus, pineapple, banana, kiwifruit, garlic onions, Cucurbitaceous and Rosaceous produce (PaDIL 2018).	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Tenuipalpus pacificus</i> Baker, 1945 Synonym: <i>Tenuipalpus orchidarum</i> (Parfitt) [Tenuipalpidae]	Worldwide, including Greece, France, New Zealand (Hatzinikolis 1986), USA, Panama, Thailand (Siam), Indonesia (Java), UK, the Netherlands (Jeppson, Keifer & Baker 1975), Barbados, Germany, Malaysia, Puerto Rico, Venezuela (Vacante 2016), India (Bhaskar, Mallik & Srinivasa 2013), Singapore, Philippines (Manson 1967) and Thailand (Yano et al. 1995).	Present, NT, SA, NSW and Vic. (ABRS 2009; Jeppson, Keifer & Baker 1975; Plant Health Australia 2018). Declared pest, prohibited in WA (Government of Western Australia 2017).	3 & 7	<b>Yes.</b> Known to be present in some countries across Europe and Asia-Pacific (Bhaskar, Mallik & Srinivasa 2013; Jeppson, Keifer & Baker 1975; Manson 1967; Vacante 2016; Yano et al. 1995).	<b>Yes.</b> Known pest of Orchids and ferns causing physiological damage affecting plant health and saleability (Denmark 1987).	Yes (WA)
<i>Tetranychus evansi</i> Baker & Pritchard, 1960 Synonym: <i>Tetranychus marianae</i> (Mcgregor, 1950), <i>Tetranychus takafujii</i> (Ehara and Ohashi, 2002) [Tetranychidae]	Japan, Taiwan (Ali et al. 2016), Israel, Kenya, Malawi, Mauritius, Morocco, South Africa, Zimbabwe, USA, Argentina, France, Greece, Italy, the Netherlands, Portugal, Spain (CABI 2018a; EPPO 2018), China and Israel (Migeon & Dorkeld 2017).	Present, limited distribution in NSW, Vic. and Qld (CABI 2018a; IPPC 2017; PIRSA 2017b). Declared pest, prohibited in WA (Government of Western Australia 2017)	8	<b>Yes.</b> Known to be present in some countries across North America, Europe and Asia (Ali et al. 2016; CABI 2018a; EPPO 2018; Migeon & Dorkeld 2017).	<b>Yes.</b> Has been recorded as a pest of plants of economic crops tomato, eggplant, potato, bean citrus, cotton, tobacco and roses (IPPC 2017).	Yes (WA)
<i>Tetranychus kanzawai</i> Kishida, 1927 Synonym: <i>Tetranychus hydrangeae</i> Pritchard & baker, 1955 [Tetranychidae]	China, India, Indonesia, Japan, Republic of Korea, Malaysia, Philippines, Taiwan, Thailand, Vietnam, South Africa, Mexico, Papua New Guinea (CABI 2018a), Colombia, Greece, the Netherlands, USA and Singapore (Migeon & Dorkeld 2017).	Present (Plant Health Australia 2018). Declared pest, prohibited in WA (Government of Western Australia 2017).	1, 3 & 4	<b>Yes.</b> Assessed in Final import risk analysis report for table grapes from the People's Republic of China (Biosecurity Australia 2011a), Final report for the non-regulated analysis	<b>Yes.</b> Assessed in Final import risk analysis report for table grapes from the People's Republic of China (Biosecurity Australia 2011a), Final report for the non-regulated	Yes (WA)

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				of existing policy for table grapes from Japan (Department of Agriculture 2014), Final non-regulated risk analysis report for table grapes from the Republic of Korea (Biosecurity Australia 2011b) and Final report for the non-regulated analysis of existing policy for fresh strawberry fruit from the Republic of Korea (Department of Agriculture and Water Resources 2018a).	analysis of existing policy for table grapes from Japan (Department of Agriculture 2014), Final non-regulated risk analysis report for table grapes from the Republic of Korea (Biosecurity Australia 2011b) and Final report for the non-regulated analysis of existing policy for fresh strawberry fruit from the Republic of Korea (Department of Agriculture and Water Resources 2018a).	
<i>Tetranychus lambi</i> Pritchard & Baker, 1955 Synonym: <i>Tetranychus cordylinicolus</i> Lo, 1969 [Tetranychidae]	Japan, New Caledonia, Papua New Guinea, Tonga (CABI 2018a) Fiji, Iran, New Zealand, Taiwan, and Vanuatu (Migeon & Dorkeld 2017).	Present, WA, Qld, NT, NSW and Tas. (ABRS 2009; Government of Western Australia 2017; Migeon & Dorkeld 2017; Plant Health Australia 2018).	1,3 & 4	Assessment not required	Assessment not required	No
<i>Tetranychus ludeni</i> Zacher, 1913 [Tetranychidae]	Widespread throughout tropics, including China, India, Israel, Japan, Taiwan, Thailand, Egypt, Kenya, Madagascar, Malawi, Mauritius, Morocco, South Africa, Zimbabwe,	Present, widespread, Qld, NT, NSW, Vic., WA, SA, ACT and Tas. (ABRS 2009; CABI	3	Assessment not required	Assessment not required	No



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Mexico, USA, Argentina, Chile, Colombia, France, Greece, Portugal, Spain, Fiji, New Caledonia, New Zealand, Papua New Guinea, Peru (CABI 2018a; Jeppson, Keifer & Baker 1975) and Iran (Migeon & Dorkeld 2017).	2018a; Government of Western Australia 2017; Migeon & Dorkeld 2017; Plant Health Australia 2018).				
<i>Tetranychus piercei</i> McGregor, 1950 Synonym: <i>Tetranychus manihotis</i> Flechtmann, 1981 [Tetranychidae]	Cambodia, China, Indonesia, Japan, Republic of Korea, Malaysia, Philippines, Taiwan, Thailand, Papua New Guinea and Vietnam (CABI 2018a; Migeon & Dorkeld 2017).	No record found (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	3	<b>Yes.</b> <i>Tetranychus piercei</i> was assessed in the Final import risk analysis report for the importation of Cavendish bananas from the Philippines (Biosecurity Australia 2008).	<b>Yes.</b> <i>Tetranychus piercei</i> was assessed in the Final import risk analysis report for the importation of Cavendish bananas from the Philippines (Biosecurity Australia 2008).	Yes
<i>Tetranychus shihlinensis</i> Lo, 1969 [Tetranychidae]	Taiwan (Migeon & Dorkeld 2017).	No record found (ABRS 2009; Plant Health Australia 2018).	3	<b>Yes.</b> The genus <i>Tetranychus</i> was assessed in the Final report for the non-regulated analysis of existing policy for fresh mangosteen fruit from Indonesia (DAFF 2012).	<b>Yes.</b> The genus <i>Tetranychus</i> was assessed in the Final report for the non-regulated analysis of existing policy for fresh mangosteen fruit from Indonesia (DAFF 2012).	Yes
<i>Tetranychus urticae</i> Koch, 1836 Synonym: <i>Tetranychus cinnabarinus</i> (Boisduval, 1867), <i>Tetranychus cucumeris</i> (Boisduval,	Widespread, including Ecuador (Letter from Agrocalidad on 15/02/2018), Colombia (ICA 2017b, a, c), Afghanistan, China, India, Indonesia, Iran, Israel, Japan, Republic of Korea, Lebanon, Malaysia,	Present, Vic., NT, NSW, WA, SA, Qld and Tas. (ABRS 2009; Government of Western Australia 2017;	1,2, Ecuador, 3, 4, 6, 9, 10, 11 & 12	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
1867), <i>Tetranychus urticae</i> Koch, 1835 [Tetranychidae]	Pakistan, Philippines, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Egypt, Kenya, Madagascar, Malawi, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, Mexico, USA, Argentina, Chile, Colombia, Belgium, France, Greece, Italy, the Netherlands, Spain, Switzerland, UK, New Caledonia, New Zealand, Papua New Guinea (CABI 2018a), and Fiji, Panama, Peru and Nepal (Migeon & Dorkeld 2017).	Migeon & Dorkeld 2017; Plant Health Australia 2018).				
<i>Tydeus californicus</i> (Banks, 1904) Banks, 1904 Synonym: <i>Orthotydeus californicus</i> , <i>Tetranychoides californicus</i> [Tydeidae]	Temperate areas including USA (Jeppson, Keifer & Baker 1975), Egypt, Italy, Lebanon, New Zealand, Spain, Taiwan (CABI 2018a), China (Zhang, Hong & Fan 2010), Portugal (Pereira et al. 2006) and Iran (Darbemamieh et al. 2016).	Present, NSW, Vic. and SA (ABRS 2009; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Tydeus caudatus</i> Dugés, 1834 * Synonym: <i>Tetranychus caudatus</i> Dugés, 1834, <i>Orthotydeus caudatus</i> (Dugés, 1834), <i>Tydeus spathulatus</i> Oudemans, 1928, <i>Brachytydeus caudatus</i> (Dugés) Thor 1933, <i>Tydeus (Tydeus) caudatus</i> (Dugés) Baker, 1970	Iran (Darbemamieh et al. 2016), Italy (Duso et al. 2009), China (Zhang, Hong & Fan 2010), Greece, Portugal, Egypt (Tempfli et al. 2015), Spain, France, Netherlands, UK, Tanzania and New Zealand (Andre 2011).	No records found (ABRS 2009).  Note: Few records from late 1980's in APPD (Plant Health Australia 2018) – no other publication or record in Australia, therefore	1	<b>Yes.</b> Known to be present in some countries in Europe (Ehara & Masaki 2001), Asia (Zhang, Hong & Fan 2010) and Africa (Tempfli et al. 2015).	<b>Yes.</b> Known plant hosts are <i>Citrus</i> spp., <i>Malus</i> spp., <i>Olea</i> spp. and ornamental <i>Viburnum</i> spp. and <i>Laurus</i> spp. (Ehara & Masaki 2001).	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
[Tydeidae] *The taxonomic status of this species is uncertain.		considered not present.				
<i>Tydeus kochi</i> (Oudemans, 1928) [Tydeidae]	Canada, Egypt, Greece (Hagstrum et al. 2013), and Italy (Vacante & Nucifora 1986)	No record found (ABRS 2019)	1	<b>Yes.</b> Known to be present in some countries across North America and Europe (Hagstrum et al. 2013; Vacante & Nucifora 1986).	<b>Yes.</b> Members of the <i>Tydeus</i> genus are not regarded as plant pests of economic consequence. However, they are regarded as a predatory arthropod of other mite species, fungal spores and pollen (Tempfli et al. 2015). Therefore has the potential for negative consequences such as environmental impact.	Yes
<b>Acari: Sarcoptiformes</b>						
<i>Aleuroglyphus ovatus</i> (Troupeau, 1879) [Acaridae]	China, Iran, the Netherlands, India, France, Central and South America (CABI 2018a; Colloff 2009).	Present, NSW (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1	<b>Yes.</b> Known to be present in some countries across North America, Europe and Asia (CABI 2018a; Colloff 2009).	<b>Yes.</b> Is a known pest of stored products such as grain, seeds, dried fruits, vegetables, herbs and spices (Xia et al. 2009).	Yes (WA)
<i>Glycyphagus domesticus</i> (De Geer, 1778) [Glycyphagidae]	China, UK, the Netherlands, France, Japan, Mexico and USA (CABI 2018a).	Present, NSW, SA and WA (ABRS 2009; Government of Western	1	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
		Australia 2017; Plant Health Australia 2018).				
<i>Lepidoglyphus destructor</i> (Schränk 1781) Synonym: <i>Acarus destructor</i> Schränk, 1781, <i>Glycyphagus destructor</i> (Schränk 1781) [Glycyphagidae]	Cosmopolitan worldwide distribution (Colloff 2009; Hagstrum & Subramanyam 2016).	Present (ABRS 2019; Colloff 2009)	1	Assessment not required	Assessment not required	No
<i>Procalvolia zacheri</i> (Oudemans) [Winterschmidtidae]	Europe (Thind & Ostoj-Starzewski 2003).	No record found (ABRS 2019)	1	<b>Yes.</b> Known to be present in some countries across Europe (Thind & Ostoj-Starzewski 2003).	<b>Yes.</b> Members of the family Winterschmidtidae are not regarded as plant pests of economic consequence. However, they are regarded as a predatory to others arthropods (Thind & Ostoj-Starzewski 2003). Therefore has the potential for negative consequences such as environmental impact.	Yes
<i>Rhizoglyphus caladii</i> Manson, 1972 Synonym: <i>Rhizoglyphus longispinos</i> Ho & Chen, 2001 (Fan & Zhang 2004) [Acaridae]	Taiwan, India and Nepal (Fan & Zhang 2004).	No record found (ABRS 2009; Plant Health Australia 2018).	3	<b>Yes.</b> Mites of the genus <i>Rhizoglyphus</i> are frequently found in exported and imported horticultural products (Fan & Zhang 2004).	<b>Yes.</b> Many species of the genus <i>Rhizoglyphus</i> have been identified as economic pests of crops such as carrots, onions, garlic, potatoes and bulbs, corms, and tubers of ornamental plants.	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					Miticide resistance has been documented in <i>Rhizoglyphus</i> spp. with cultural and biological control being used with limited success (Díaz et al. 2000).	
<i>Rhizoglyphus echinopus</i> (Fumouze & Robin, 1868) Synonym: <i>Tyroglyphus echinopus</i> Fumouze & Robin, 1868, <i>Rhizoglyphus callae</i> Oudemans, 1924, <i>Rhizoglyphus lucasii</i> Hughes, 1948 [Acaridae]	Southern Africa (ABRS 2009), Egypt, Fiji, Japan, New Zealand, the Netherlands, UK, Mexico, USA (Fan & Zhang 2004), Chile, China, France, Colombia, India and Spain (CABI 2018a).	Present NSW, SA, Vic., WA, Qld, and Tas. (ABRS 2009; Fan & Zhang 2004; Government of Western Australia 2017; Plant Health Australia 2018).	1 & 9	Assessment not required	Assessment not required	No
<i>Rhizoglyphus minutus</i> Manson, 1972 [Acaridae]	Fiji, Samoa, Tonga and New Zealand (Fan & Zhang 2004).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Mites of the genus <i>Rhizoglyphus</i> are frequently found in exported and imported horticultural products (Fan & Zhang 2004).	<b>Yes.</b> Many species of the genus <i>Rhizoglyphus</i> have been identified as economic pests of crops such as carrots, onions, garlic, potatoes and bulbs, corms, and tubers of ornamental plants. Miticide resistance has been documented in <i>Rhizoglyphus</i> spp. with cultural and biological control being used with limited success (Díaz et al. 2000).	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Rhizoglyphus robini</i> Claparede, 1869 Synonym: <i>Rhizoglyphus</i> Banks, 1906, <i>Rhizoglyphus</i> <i>solani</i> Oudemans, 1924, <i>Rhizoglyphus feculae</i> Oudemans, 1937, <i>Rhizoglyphus hyacinthi</i> Boisduval; Southcott, 1976 [Acaridae]	Southern Africa (ABRS 2009), Iran (CABI 2018a), Belgium, China, Taiwan, Colombia, Egypt, Fiji, France, Greece, India, Israel, Italy, Japan, Republic of Korea, Mexico, the Netherlands, New Zealand, Nepal, South Africa, Switzerland, UK, and USA (Fan & Zhang 2004).	Present, NSW (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1 & 9	<b>Yes</b> Known to be present in some countries across Africa, Americas, Europe and Asia (ABRS 2009), Iran (CABI 2018a; Fan & Zhang 2004).	<b>Yes</b> Known pest on various species of <i>Lilium</i> , <i>Dahlia</i> , <i>Allium</i> , <i>Crinum</i> , <i>Narcissus</i> and other bulb plant species (Fan & Zhang 2003).	Yes (WA)
<i>Rhizoglyphus setosus</i> Manson, 1972 [Acaridae]	Hong Kong and Taiwan (Fan, Chen & Wang 2010), Fiji, Japan, Samoa, Singapore, Thailand, Tonga and USA (Fan & Zhang 2004).	No records found (ABRS 2009; Fan & Zhang 2004).  Declared pest, prohibited in WA (Government of Western Australia 2017).	3, 6 & 9	<b>Yes.</b> Mites of the genus <i>Rhizoglyphus</i> are frequently found in exported and imported horticultural products (Fan & Zhang 2004).	<b>Yes.</b> Many species of the genus <i>Rhizoglyphus</i> have been identified as economic pests of crops such as carrots, onions, garlic, potatoes and bulbs, corms, and tubers of ornamental plants. Miticide resistance has been documented in <i>Rhizoglyphus</i> spp. with cultural and biological control being used with limited success (Díaz et al. 2000).	Yes
<i>Rhizoglyphus singularis</i> Manson, 1972 Synonym: <i>Rhizoglyphus</i> <i>tsutienensis</i> Ho & Chen, 2000 [Acaridae]	Taiwan, Fiji, India and Indonesia (Fan & Zhang 2004).	No record found (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	6 & 9	<b>Yes.</b> Mites of the genus <i>Rhizoglyphus</i> are frequently found in exported and imported horticultural products (Fan & Zhang 2004).	<b>Yes.</b> Many species of the genus <i>Rhizoglyphus</i> have been identified as economic pests of crops such as carrots, onions, garlic, potatoes and	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					bulbs, corms, and tubers of ornamental plants. Miticide resistance has been documented in <i>Rhizoglyphus</i> spp. with cultural and biological control being used with limited success (Díaz et al. 2000).	
<i>Schwiebea cuncta</i> Ho, 1993 Synonym: <i>Schwiebea (Jacotietta) cuncta</i> Ho, 1993 [Acaridae]	Taiwan (Fan, Chen & Wang 2010).	No record found (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	6 & 9	<b>Yes.</b> Studies have found species established on different continents after being imported on plant commodities (Fain 1976).	<b>Yes.</b> This pest is a known pest of the ornamental plant of <i>Lilium</i> spp. (MAF 2011).	Yes
<i>Schwiebea taiwanensis</i> Ho, 1993 [Acaridae]	Taiwan (Fan, Chen & Wang 2010).	No record found (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	9	<b>Yes.</b> Members of the genus <i>Schwiebea</i> are known to have the potential for establishment and spread. Studies have found species established on different continents after being imported on plant commodities (Fain 1976).	<b>Yes.</b> This pest is a known pest of the ornamental plant of <i>Lilium</i> spp. (MAF 2011).	Yes
<i>Tyrophagus curvipenis</i> Fain & Fauvel, 1993 [Acaridae]	New Zealand, France and Portugal (Fan & Zhang 2007).	Present (ABRS 2009; Fan & Zhang 2007).	1 & 3	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Tyrophagus longior</i> (Gervais, 1844) [Acaridae]	Worldwide (Vacante 2016).	Present (ABRS 2019).	1	Assessment not required	Assessment not required	No
<i>Tyrophagus neiswanderi</i> Johnston & Brice, 1965 [Acaridae]	New Zealand, China, Japan, Mexico, the Netherlands, South Africa, Switzerland, UK and USA (Fan & Zhang 2007).	Present (ABRS 2009; Fan & Zhang 2007).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1	<b>Yes.</b> Known to be present in some countries across Africa, North America, Europe and Asia (Fan & Zhang 2007).	<b>Yes.</b> Known pest of plant species <i>Gebera</i> , <i>Narcissus</i> , <i>Tulipa</i> , <i>Freesia</i> , and <i>Cucumis</i> (Sanchez-Ramos, Avvarez-Alfageme & Castanera 2007).	Yes (WA)
<i>Tyrophagus putrescentiae</i> (Schränk, 1781) Synonym: <i>Tyroglyphus lintneri</i> (Osborn, 1893), <i>Tyroglyphus castellani</i> Hirst, 1912 [Acaridae]	Worldwide in stored food (ABRS 2009), including New Zealand, China, Taiwan, Japan, the Netherlands, USA (Fan & Zhang 2007); India, Indonesia, Iran, Israel, Republic of Korea, Malaysia, Nepal, Philippines, Singapore, Egypt, Kenya, Zimbabwe, Mexico, Panama, Chile, Colombia, Peru, Belgium, France, Greece, Italy, Spain, Switzerland, and UK (CABI 2018a).	Present, SA, NSW, NT and WA (ABRS 2009; Fan & Zhang 2007; Government of Western Australia 2017; Plant Health Australia 2018).	1 & 3	Assessment not required	Assessment not required	No
<i>Tyrophagus similis</i> Volgin, 1949 Synonym: <i>Tyrophagus oudemansi</i> Robertson, 1959 [Acaridae]	New Zealand, the Netherlands, South Africa, UK, Belgium, China, France, Iceland, Iran, Italy, Japan, Mexico and USA (Fan & Zhang 2007).	Present (ABRS 2009; Fan & Zhang 2007; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<b>APHIDS</b>						



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<b>Hemiptera: Aphididae</b>						
<i>Acyrtosiphon gossypii</i> Mordvilko, 1914 Synonym: <i>Macrosiphum gossypii</i> [Aphididae]	India to Central Asia, Western Continental Europe, and Middle East (Gao et al. 2013); including China, Republic of Korea, Portugal, Spain (CABI 2018a), India, Sri Lanka, South Africa (Joshi & Poorani 2017) and Saudi Arabia (Favret 2018).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes/potential regulated article
<i>Amphorophora catharinae</i> (Nevsky, 1928) [Aphididae]	Iran (Mehrparvar, Mansouri & Hatami 2016).	No record found (ABRS 2009; Plant Health Australia 2018).	16	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes/potential regulated article
<i>Aphis alstroemeriae</i> Essig, 1953	Chile (Nafria et al. 2016).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Members of the Aphididae family that are	<b>Yes.</b> Members of the Aphididae family are	Yes/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
Misspelling: <i>Aphis alstromeriae</i> [Aphididae]		Health Australia 2018).		crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	
<i>Aphis craccivora</i> Koch, 1854 [Aphididae]  Note: This species includes two subspecies, <i>Aphis craccivora</i> subsp. <i>craccivora</i> and <i>Aphis craccivora</i> subsp. <i>pseudoacaciae</i> which are not listed in this pest list (Blackman & Eastop 2018; Favret 2018).	Worldwide, including India, Argentina, Japan, Iran (Blackman & Eastop 2018), Kenya (letter from KEPHIS on 29/01/2018), Ethiopia (letter from MANR on 06/03/2018), Afghanistan, Cambodia, China, Indonesia, Israel, Japan, Republic of Korea, Lebanon, Malaysia, Nepal, Pakistan, Philippines, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Egypt, Madagascar, Malawi, Mauritius, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, USA, Mexico, Chile, Belgium, France, Greece, Italy, Portugal, Spain, UK, Fiji, Kiribati, Marshall Islands, New Zealand, Papua New Guinea and Tonga (CABI 2018a).	Present, NT, NSW, Qld, Tas., Vic. and WA (ABRS 2009; CABI 2018a; Government of Western Australia 2017; Plant Health Australia 2018).	1, 2 Kenya and Ethiopia	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Aphis fabae</i> Scopoli, 1763 Synonym: <i>Aphis nerii</i> Kaltenbach, 1843 [Aphididae]	Worldwide, including Kenya (letter from KEPHIS on 29/01/2018), Ethiopia (letter from MANR on 06/03/2018), Afghanistan, China, India, Iran, Israel, Japan, Republic of Korea, Lebanon, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Taiwan, Egypt, Malawi, Mauritius, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, Mexico, USA, Argentina, Chile, Peru, Belgium, France, Greece, Iceland, Italy, the Netherlands, Portugal, Spain, Switzerland, UK (CABI 2018a) and Ecuador (letter from Agrocalidad on the 23/03/2019).	No record found (Plant Health Australia 2018).	1, 2 Kenya and Ethiopia	<b>Yes.</b> Assessed in the Netherlands Truss Tomatoes Import Policy (DAFF 2003).	<b>Yes.</b> Assessed in the Netherlands Truss Tomatoes Import Policy (DAFF 2003). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes/potential regulated article
<i>Aphis gossypii</i> Glover, 1877 [Aphididae]	Worldwide, including Kenya (Letter from KEPHIS on 29/01/2018), Ethiopia (letter from MANR on 06/03/2018), Afghanistan, Cambodia, China, India, Indonesia, Iran, Israel, Japan, Republic of Korea, Lebanon, Malaysia, Nepal, Pakistan, Philippines, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Thailand, UAE, Vietnam, Egypt, Madagascar, Malawi, Mauritius, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, Mexico, USA, Panama, Argentina, Chile, Colombia, Peru, Belgium, France, Greece, Italy, the Netherlands, Portugal, Spain, Switzerland, UK,	Present, NT, NSW, Qld, SA, Tas., Vic. and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1, 2, Kenya and Ethiopia, 3, 7 & 9	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	American Samoa, Fiji, Kiribati, Marshall Islands, New Caledonia, New Zealand, Papua New Guinea, Pitcairn Island, Tonga and Vanuatu (CABI 2018a).					
<i>Aphis nasturtii</i> Kaltenbach, 1843 [Aphididae]	Considered worldwide except for Australia (Adachi et al. 2017; CABI 2019).	No Records found (ABRS 2019)	1	<b>Yes.</b> Has a wide distribution and host range (Adachi et al. 2017).	<b>Yes.</b> This species is associated with <i>Solanum tuberosum</i> and <i>Nasturtium officinale</i> (Blackman & Eastop 2018) and is known vectors of <i>Potato Virus Y</i> (PVY) (Blackman & Eastop 2000).	Yes/potential regulated article
<i>Aphis nerii</i> Boyer de Fonscolombe, 1841 [Aphididae]	Worldwide, including India, Japan, Republic of Korea, Lebanon, Pakistan, Philippines, Saudi Arabia, Vietnam, Egypt, Mexico, USA, Argentina, Peru, Portugal and Spain (CABI 2018a).	Present, NT, Qld, Tas., Vic., SA, WA and NSW (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Aphis spiraecola</i> Patch, 1914 Synonym: <i>Aphis citricola</i> (van der Groot, 1912) [Aphididae]	Almost worldwide, including North America, Japan (Blackman & Eastop 2018), Kenya (Letter from KEPHIS on 29/01/2018), China, India, Indonesia, Iran, Israel, Japan, Republic of Korea, Lebanon, Malaysia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Egypt, Ethiopia, Malawi, Mauritius, Morocco,	Present, ACT, NSW, Qld, SA, Tas., WA and Vic. (excluding NT) (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1,2, Kenya, 3 & 4	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	South Africa, Zimbabwe, Mexico, USA, Panama, Argentina, Chile, Colombia, Ecuador, Peru, France, Greece, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, Fiji, New Zealand, Papua New Guinea and Vanuatu (CABI 2018a).					
<i>Aulacorthum circumflexum</i> (Buckton, 1876) Synonym: <i>Aulacorthum</i> (Neomyzus) <i>circumflexum</i> (Buckton, 1876), <i>Neomyzus circumflexus</i> Buckton, <i>Neomyzus circumflexum</i> (Buckton, 1876) [Aphididae]	Cosmopolitan distribution, India (CABI 2018a), Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Spain, UK, Morocco, South Africa, Hawaii, New Zealand, Indonesia, Japan, Philippines, USA, Canada, Costa Rica, Argentina, Chile, and Colombia (CABI 1990).	Present, Tas. and Vic. (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1,3 & 9	<b>Yes.</b> Known to be present in some countries across Europe and Asia (CABI 1990)  Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	<b>Yes.</b> Is a known pest of tomato and potatoes in addition to numerous ornamental plants (Martin 2017)  Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes (WA)/potential regulated article in other Australian states
<i>Aulacorthum rufum</i> Hille Ris Lambers, 1947 [Aphididae]	North-west, north and central Europe (Blackman & Eastop 2018) including UK, France, Switzerland, South Africa and Spain (Nafría, Remaudière & Durante 1991).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include	Yes/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					serious exotic pathogens for Australia.	
<i>Aulacorthum solani</i> (Kaltenbach, 1843) [Aphididae]	Cosmopolitan distribution, China, Iran, Japan, Republic of Korea, Ethiopia, Kenya, Mauritius, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, Argentina, Belgium, France, Greece, Iceland, Italy, the Netherlands, Portugal, Spain, Switzerland, UK and New Zealand (CABI 2018a).	Present, NSW, Qld, SA, Tas., Vic. and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1 & 9	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Brachycaudus cardui</i> (Linnaeus, 1758) [Aphididae]	Widespread in Europe, Asia, North Africa, North America (Blackman & Eastop 2008), USA, Central Asia, Europe, India, Middle East, north Africa, (Miller & Stoetzel 1997), China, Lebanon, Spain and Switzerland (CABI 2018a).	No record found (ABRS 2009; Plant Health Australia 2018).	13	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes/potential regulated article
<i>Brachycaudus helichrysi</i> (Kaltenbach, 1843) [Aphididae]	Widespread, including USA, (Miller & Stoetzel 1997), China, India, Iran, Republic of Korea, Lebanon, Pakistan, Taiwan, Thailand, Egypt, Argentina, Chile, France, Greece, Italy, the Netherlands, Spain, Switzerland, UK, New Zealand, and Tonga (CABI	Present, NSW, Qld, SA, Tas., Vic. and WA (ABRS 2009; Nafria, Remaudière & Durante 1991;	1 & 13	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	2018a), and Kenya (Stary & Schmutterer 1973).	Plant Health Australia 2018).		exotic pathogens for Australia.	serious exotic pathogens for Australia.	
<i>Brachycaudus (Acaudus) persicae</i> (Passerini, 1860) [Aphididae]	Worldwide distribution (Eastop 1966; Stoetzel & Miller 1998).	Present (ABRS 2019).	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Brevicoryne brassicae</i> (Linnaeus, 1758) [Aphididae]	Worldwide, including Afghanistan, China, India, Iran, Israel, Japan, Republic of Korea, Lebanon, Nepal, Pakistan, Philippines, Saudi Arabia, Taiwan, Thailand, Vietnam, Egypt, Ethiopia, Kenya, Madagascar, Malawi, Morocco, South Africa, Tanzania, Zimbabwe, Mexico, USA, Argentina, Chile, Colombia, Peru, Belgium, France, Greece, Iceland, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, New Caledonia, New Zealand (CABI 2018a) and Ecuador (Heie et al. 1996).	Present, NSW, Qld, SA, Tas., Vic., WA, NT and SA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Cavariella aegopodii</i> (Scopoli, 1763) [Aphididae]	China, India, Israel, Lebanon, France, Italy, the Netherlands, Spain, UK, New Zealand (CABI 2018a), Belgium, Iceland, Portugal and Switzerland (Nafria 2013).	Present, NSW, Tas., Vic., WA, Qld and SA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Cerataphis orchidearum</i> (Westwood, 1879) [Aphididae]	India, Indonesia, Malaysia, Philippines, Singapore, Thailand, Kenya, Madagascar, South Africa, Tanzania, Uganda, Zimbabwe, USA, Colombia, Belgium, France, Portugal, Spain, UK, and Fiji (CABI 2018a).	Present, NSW and Qld (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	3	exotic pathogens for Australia.  <b>Yes.</b> Known to be present in some countries across Europe, Africa and Asia (CABI 2018a).  Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	serious exotic pathogens for Australia.  <b>Yes.</b> Known pest of orchids, causing extensive damage making flowers unsaleable (Klara, Gabor & Laszlo 1997).  Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes (WA)/potential regulated article
<i>Chaetosiphon tetrarhodum</i> (Walker, 1849) Synonym: <i>Chaetosiphon (Pentatrachopus) tetrarhodum</i> , <i>Aphis tetrarhoda</i> Walker 1849, <i>Chaetosiphon tetrarhoda</i> (Walker, 1849) [Aphididae]	Worldwide, including UK (Blackman & Eastop 2018), Belgium, France, Greece, Italy, Portugal, Spain, Switzerland (Nafria 2013), South Africa, Kenya, Ethiopia (Remaudiere, Eastop & Autrique 1985), Chile (Stary 1993), Sri Lanka (Edirisinghe & Wijerathna 2006), India (Favret 2019) and Pakistan (Amin et al. 2017).	Present, NSW, ACT, Vic., Tas., SA and WA (ABRS 2009; Blackman & Eastop 2018; Government of Western Australia 2017; Plant Health Australia 2018).	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Chaetosiphon thomasi</i> Hille Ris Lambers, 1953 Synonym: <i>Myzus potentillae</i> Oestlund, 1886 [Aphididae]	Global distribution within temperate regions (Favret & Miller 2014), including Chile, Argentina, (Blackman & Eastop 2018), USA (Bruun 2005), and Pakistan (Amin et al. 2017).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van	Yes/potential regulated article



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	
<i>Coloradoa rufomaculata</i> (Wilson, 1908) Synonym: <i>Aphis rufomaculata</i> Wilson, 1908 [Aphididae]	Worldwide (Blackman & Eastop 2018): Central Asia, Europe, Middle East, Africa and North America, including USA, India (Hussain, Aldryhim & Al-Dhafer 2015; Miller & Stoetzel 1997), Portugal, Belgium, Iceland, Portugal, Spain, Netherlands (Nafria 2013), Saudi Arabia (CABI 2018a), New Zealand, South Africa, China, Japan, Taiwan (Favret 2019) 2019), Zimbabwe, Kenya (Remaudiere, Eastop & Autrique 1985), India (Joshi & Poorani 2017), Greece (Tsitsipis et al. 2007) and Pakistan (Bodlah, Naeem & Mohsin 2011).	Present, Vic., NSW, Tas. and WA (ABRS 2009; Government of Western Australia 2017; Miller & Stoetzel 1997; Plant Health Australia 2018).	13	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Diuraphis noxia</i> (Kurdjumov, 1913) [Aphididae]	Kenya (Letter from KEPHIS on 29/01/2018), Ethiopia (letter from MANR on 06/03/2018), Afghanistan, China, Iran, Israel, Pakistan, Saudi Arabia, Egypt, Morocco, South Africa, Zimbabwe, Mexico, USA, Argentina, Chile, France, Greece, Italy, Portugal,	Present - Anholocyclic/ Asexual form only. Limited distribution in SA, Vic., NSW and Tas.	1, 2, Kenya and Ethiopia	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington	Yes/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Spain and UK (CABI 2018a; Yoshida 2016).	(ABRS 2009; DAWR 2016; DPIPWE Tasmania 2017; EPPO 2018; Yazdani et al. 2017).		2009) and can have wide plant host ranges (Blackman & Eastop 2000).	2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	
<i>Dysaphis apiifolia</i> (Theobald, 1923) [Aphididae]	France, Argentina, Belgium, USA (CABI 2018a), Greece (Tsitsipis et al. 2007), New Zealand (Sunde 1973), Chile (Munoz 1995), Egypt (Ahmed, Soliman & Waziri 2012), South Africa and Zimbabwe (Remaudiere, Eastop & Autrique 1985), UK, Italy, North Africa, Portugal, Spain and Switzerland (Nafria 2013).	Present, Qld, Tas., Vic. and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Dysaphis foeniculus</i> (Theobald, 1923) [Aphididae]	Southern Europe, Middle East, Central Asia, Africa, North and South America, including India, Pakistan, Japan, New Zealand (Blackman & Eastop 2018), Ethiopia (Letter from MANR on 06/03/2018), Portugal, Egypt (CABI 2018a), Italy, Spain (Nafria 2013), Kenya, Tanzania, Zimbabwe and South Africa (Remaudiere, Eastop & Autrique 1985).	Present, NSW, Qld, SA, Tas., Vic. and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1 & 2, Ethiopia	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Hyadaphis foeniculi</i> (Passerini, 1860) [Aphididae]	Globally widespread, North America, Europe, Zimbabwe, South Africa and Pakistan (Eastop 1966).	Present (ABRS 2019; Eastop 1966)	1	Not applicable to vector. However, aphids are capable of vectoring a	Not applicable to vector. However, aphids are capable of vectoring a	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	
<i>Hysteroneura setariae</i> (Thomas 1878) [Aphididae]	China, Chile, India, Malaysia, Philippines, Singapore, South Africa, Sri Lanka, Taiwan (CABI 2018a), USA, Central and South America, Pacific Islands (PaDIL 2018) and North Africa (Blackman & Eastop 2018).	Present, ACT, NSW, NT, Qld, SA, WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	3	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Idiopterus nephrolepidis</i> Davis, 1909 [Aphididae]	China, USA (CABI 2018a), Greece (Tsitsipis et al. 2007), South Africa, Zimbabwe, Kenya (Remaudiere, Eastop & Autrique 1985), New Zealand (ABRS 2019), Belgium, France, Italy, UK, Portugal, Spain and the Netherlands (Nafria 2013).	Present, Tas., NSW, Qld, WA, ACT and SA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Macrosiphoniella sanborni</i> (Gillette, 1908) Synonym: <i>Macrosiphum sanborni</i> [Aphididae]	Cosmopolitan, including USA (Miller & Stoetzel 1997), UK, India, China (Blackman & Eastop 2018), Israel, Argentina, Chile, Colombia, Peru (CABI 2018a), Malaysia, Thailand, Japan, Taiwan (Tao 1963), Republic of Korea (Lee et al. 2011), South Africa, Zimbabwe, Malawi, Tanzania, Uganda, Kenya, Ethiopia (Remaudiere, Eastop & Autrique	Present, Tas., NSW, Vic., WA and Qld (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	13	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	1985), New Zealand (ABRS 2019; MacFarlane et al. 2010), Belgium, France, Italy, Portugal, Spain, Switzerland (Nafria 2013), Panama (Muller et al. 2010), Pakistan (Bodlah, Naeem & Mohsin 2011), Indonesia (Noordam 2004), and Egypt (Abul-Nasr, Swailem & Dawood 1975).					
<i>Macrosiphoniella subterranea</i> (Koch, 1855) [Aphididae]	USA and widely distributed in Europe (Blackman & Eastop 2018; Miller & Stoetzel 1997), including Belgium, France, the Netherlands and UK (Nafria 2013).	No record found (ABRS 2009; Plant Health Australia 2018).	13	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes/potential regulated article
<i>Macrosiphoniella tanacetaria</i> (Kaltenbach, 1843) [Aphididae]	Central Asia, Europe, North and South America, including Morocco, Israel, Italy, France (Blackman & Eastop 2018), Greece, Belgium, UK, Switzerland (Nafria, Remaudière & Durante 1991), USA (Miller & Stoetzel 1997), Argentina and Chile (Ortego et al. 2006).	No record found (ABRS 2009; Plant Health Australia 2018).	13	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a	Yes/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Note: this species has four subspecies whose distributions are also listed here.			(Blackman & Eastop 2000).	large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	
<i>Macrosiphum euphorbiae</i> (Thomas, 1878) [Aphididae]	Kenya (letter from KEPHIS on 29/01/2018), Ecuador (letter from Agrocalidad on 15/02/2018, (Heie et al. 1996)), Ethiopia (letter from MANR on 06/03/2018), Colombia (ICA 2017c), China, India, Iran, Israel, Japan, Republic of Korea, Lebanon, Malaysia, Pakistan, Saudi Arabia, Sri Lanka, Egypt, Malawi, Morocco, South Africa, Tanzania, Zimbabwe, Mexico, USA, Argentina, Chile, Peru, Belgium, France, Greece, Iceland, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, New Caledonia and New Zealand (CABI 2018a).	Present, NSW, Qld, SA, Tas., Vic. and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1,2, Kenya, Ecuador and Ethiopia, 3,4 & 12	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Macrosiphum pallidum</i> (Oestlund, 1887) [Aphididae]	India (Sharma & Kumar 2015) and Widespread in North America (Blackman & Eastop 2018).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include	Yes/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
					serious exotic pathogens for Australia.	
<i>Macrosiphum rosae</i> (Linnaeus, 1758) [Aphididae]	Kenya (Letter from KEPHIS on 29/01/2018), Ecuador (letter from Agrocalidad on 15/02/2018), Colombia (ICA 2017c), Afghanistan, China, India, Iran, Israel, Republic of Korea, Lebanon, Nepal, Pakistan, Egypt, Ethiopia, Malawi, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, Mexico, USA, Belgium, France, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, New Zealand (CABI 2018a), Greece (Nafria 2013), Madagascar (Stary 2005) and Peru (Delfino 2005).	Present, NSW, Tas., Vic., WA, Qld and SA (ABRS 2009; CABI 2018a; Government of Western Australia 2017; Plant Health Australia 2018).	1,2, Kenya and Ecuador, 8 & 12	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Metopolophium dirhodum</i> (Walker, 1849) Synonym: <i>Aphis dirhoda</i> Walker, 1849 [Aphididae]	Widely distributed in temperate regions around the world, including New Zealand (Blackman & Eastop 2018), Belgium, France, Greece, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, China, India, Iran, Israel, Japan, Pakistan, Egypt, Ethiopia, Kenya, Morocco, South Africa, Mexico, USA, Argentina, Chile, Colombia, Peru (CABI 2018a) and Iceland (Nafria 2013).	Present, Vic., Tas., Qld, ACT, NSW and SA (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1	<b>Yes.</b> Widely distributed in temperate regions around the world, including New Zealand (Blackman & Eastop 2018).  Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	<b>Yes.</b> Known pest on cereals crops, grasses and roses (Krzyzanowski 2017)  Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes (WA)/potential regulated article
<i>Myzaphis rosarum</i> (Kaltenbach, 1843) [Aphididae]	Cosmopolitan: Europe, Asia, North and South America, including Morocco, South Africa, New Zealand	Present, Tas. (Eastop 1966;	1	Not applicable to vector. However, aphids are capable of vectoring a	Not applicable to vector. However, aphids are capable of vectoring a	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	(Blackman & Eastop 2018), USA, Egypt (CABI 2018a), Greece (Tsitsipis et al. 2007), Turkey (Barjadze et al. 2011), UK, Belgium, France, Portugal, Spain, Switzerland and the Netherlands (Nafria 2013).	Plant Health Australia 2018).		large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	
<i>Myzus ascalonicus</i> Doncaster, 1946 [Aphididae]	Europe, North and South America, including USA, India, Japan, New Zealand (Miller & Stoetzel 1997), Belgium, France, UK, New Zealand (CABI 2018a), Italy, Iceland, Portugal, Spain, Switzerland and the Netherlands (Nafria 2013).	Present, ACT, Tas. and NSW (ABRS 2009; PaDIL 2018; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1	<b>Yes.</b> Widely distributed in temperate regions around the world (CABI 2018a; Miller & Stoetzel 1997; Nafria 2013).  Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	<b>Yes.</b> This aphid species has a large host range of vegetable crops and ornamental plants including cucurbits, brassicas, strawberry, chrysanthemum and tulips (Doncaster & Kassanis 1946; Miller & Stoetzel 1997).  This species of aphid has been shown to be capable of vectoring at numerous different plant viruses (Doncaster & Kassanis 1946).	Yes (WA)/potential regulated article
<i>Myzus cymbalariae</i> Stroyan, 1954 Synonym: <i>Myzus (Sciamyzus) cymbalariae</i> Stroyan, 1954 [Aphididae]	UK, Switzerland, Italy, Spain, South Africa, India, Pakistan, New Zealand, Chile (Blackman & Eastop 2018), Belgium, France, Switzerland (Nafria 2013), USA (Skvarla et al. 2017), Argentina (Ortego, Difabio & Durante 2004) and Greece (Tsitsipis et al. 2007).	Present, ACT, Tas. and Vic.(ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of	1 & 3	<b>Yes.</b> Widely distributed in temperate regions around the world (Blackman & Eastop 2018; Nafria 2013; Ortego, Difabio & Durante 2004; Skvarla et al. 2017; Tsitsipis et al. 2007).	<b>Yes.</b> This aphid species has a large host range including vegetable crops cucurbits and brassicas, and ornamentals within the plant families of Asteraceae,	Yes (WA)/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
		Western Australia 2017).		Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Caryophyllaceae, and Iridaceae (Favret 2019).  This species of aphid has been shown to be capable of vectoring at least 16 different plant viruses (Favret 2019).	
<i>Myzus ornatus</i> Laing, 1932 [Aphididae]	Worldwide, including Papua New Guinea, India (Blackman & Eastop 2018), Peru, Spain, UK, Portugal, New Zealand, USA, the Netherlands (CABI 2018a), Belgium, France, Italy and Switzerland (Nafria 2013), Mexico (Palmer & Pullen 2001), Kenya (Stary & Schmutterer 1973), Sri Lanka (Edirisinghe & Wijerathna 2006), Ecuador (Davila 2010) and South Africa (Hatting et al. 1999).	Present, NSW, Tas., Vic. and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).		Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Myzus persicae</i> (Sulzer, 1776) Synony: <i>Myzus (Nectarosiphon) persicae</i> (Sulzer, 1776) [Aphididae]	Kenya (letter from KEPHIS on 29/01/2018), Ethiopia (letter from MANR on 06/03/2018), Colombia (ICA 2017a, b), Ecuador (letter from Agrocalidad 23/03/2019) Afghanistan, Cambodia, China, India, Indonesia, Iran, Israel, Japan, Republic of Korea, Lebanon, Malaysia, Nepal, Pakistan, Philippines, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Egypt, Madagascar, Malawi, Mauritius, Morocco, South Africa, Tanzania,	Present, NSW, Qld, SA, Tas., Vic., WA, NT and ACT (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1, 2, Kenya and Ethiopia, 3, 4, 6, 9, 10 & 11	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Uganda, Zimbabwe, Mexico, USA, Panama, Argentina, Chile, Peru, Belgium, France, Greece, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, Fiji, New Zealand, New Caledonia, and Tonga (CABI 2018a).					
<i>Pleotrichophorus chrysanthemi</i> (Theobald, 1920) Synonym: <i>Capitophorus chrysanthemi</i> [Aphididae]	Widespread, including USA (Miller & Stoetzel 1997), South America (Chile (Munoz 1995) and Argentina (Ortego, Difabio & Durante 2004), South Africa, Egypt, Zimbabwe, India, Nepal, Japan, China (Blackman & Eastop 2018), France, Portugal, Spain, UK (Nafria 2013), Greece (Tsitsipis et al. 2007), and Republic of Korea (CABI 2018a).	Present, SA, Tas. and Vic. (ABRS 2009; Plant Health Australia 2018).	13	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Pseudaphis abyssinica</i> Hille Ris Lambers, 1954 [Aphididae]	East Africa (Ethiopia) and India (Blackman & Eastop 2018).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Pseudomegoura magnoliae</i> (Essig & Kuwana, 1918) Synonym: <i>Aulacorthum magnolia</i> [Aphididae]	China (Su & Qiao 2011), India, Japan (CABI 2018a) and Republic of Korea (Blackman & Eastop 2018).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen 2009) and can have wide plant host ranges (Blackman & Eastop 2000).	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington 2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes/potential regulated article
<i>Rhodobium porosum</i> (Sanderson, 1900) [Aphididae]	Widely distributed, including Chile (Rivera & Engel 2010), Pakistan (Amin et al. 2017), Iran (Mehrparvar, Mansouri & Hatami 2016), Korea (Department of Agriculture and Water Resources 2016a), USA, Canada (Brumley 2013), Greece (Tsitsipis et al. 2007), Mauritius, India, Pakistan, China, Taiwan, Korea, Samoa (Barjadze et al. 2011), Japan, Fiji (Barjadze et al. 2011), Kenya (Letter from KEPHIS on 29/01/2018), Turkey (CABI 2018a), UK, France, Italy, Portugal, Spain, Switzerland, the Netherlands (Nafria 2013), Colombia (Bustillo & Sanchez 1980) and Ethiopia (Negsu, Banchiamlak & Mihirat 2016).	Present, ACT, Vic., WA, Tas. and SA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1 & 2, Kenya	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Rhopalosiphoninus staphyleae</i> (Koch, 1854) Synonym: <i>Rhopalosiphum staphyleae</i> Koch, 1854, <i>Rhopalosiphoninus (Myzosiphon) staphyleae</i> (Koch, 1854) [Aphididae]	New Zealand (ABRS 2009), Belgium, UK, France, Greece, Italy, Portugal, Spain, the Netherlands (Nafria 2013), Kenya, South Africa, North America (USA), Japan and Peru (Blackman & Frazer 1987; Pita, Fernandes & Ilharco 2005).	Present, Tas., Vic. and WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Rhopalosiphum maidis</i> (Fitch, 1856) [Aphididae]	Cosmopolitan, including Pakistan, Republic of Korea, Japan (Blackman & Eastop 2018), Cambodia, China, India, Indonesia, Iran, Israel, Lebanon, Malaysia, Nepal, Philippines, Saudi Arabia, Singapore, Taiwan, Thailand, Vietnam, Egypt, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, Mexico, USA, Argentina, Chile, Colombia, Ecuador, Peru, Belgium, France, Greece, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, Fiji, New Caledonia, New Zealand, Papua New Guinea and Tonga (CABI 2018a; Nafria 2013).	Present, NSW, Qld, Tas., Vic., WA, NT and SA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Rhopalosiphum nymphaeae</i> (Linnaeus, 1761) [Aphididae]	Italy (Blackman & Eastop 2018), China, India, Iran, Philippines, Vietnam, USA, Fiji (CABI 2018a), Belgium, France, Portugal, Spain, Switzerland, the Netherlands (Nafria 2013), South Africa (Ballou, Tsai &	Present, Vic., Tas., WA, Qld, NSW and NT (ABRS 2009; Government of Western Australia	1	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Center 1986), Portugal, Spain, Italy, Yugoslavia, Poland, Great Britain, Denmark, Sweden, Norway, Finland, Russia, Morocco, Egypt, Nigeria, Zimbabwe, Kenya, Malawi, South Africa, Angola, Mozambique, New Zealand, Canada, USA, Mexico, Bermuda's, Cuba, Puerto Rico, Brazil, Argentina, Chile, Peru, Yemen (Pita & Ilharco 1997), Korea (Lee et al. 2011), and Greece (Tsitsipis et al. 2007).	2017; Plant Health Australia 2018).		exotic pathogens for Australia.	serious exotic pathogens for Australia.	
<i>Rhopalosiphum padi</i> (Linnaeus, 1758) Synonym: <i>Aphis padi</i> Linnaeus, 1758 [Aphididae]	Cosmopolitan (PaDIL 2018), including Kenya (letter from KEPHIS on 29/01/2018), Ethiopia (letter from MANR on 06/03/2018), China, India, Indonesia, Iran, Israel, Japan, Republic of Korea, Malaysia, Nepal, Pakistan, Philippines, Saudi Arabia, Taiwan, Vietnam, Egypt, Morocco, South Africa, Zimbabwe, Mexico, USA, Argentina, Chile, Colombia, Peru, Belgium, France, Greece, Iceland, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, and New Zealand (CABI 2018a).	Present, NSW, Qld, SA, Vic. and WA (ABRS 2009; Government of Western Australia 2017; PaDIL 2018; Plant Health Australia 2018).	1,2, Kenya and Ethiopia & 3.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Rhopalosiphum rufiabdominale</i> (Sasaki, 1899) Synonym: <i>Rhopalosiphum rufiabdominalis</i> (Sasaki, 1899)	Cosmopolitan, including China, India, Iran, Israel, Japan, Republic of Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand, Egypt, Kenya, Morocco, South Africa, Tanzania, Mexico, USA,	Present, NSW, Qld, SA, Tas., Vic., WA and ACT (ABRS 2009; CABI 2018a; Government of Western Australia	3	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
[Aphididae]	Argentina, Chile, Colombia, Peru, Italy, Portugal, Spain, New Zealand, Papua New Guinea (CABI 2018a), Greece, France, UK (Nafria 2013) and Ecuador (Mariau 1998).	2017; Plant Health Australia 2018).		exotic pathogens for Australia.	serious exotic pathogens for Australia.	
<i>Sitobion luteum</i> (Buckton, 1876) Synonym: <i>Macrosiphum luteum</i> [Aphididae]	Almost worldwide: Europe, North, Central and South America, including, Madagascar, Mauritius, India, Indonesia, Singapore, Papua New Guinea, Fiji, USA (Blackman & Eastop 2018), Italy, Belgium, UK, France (Nafria 2013) and Mexico (CABI 2018a).	Present, ACT, Qld and Vic. (ABRS 2009; Plant Health Australia 2018).	1 & 3	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Toxoptera aurantii</i> Fonscolombe, 1841 Synonym: <i>Aphis (Toxoptera) aurantii</i> [Aphididae]	Widespread, including Kenya (letter from KEPHIS on 29/01/2018), Ethiopia (letter from MANR on 06/03/2018), Cambodia, China, India, Indonesia, Iran, Israel, Japan, Lebanon, Malaysia, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Egypt, Malawi, Mauritius, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, Mexico, USA, Argentina, Chile, Colombia, Ecuador, Peru, France, Greece, Italy, Portugal, Spain, UK, Fiji, New Caledonia, New Zealand, Papua New Guinea, Tonga, Vanuatu (CABI 2018a) and Belgium (Nafria 2013).	Present, Qld, Tas., Vic., NSW, WA and SA (ABRS 2009; Carver 1978; Government of Western Australia 2017; PaDIL 2018; Plant Health Australia 2018).	2, Kenya and Ethiopia & 3	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Not applicable to vector. However, aphids are capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	No/potential regulated article
<i>Toxoptera citricidus</i> Stuetzel, 1994	Kenya (Letter from KEPHIS on 29/01/2018), Cambodia, China, India, Indonesia, Iran, Japan, Republic	Present, NSW, Qld, SA, Vic., WA, ACT and Tas. (ABRS	2, Kenya & 3	Not applicable to vector. However, aphids are capable of vectoring a	Not applicable to vector. However, aphids are capable of vectoring a	No/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
Synonym: <i>Aphis</i> ( <i>Toxoptera</i> ) <i>citricidus</i> , <i>Toxoptera citricida</i> Stoetzel, 1994 [Aphididae]	of Korea, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam, Ethiopia, Malawi, Mauritius, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, Mexico, USA, Panama, Argentina, Chile, Colombia, Peru, Italy, the Netherlands, Portugal, Spain, Fiji, New Zealand, Papua New Guinea, Tonga, Vanuatu (Blackman & Eastop 2018; CABI 2018a) and Ecuador (Yokomi 2009).	2009; CABI 2018a; Government of Western Australia 2017; Plant Health Australia 2018).		large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	
<i>Toxoptera odinae</i> (van der Goot, 1917) Synonym: <i>Aphis odinae</i> (van der Goot) [Aphididae]	Widely distributed in Asia and Sub-Saharan Africa (Favret & Miller 2014), including China, India, Indonesia, Japan, Republic of Korea, Malaysia, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Kenya and South Africa (Blackman & Eastop 2018; CABI 2018a).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Assessed in Policy for the Importation of Fresh Mangoes ( <i>Mangifera indica</i> L.) from Taiwan (Biosecurity Australia 2006).	<b>Yes.</b> Assessed in Policy for the Importation of Fresh Mangoes ( <i>Mangifera indica</i> L.) from Taiwan (Biosecurity Australia 2006). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	Yes/potential regulated article
<i>Wahlgreniella nervata</i> (Gillette, 1908) [Aphididae]	North, Central and South America, Europe and Africa including, Saudi Arabia, India, Pakistan, USA (Blackman & Eastop 2018), Mexico, Argentina, Chile, Peru, Greece (CABI 2018a), Belgium and Spain (Nafria 2013).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> Members of the Aphididae family that are crop pests can rapidly reach high population densities (Cœur d'acier, Hidalgo & Petrovic-Obradovic 2010; Sorensen	<b>Yes.</b> Members of the Aphididae family are known to cause serious economic damage to many food and commodity crops (van Emden & Harrington	Yes/potential regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				2009) and can have wide plant host ranges (Blackman & Eastop 2000).	2017). Aphids are also capable of vectoring a large number of plant viruses (King et al. 2012) which include serious exotic pathogens for Australia.	
<b>THRIPS</b>						
<b>Thysanoptera</b>						
<i>Aeolothrips collaris</i> Priesner, 1919 [Aeolothripidae]	Widespread across Europe to Syria and Afghanistan (ThripsWiki 2018), India (CABI 2018a) and Ethiopia (Vierbergen 2014).	No record found (ABRS 2009; Plant Health Australia 2018).	14	<b>Yes.</b> Members of the family Aeolothripidae are known to have been introduced to Australia from Europe (Mound & Marullo 1998).	<b>Yes.</b> Members of the family Aeolothripidae are not regarded as plant pests of economic consequence (Australian Government Department of Agriculture and Water Resources 2017; Mound 1997). However, predatory arthropod (ThripsWiki 2018), and therefore has the potential for negative consequences such as environmental impact.	Yes
<i>Aeolothrips fasciatus</i> (Linnaeus, 1758) [Aeolothripidae]	Italy, USA (CABI 2018a), New Zealand and Japan (Mound, Tree & Paris 2018; ThripsWiki 2018).	Present, Tas. and Vic. (ABRS 2009; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Aeolothrips tenuicornis</i> Bagnall, 1926 [Aeolothripidae]	Ethiopia (Vierbergen 2014), Egypt and widespread across Europe (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	15	<b>Yes.</b> Members of the family Aeolothripidae are known to have been introduced to Australia from Europe (Mound & Marullo 1998).	<b>Yes.</b> Members of the family Aeolothripidae are not regarded as plant pests of economic consequence (Australian Government Department of Agriculture and Water Resources 2017; Mound 1997). However, predatory arthropod (ThripsWiki 2018), and therefore has the potential for negative consequences such as environmental impact.	Yes
<i>Aleurodothrips fasciapennis</i> (Franklin, 1908) [Phlaeothripidae]	Belgium, Japan (ThripsWiki 2018), China, India, Indonesia, South Africa, USA and Fiji (CABI 2018a).	Present, NT and Qld (ABRS 2009; Plant Health Australia 2018; ThripsWiki 2018).	1	Assessment not required	Assessment not required	No
<i>Anaphothrips dubius</i> (Girault, 1926) [Thripidae]	New Zealand (ThripsWiki 2018).	Present, NSW, Qld, SA, ACT and NT (ABRS 2009; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Anaphothrips latis</i> Bhatti, 1967 [Thripidae]	India (ThripsWiki 2018) and Ethiopia (Vierbergen 2014).	No record found (ABRS 2009; Mound, Tree &	15	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae	Yes



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
		Paris 2018; Plant Health Australia 2018).		the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	
<i>Anaphothrips obscurus</i> (Müller, 1776) [Thripidae]	Worldwide in temperate areas (Australian Government Department of Agriculture and Water Resources 2017) including France, USA (ThripsWiki 2018), China, India, Israel, Egypt, Morocco, Mexico, Chile, Peru, Portugal, UK, Kiribati, Japan, Colombia, Malaysia and New Zealand (CABI 2018a).	Present, SA, WA, NSW, ACT, Vic., Tas. and Qld (CABI 2018a; Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant Health Australia 2018; ThripsWiki 2018).	1 & 14	Assessment not required	Assessment not required	No
<i>Anaphothrips sudanensis</i> Trybom, 1911 [Thripidae]	Worldwide in tropical and subtropical areas (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018) including Ethiopia (Letter from MANR on 06/03/2018)(Vierbergen 2014), Philippines, Taiwan, South Africa, Egypt, Indonesia, Sri Lanka (ThripsWiki 2018), China, India and Mexico (CABI 2018a).	Present, widespread, NT, Qld, WA, NSW, SA and Vic. (ABRS 2009; Australian Government Department of Agriculture and Water Resources 2017; Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant	1, 2, Ethiopia & 14	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
		Health Australia 2018).				
<i>Apterothrips apteris</i> (Daniel, 1904) [Thripidae]	Widespread south of California along western coast of South America, New Zealand (Mound, Tree & Paris 2018), Argentina, USA and Chile (ThripsWiki 2018).	Present, WA, Tas., NSW, SA and Vic. (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Arorathrips mexicanus</i> (Crawford, 1909) [Thripidae]	Widespread throughout the world in tropics and subtropics (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018; PaDIL 2018), including Mexico, USA and Argentina (ThripsWiki 2018).	Present, Qld, WA, NSW, NT, SA and Vic. (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018; PaDIL 2018; Plant Health Australia 2018).	1 & 14	Assessment not required	Assessment not required	No
<i>Caliothrips fasciatus</i> (Pergande, 1895) [Thripidae]	Western USA, parts of Mexico and China (Australian Government Department of Agriculture and Water Resources 2017; Mirab-balou et al. 2011; ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1, 3 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Ceratothripoides brunneus</i> Bagnall, 1918 [Thripidae]	Kenya (Letter from KEPHIS on 29/01/2018), Ethiopia, South Africa, United Republic of Tanzania, Uganda, Zimbabwe, USA, China, Indonesia,	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 2, Kenya.	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Malaysia and the Netherlands (EPPO 2018).			establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	
<i>Chaetanaphothrips orchidii</i> (Moulton, 1907) Synonym: <i>Anaphothrips orchidii</i> (Moulton) [Thripidae]	Widespread in tropical and subtropical countries including North, Central and South America, Africa, Europe, Asia, Australasia and greenhouses in temperate areas (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), including Argentina, Indonesia, USA, Japan, India, Malaysia, Nepal, Sri Lanka, Taiwan, Mauritius, Italy, Mexico, USA and Tonga (CABI 2018a; ThripsWiki 2018).	Present, NSW, Qld, SA and Vic. (ABRS 2009; Mound, Tree & Paris 2018; Plant Health Australia 2018).  Declared pest, Prohibited in WA (Government of Western Australia 2017).	1,3 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes (WA)
<i>Chaetanaphothrips signipennis</i> (Bagnall 1914) [Thripidae]	Worldwide in tropical areas (Mound, Tree & Paris 2018) including India, Indonesia, Philippines, Sri Lanka, Mexico, USA, Panama, Peru, Fiji, Papua New Guinea (Australian Government Department of Agriculture and Water Resources 2017; CABI 2018a; EPPO 2018; ThripsWiki 2018) and Ecuador (Clercx et al. 2015; Clercx & Huyghe 2013).	Present, NSW, Qld and NT (Mound, Tree & Paris 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	3,4 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes (WA)

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Chirothrips manicatus</i> (Haliday, 1836) [Thripidae]	Widespread in temperate regions (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), including Taiwan, Spain, France, USA (ThripsWiki 2018), New Zealand and UK (CABI 2018a).	Present, (Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant Health Australia 2018).	14	Assessment not required	Assessment not required	No
<i>Desmothrips propinquus</i> (Bagnall 1916) [Aeolothripidae]	Australia (Mound, Tree & Paris 2018)	Present in all states and territories (ABRS 2017; Mound, Tree & Paris 2018).	1	Assessment not required	Assessment not required	No
<i>Dichromothrips corbetti</i> (Priesner, 1936) [Thripidae]	Widespread around the world (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), including Malaysia, India, Thailand, Hawaiian Islands (ThripsWiki 2018), USA, Indonesia, Philippines, Taiwan, Singapore, the Netherlands, Belgium and Fiji (EPPO 2018).	Present, NT and Qld (Mound, Tree & Paris 2018). Declared pest, prohibited in WA (Government of Western Australia 2017).	1,3,7 & 14	<b>Yes.</b> Widespread around the world (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018).	<b>Yes.</b> Significant pest species of orchids (Masarovič et al. 2017).	Yes (WA)
<i>Dichromothrips dendrobii</i> (Sakimura 1955) [Thripidae]	USA and Philippines (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	3	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Dichromothrips smithi</i> (Zimmermann 1990) [Thripidae]	India, Malaysia, Taiwan and Japan (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	6	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Echinothrips americanus</i> Morgan, 1913 [Thripidae]	North and Central America, Europe and Asia (Australian Government Department of Agriculture and Water Resources 2017) including China, USA, Indonesia, Japan, Taiwan, Mexico, Thailand, Belgium, France, Italy UK, and the Netherlands (CABI 2018a; EPPO 2018; ThripsWiki 2018).	Present, Qld (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	3,4 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes (WA)
<i>Elixothrips brevisetis</i> (Bagnall, 1921) [Thripidae]	Taiwan and the Philippines (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018).	Present, NT and Qld (Mound, Tree & Paris 2018; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes (WA)

<b>Pest</b>	<b>Geographical Distribution</b>	<b>Present within Australia</b>	<b>Potential to be on pathway</b>	<b>Potential for establishment and spread</b>	<b>Potential for economic consequences</b>	<b>Quarantine pest/Regulated article</b>
<i>Ernothrips lobatus</i> (Bagnall, 1926) [Thripidae]	Asia (Australian Government Department of Agriculture and Water Resources 2017) including India, China, Thailand, Japan, Taiwan and Malaysia (ThripsWiki 2018).	No record found (Mound, Tree & Paris 2018).	14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Frankliniella borinquen</i> Hood, 1942 [Thripidae]	Panama (ThripsWiki 2018) and Mexico (Rocha et al. 2012).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Frankliniella cephalica</i> (Crawford, 1910) [Thripidae]	Mexico, Colombia, Japan, Taiwan (Australian Government Department of Agriculture and Water Resources 2017; Hoddle, Mound & Paris 2012; ThripsWiki 2018), USA and China (CABI 2018a).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Frankliniella fusca</i> (Hinds, 1902) [Thripidae]	Japan, and Central and North America (Australian Government Department of Agriculture and Water Resources 2017; ThripsWiki 2018), Mexico, USA and the Netherlands (CABI 2018a).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine orthotospoviruses vectored by this thrips have potential for establishment and spread (Australian Government Department of Agriculture	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine orthotospoviruses vectored by this thrips have potential for consequences (Australian Government Department of	Yes/regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				and Water Resources 2017).	Agriculture and Water Resources 2017).	
<i>Frankliniella intonsa</i> (Trybom, 1895) [Thripidae]	Europe, Asia and Pacific North America (Australian Government Department of Agriculture and Water Resources 2017) including Vietnam, Japan, Taiwan, England (ThripsWiki 2018), China, India, Iran, Israel, Republic of Korea, Pakistan, Philippines, Thailand, Italy, USA, Belgium, France, Greece, the Netherlands, Portugal, Spain, Switzerland, UK and New Zealand (CABI 2018a).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1,6,7,9 & 14	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine orthotospoviruses vectored by this thrips have potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine orthotospoviruses vectored by this thrips have potential for consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes/regulated article
<i>Frankliniella liliivora</i> Kurosawa, 1937 [Thripidae]	The Netherlands (CABI 2018a) and Japan (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	6	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Frankliniella minuta</i> (Moulton, 1907) [Thripidae]	North, Central and South America (Australian Government Department of Agriculture and Water Resources 2017; Hoddle, Mound & Paris 2012), including USA, Panama, Colombia and Peru (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Frankliniella occidentalis</i> (Pergande, 1895) Synonym: <i>Frankliniella dianthi</i> Moulton, 1948 [Thripidae]	Cosmopolitan (Australian Government Department of Agriculture and Water Resources 2017) including export partners Colombia (ICA 2017b, a, c), Ecuador (letter from Agrocalidad on 15/02/2018), Kenya (letter from KEPHIS on 29/01/2018), Ethiopia (Vierbergen 2014), Argentina, Belgium, Chile, China, Egypt, France, Greece, India, Iran, Israel, Italy, Japan, Republic of Korea, Malaysia, Mexico, Morocco, the Netherlands, New Zealand, Peru, Portugal, Singapore, South Africa, Spain, Sri Lanka, Switzerland, Thailand, Uganda, UK, USA and Zimbabwe (CABI 2018a; EPPO 2018).	Present, WA, Qld, SA, Tas., Vic., NSW and ACT (CABI 2018a; Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant Health Australia 2018).  Not present in NT; host plants are regulated by NT (DPIF 2013).	1,2, Ecuador and Kenya, 3,4, 5,8, 10,11, 12 & 14	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine orthotospoviruses vectored by this thrips have potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine orthotospoviruses vectored by this thrips have potential for consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes (NT)/regulated article
<i>Frankliniella panamensis</i> Hood, 1925 [Thripidae]	Colombia, Panama, Peru (EPPO 2018; ThripsWiki 2018) and Ecuador (Suarez, Juan & Marco 2014).	No record found (ABRS 2009; Plant Health Australia 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Frankliniella schultzei</i> (Trybom, 1910) [Thripidae]	Pantropical (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), including Kenya (letter from	Present, widespread (ABRS 2009; Mound, Tree & Paris 2018).	1, 2, Kenya and Ethiopia, 14 & 15	Not applicable to vector. However, the emerging quarantine orthotospoviruses	Not applicable to vector. However, the emerging quarantine orthotospoviruses	No/Regulated Article



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	KEPHIS on 29/01/2018), Ethiopia (letter from MANR on 06/03/2018)(Vierbergen 2014), Japan, Sri Lanka, Taiwan, Egypt, Uganda (ThripsWiki 2018), India, Iran, Israel, Malaysia, Pakistan, Philippines, Saudi Arabia, Thailand, Madagascar, Mauritius, Morocco, Zimbabwe, USA, British Virgin Islands, Argentina, Chile, Colombia, Peru, Belgium, Italy, the Netherlands, Spain, UK, Kiribati, New Caledonia and Papua New Guinea (CABI 2018a).	Assessed as a vector of emerging quarantine orthotospoviruses (Australian Government Department of Agriculture and Water Resources 2017).		vectored by this thrips have potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	vectored by this thrips have potential for consequences (Australian Government Department of Agriculture and Water Resources 2017).	
<i>Frankliniella tenuicornis</i> (Uzel, 1895) [Thripidae]	USA (ThripsWiki 2018), Republic of Korea and UK (CABI 2018a).	No record found (Mound, Tree & Paris 2018; Plant Health Australia 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Frankliniella tritici</i> (Fitch, 1855) [Thripidae]	Spain, USA (CABI 2018a) and Japan (ThripsWiki 2018).	No record found (Mound, Tree & Paris 2018).	6 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Frankliniella williamsi</i> Hood, 1915	Widespread in tropical and subtropical countries (Australian Government Department of	Present, Qld, Vic. and Tas. (Mound, Tree & Paris 2018;	1,2, Kenya & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government	Yes (WA)

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
[Thripidae]	Agriculture and Water Resources 2017; Hoddle, Mound & Paris 2012; Mound, Tree & Paris 2018), including Kenya (Letter from KEPHIS on 29/01/2018), USA, Mexico (ThripsWiki 2018), Taiwan, Thailand and Argentina (CABI 2018a).	Plant Health Australia 2018).  Declared Pest, prohibited by WA (Government of Western Australia 2017).		of Agriculture and Water Resources 2017).	Department of Agriculture and Water Resources 2017).	
<i>Franklinothrips megalops</i> Trybom, 1912 [Aeolothripidae]	Widespread in southern and eastern Africa (ThripsWiki 2018), India and Israel (CABI 2018a).	No record found (ABRS 2009; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1	<b>Yes.</b> Members of this genus are known to have spread to other countries (Mound & Reynaud 2005).	<b>Yes.</b> Predatory arthropod (ThripsWiki 2018), and therefore a potential unassessed BCA with the potential for non-target effects.	Yes
<i>Gynaikothrips ficorum</i> (Marchal, 1908) [Phlaeothripidae]	Pantropical (ABRS 2009; Australian Government Department of Agriculture and Water Resources 2017), including Taiwan, Japan (ThripsWiki 2018), China, India, Indonesia, Israel, Malaysia, Singapore, Sri Lanka, Thailand, Colombia, Peru, Vietnam, Egypt, Morocco, Spain, Mexico, USA, Panama, Argentina, France, Greece, Italy, the Netherlands, Portugal and the UK (CABI 2018a).	Present, WA, NT, Qld, NSW and Vic. (ABRS 2009; Australian Government Department of Agriculture and Water Resources 2017; Plant Health Australia 2018).	1 & 14	Assessment not required	Assessment not required	No
<i>Haplothrips aculeatus</i> (Fabricius, 1803) [Phlaeothripidae]	Europe and Asia (Australian Government Department of Agriculture and Water Resources 2017), including Japan, England (ThripsWiki 2018), China, Iran,	No record found (ABRS 2009; Mound, Tree & Paris 2018; Plant	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Republic of Korea, Vietnam, Greece, Italy, Portugal and Spain (CABI 2018a).	Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).			Agriculture and Water Resources 2017).	
<i>Haplothrips biformis</i> Moulton, 1928 [Phlaeothripidae]	Ethiopia (ThripsWiki 2018; Vierbergen 2014).	No record found (ABRS 2009; Mound, Tree & Paris 2018; Plant Health Australia 2018).	15	<b>Yes.</b> Members of the genus <i>Haplothrips</i> are known to have the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Members of the genus <i>Haplothrips</i> are known to have economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Haplothrips chinensis</i> Priesner, 1936 [Phlaeothripidae]	North Asia (Australian Government Department of Agriculture and Water Resources 2017), including Hong Kong (China), Japan and Taiwan (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1,6,9 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Haplothrips clarisetis</i> Priesner, 1930	Egypt and South Africa (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018; Plant	1	<b>Yes.</b> Members of the genus <i>Haplothrips</i> are known to have the potential for	<b>Yes.</b> Members of the genus <i>Haplothrips</i> are known to have economic consequences	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
Synonym: <i>Haplothrips (Trybomiella) clarisetis</i> Priesner, 1930 [Phlaeothripidae]		Health Australia 2018).		establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	(Australian Government Department of Agriculture and Water Resources 2017).	
<i>Haplothrips collyerae</i> (Mound & Walker, 1986) [Phlaeothripidae]	New Zealand (ThripsWiki 2018).	Present, TAS (ABRS 2009; Mound & Minaei 2007; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Haplothrips ganglbaueri</i> Schmutz, 1913 [Phlaeothripidae]	Asia, the Middle East and Egypt (Australian Government Department of Agriculture and Water Resources 2017), Kenya (Letter from KEPHIS on 29/01/2018), Sri Lanka, India, Indonesia, Japan (ThripsWiki 2018) and the Philippines (CABI 2018a).	No record found (ABRS 2009; Mound, Tree & Paris 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1,2, Kenya & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Haplothrips gowdeyi</i> (Franklin, 1908) [Phlaeothripidae]	Widespread in tropical and subtropical countries (Australian Government Department of Agriculture and Water Resources 2017; Hoddle, Mound & Paris 2012), including Ethiopia (Vierbergen 2014), USA, Kenya, United Republic of Tanzania, Sri Lanka, Japan (ThripsWiki 2018), China, India, Israel, Malaysia, Pakistan, Philippines, Taiwan, Thailand,	Present, WA, NT, Qld and NSW (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018).	1,3 & 14	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Malawi, Mauritius, South Africa, Uganda, Zimbabwe, Panama, Chile, Colombia, Portugal, Fiji, Kiribati, and Papua New Guinea (CABI 2018a).					
<i>Haplothrips kurdjumovi</i> (Karny, 1913) [Phlaeothripidae]	USA (ThripsWiki 2018), Thailand and New Zealand (CABI 2018a).	No record found (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018).	1	<b>Yes.</b> Members of the genus <i>Haplothrips</i> are known to have the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Members of the genus <i>Haplothrips</i> are known to have economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Haplothrips leucanthemi</i> (Schränk, 1781) Synonym: <i>Haplothrips niger</i> Osborn [Phlaeothripidae]	Europe, the Middle East, North America, South America, and Oceania (Australian Government Department of Agriculture and Water Resources 2017), USA (ThripsWiki 2018), Iran, New Zealand, Chile and Argentina (Hoddle, Mound & Paris 2012).	Present, NSW, SA, Vic. and Tas. (ABRS 2009; Hoddle, Mound & Paris 2012; Plant Health Australia 2018).  Declared pest, prohibited by WA (Government of Western Australia 2017).	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes (WA)
<i>Haplothrips nigricornis</i> Bagnall, 1910 [Phlaeothripidae]	South Africa (Australian Government Department of Agriculture and Water Resources 2017; ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Haplothrips tenuipennis</i> Bagnall, 1918 [Phlaeothripidae]	China, India and Indonesia (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Helionothrips errans</i> (Williams, 1916) [Thripidae]	England (ThripsWiki 2018), USA and Taiwan (Mound & Tree 2012); widespread in Asia (Mound 2009).	Present, WA and NSW (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018).	3	Assessment not required	Assessment not required	No
<i>Heliothrips haemorrhoidalis</i> (Bouché, 1833) [Thripidae]	Widespread in the tropics and subtropics, and also greenhouses in temperate areas (Australian Government Department of Agriculture and Water Resources 2017), including Sri Lanka (ThripsWiki 2018), Cambodia, China, India, Indonesia, Israel, Japan, Republic of Korea, Malaysia, Nepal, Philippines, Taiwan, Thailand, Vietnam, Egypt, Kenya, Malawi, Mauritius, Morocco, South Africa, United Republic of Tanzania, Uganda, Zimbabwe, USA, Mexico, Panama, Argentina, Chile, Colombia, Peru, Belgium, France, Greece, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, Fiji, Kiribati, New Zealand, Papua New Guinea, Tonga and Vanuatu (CABI 2018a).	Present, all states (ABRS 2009; Australian Government Department of Agriculture and Water Resources 2017; Mound & Tree 2012).	3, 9 & 14	Assessment not required	Assessment not required	No

<b>Pest</b>	<b>Geographical Distribution</b>	<b>Present within Australia</b>	<b>Potential to be on pathway</b>	<b>Potential for establishment and spread</b>	<b>Potential for economic consequences</b>	<b>Quarantine pest/Regulated article</b>
<i>Hercinothrips femoralis</i> (Reuter, 1891) [Thripidae]	Pantropical and also in greenhouses in temperate areas (Mound, Tree & Paris 2018), including USA, Japan, Republic of Korea, Spain, United Republic of Tanzania, Argentina and New Zealand (CABI 2018a).	Present, WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	3,4 & 14	Assessment not required	Assessment not required	No
<i>Hoplandrothrips flavipes</i> Bagnall, 1923 [Phlaeothripidae]	Africa, Pacific, Asia, Central and South America (Australian Government Department of Agriculture and Water Resources 2017), including Kenya, Fiji, USA, India, Japan, Indonesia, Singapore, Taiwan, Thailand, Malaysia and Colombia (ThripsWiki 2018).	Present, Qld (ABRS 2009; Mound, Tree & Paris 2018).	14	Assessment not required	Assessment not required	No
<i>Hydatothrips adolfifriderici</i> Karny, 1913 [Thripidae]	Kenya (Letter from KEPHIS on 29/01/2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 2, Kenya	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Kenyattathrips katarinae</i> Mound, 2009 [Thripidae]	Kenya (Mound, Tree & Paris 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				and Water Resources 2017).	Department of Agriculture and Water Resources 2017).	
<i>Kurtomathrips morrilli</i> Moulton, 1927 [Thripidae]	USA (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	6	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Limothrips cerealium</i> (Haliday, 1836) [Thripidae]	Worldwide in temperate areas (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), including England, Italy, USA (ThripsWiki 2018), Israel, Egypt, Morocco, South Africa, Spain, Chile, Belgium, France, Greece, the Netherlands, Portugal, Switzerland and New Zealand (CABI 2018a).	Present, Tas., SA, ACT, NSW, WA, Vic. and Qld (ABRS 2009; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1 & 14	Assessment not required	Assessment not required	No
<i>Liothrips vaneeckei</i> (Priesner, 1920) [Phlaeothripidae]	Widespread (Australian Government Department of Agriculture and Water Resources 2017), including the Netherlands, Japan and New Zealand (ThripsWiki 2018).	Present, Qld, Vic. and SA (ABRS 2009; Plant Health Australia 2018).  Declared pest, prohibited by WA (Government of	9	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes (WA)



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
		Western Australia 2017).				
<i>Megalurothrips distalis</i> (Karny, 1913) [Thripidae]	Asia (Australian Government Department of Agriculture and Water Resources 2017), including Japan, India, Indonesia (ThripsWiki 2018), China, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand and USA (CABI 2018a).	No, record for Australia (CABI 2018a) is likely based on misidentification of a SA specimen (pers. Com. L Mound 2015) (Australian Government Department of Agriculture and Water Resources 2017).	3,6,9 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Megalurothrips sjostedti</i> (Trybom, 1910) [Thripidae]	Sub-Saharan Africa and Saudi Arabia (Australian Government Department of Agriculture and Water Resources 2017), including Kenya (Letter from KEPHIS on 29/01/2018), United Republic of Tanzania, Uganda (ThripsWiki 2018), Ethiopia (Vierbergen 2014), Malawi, Mauritius, South Africa and Zimbabwe (CABI 2018a).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1,2, Kenya & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Megalurothrips usitatus</i> (Bagnall, 1913) [Thripidae]	Australasia and Asia (Australian Government Department of Agriculture and Water Resources 2017), including India, Sri Lanka, Thailand (ThripsWiki 2018), Cambodia, China, Indonesia, Japan,	Present, WA, NT, Qld and NSW (ABRS 2009; Mound, Tree & Paris 2018; Plant	14	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Malaysia, Nepal, Pakistan, Philippines, Taiwan, Vietnam, Fiji, Kiribati, Papua New Guinea and Tonga (CABI 2018a).	Health Australia 2018).				
<i>Microcephalothrips abdominalis</i> (Crawford, 1910) [Thripidae]	Tropical and subtropical around the world (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), including Mexico, USA, Egypt, India, China (ThripsWiki 2018), India, Japan, Republic of Korea, Malaysia, Taiwan, Thailand, Peru, France, Fiji, New Zealand, Tonga (CABI 2018a) and Indonesia (EPPO 2018).	Present, NT, Qld, Vic., Tas. and WA (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018).	1 & 14	Assessment not required	Assessment not required	No
<i>Mycterothrips chaetogastra</i> Ramakrishna, 1934 [Thripidae]	India (Masumoto & Qkajima, 2006).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Mycterothrips laticauda</i> Trybom, 1910 [Thripidae]	South Africa, Ghana and Chad (ThripsWiki 2018).	No record found (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
		Health Australia 2018).		and Water Resources 2017).	Department of Agriculture and Water Resources 2017).	
<i>Neohydatothrips samayunkur</i> (Kudo, 1995) [Thripidae]	North and central America, Africa, Asia and Australia (Australian Government Department of Agriculture and Water Resources 2017), including Mexico, USA, Japan, Sri Lanka, Mauritius, Kenya (Mound, Tree & Paris 2018), Taiwan, South Africa, New Zealand (ThripsWiki 2018), Egypt, France (CABI 2018a) and India (EPPO 2018).	Present, NSW, Qld and WA (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018).	1 & 14	Assessment not required	Assessment not required	No
<i>Nesothrips propinquus</i> (Bagnall, 1916) Bagnall, 1916 [Phlaeothripidae]	New Caledonia, New Zealand, and South Africa (ABRS 2009; ThripsWiki 2018).	Present, ACT, NSW, Qld, SA, Tas., Vic. and WA (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Oxythrips uncinatus</i> Priesner, 1940 [Thripidae]	Israel (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				and Water Resources 2017).	Agriculture and Water Resources 2017).	
<i>Parthenothrips dracaenae</i> (Heeger, 1854) [Thripidae]	Widespread around the world, and in temperate countries on plants in domestic environments, including Africa (Mound, Tree & Paris 2018), China (Wang 1987) and Europe (ThripsWiki 2018).	Present, ACT, NSW, Qld, Tas., WA, SA and Vic. (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant Health Australia 2018).	3 & 4	Assessment not required	Assessment not required	No
<i>Podothrips lucasseni</i> (Krüger, 1890) [Phlaeothripidae]	Asia, including Indonesia, USA, Thailand and India (ThripsWiki 2018).	Present (ABRS 2009; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Retithrips syriacus</i> (Mayet, 1890) [Thripidae]	Widespread from Africa to Syria, and recorded in Israel, Egypt (ThripsWiki 2018), Africa, India, and Florida (Australian Government Department of Agriculture and Water Resources 2017; CABI 2018a; Hoddle, Mound & Paris 2012).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Rhipidothrips brunneus</i> Williams, 1913 [Aeolothripidae]	Widespread in Europe and Mediterranean, introduced into Australia and USA (ThripsWiki 2018).	Present, WA (ABRS 2009; Government of Western Australia 2017; Plant Health Australia 2018).	1	Assessment not required	Assessment not required	No
<i>Rhipiphorothrips cruentatus</i> Hood, 1919	India, Sri Lanka, Pakistan (Australian Government Department of	No record found (ABRS 2009;	14	<b>Yes.</b> Assessed in the thrips group PRA (Australian	<b>Yes.</b> Assessed in the thrips group PRA	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
[Thripidae]	Agriculture and Water Resources 2017; Hoddle, Mound & Paris 2012; ThripsWiki 2018), China, Taiwan and Thailand (CABI 2018a).	Mound, Tree & Paris 2018).		Government Department of Agriculture and Water Resources 2017).	(Australian Government Department of Agriculture and Water Resources 2017).	
<i>Scirtothrips albomaculatus</i> Bianchi, 1945 [Thripidae]	New Caledonia (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018).	Present, NSW, SA and Qld and ACT (Mound, Tree & Paris 2018; Plant Health Australia 2018).  Declared pest, prohibited by WA (Government of Western Australia 2017).	14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes (WA)
<i>Scirtothrips aurantii</i> Faure, 1929 [Thripidae]	Widespread in Africa (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), including Kenya (Letter from KEPHIS on 29/01/2018), South Africa (ThripsWiki 2018), Egypt, Ethiopia, Malawi, Mauritius, United Republic of Tanzania, Uganda, Zimbabwe and the Netherlands (CABI 2018a).	Present, Qld and NSW (Mound, Tree & Paris 2018).  Declared pest, prohibited by WA (Government of Western Australia 2017).	1,2, Kenya & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes (WA)
<i>Scirtothrips dorsalis</i> Hood, 1919 [Thripidae]	Widespread across Asia, between Pakistan, Japan and Australia; introduced to Israel and the Caribbean area (Australian Government Department of	Present, widespread across northern Australia (Mound, Tree & Paris 2018): Qld,	1, 2, Kenya, 9 & 14	Not applicable to vector. However, the emerging quarantine orthotospoviruses vectored by this thrips	Not applicable to vector. However, the emerging quarantine orthotospoviruses vectored by this thrips	No/regulated Article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), Kenya (Letter from KEPHIS on 29/01/2018), Bangladesh (Ali et al. 2016), India, Indonesia (ThripsWiki 2018), Cambodia, China, Iran, Republic of Korea, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam, South Africa, Uganda, USA, Belgium, the Netherlands, UK, Papua New Guinea (CABI 2018a) and Spain (EPPO 2018).	NT, NSW and WA (Government of Western Australia 2017; Plant Health Australia 2018).		have potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	have potential for consequences (Australian Government Department of Agriculture and Water Resources 2017).	
<i>Scirtothrips fulleri</i> Faure, 1929 [Thripidae]	South Africa (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Scirtothrips kenyensis</i> Mound, 1968 [Thripidae]	Kenya (Letter from KEPHIS on 29/01/2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1 & 2, Kenya	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes

<b>Pest</b>	<b>Geographical Distribution</b>	<b>Present within Australia</b>	<b>Potential to be on pathway</b>	<b>Potential for establishment and spread</b>	<b>Potential for economic consequences</b>	<b>Quarantine pest/Regulated article</b>
<i>Scirtothrips mangiferae</i> Priesner, 1932 [Thripidae]	North Africa, Middle East (Australian Government Department of Agriculture and Water Resources 2017; Mound & Stiller 2011), and widespread in eastern Africa, including Egypt (ThripsWiki 2018), India, Iran and Israel (CABI 2018a).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	3 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Scirtothrips oligochaetus</i> (Karny, 1926) [Thripidae]	India (ThripsWiki 2018) and central Africa (Australian Government Department of Agriculture and Water Resources 2017).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Scirtothrips spinosus</i> Faure, 1929 [Thripidae]	South Africa (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Scolothrips rhagebianus</i> Priesner, 1950 [Thripidae]	Widespread in the tropics, Egypt, Japan and Ethiopia (Vierbergen 2014); also present in Mauritius, India and South Africa (Mound, Tree & Paris 2018; ThripsWiki 2018).	Present, Qld, NT, WA, Vic. and NSW (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018).	15	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Sigmothrips aotearoana</i> Ward, 1970 [Thripidae]	New Zealand (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	3	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Tenothrips frici</i> (Uzel, 1895) [Thripidae]	Southern Europe, South Africa, USA, Colombia, Argentina, Pakistan, Hawaii, New Zealand (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), India and Iran (ThripsWiki 2018).	Present, all states except the NT (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018).	1 & 14	Assessment not required	Assessment not required	No
<i>Thrips abyssiniae</i> Moulton, 1928 [Thripidae]	Ethiopia (ThripsWiki 2018; Vierbergen 2014).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips acaciae</i> Trybom, 1910 [Thripidae]	Kenya and Tanzania (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				and Water Resources 2017).	Agriculture and Water Resources 2017).	
<i>Thrips alatus</i> Bhatti, 1980 [Thripidae]	India (Bhatti, 1980) and Malaysia (Mound & Azidah, 2009).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips angusticeps</i> Uzel, 1895 [Thripidae]	South and southwest Asia, Africa and Europe (Australian Government Department of Agriculture and Water Resources 2017), including England, Italy (ThripsWiki 2018), Iran, Israel, Egypt, Morocco, Belgium, France, Greece, the Netherlands, Portugal, Spain, Switzerland and UK (CABI 2018a; EPPO 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips australis</i> (Bagnall, 1915) [Thripidae]	Widespread around the world where <i>Eucalyptus</i> spp. are grown (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018); including Peru, Colombia (ThripsWiki 2018), Iran, Chile, Italy (CABI 2018a), Africa, North and South America (Hoddle, Mound & Paris 2012).	Present, all states (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018).	1 & 14	Assessment not required	Assessment not required	No

<b>Pest</b>	<b>Geographical Distribution</b>	<b>Present within Australia</b>	<b>Potential to be on pathway</b>	<b>Potential for establishment and spread</b>	<b>Potential for economic consequences</b>	<b>Quarantine pest/Regulated article</b>
<i>Thrips bourbonensis</i> Bournier, 2000 [Thripidae]	France (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips brevicornis</i> Priesner, 1920 [Thripidae]	Japan (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips cacuminis</i> Vierbergen, 2014 [Thripidae]	Ethiopia (Vierbergen 2014).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 15	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes

<b>Pest</b>	<b>Geographical Distribution</b>	<b>Present within Australia</b>	<b>Potential to be on pathway</b>	<b>Potential for establishment and spread</b>	<b>Potential for economic consequences</b>	<b>Quarantine pest/Regulated article</b>
<i>Thrips coloratus</i> Schmutz, 1913 [Thripidae]	Widespread from Pakistan to Japan (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), including Sri Lanka and India (ThripsWiki 2018).	Present, Qld and NSW (ABRS 2009; Mound, Tree & Paris 2018).	1	Assessment not required	Assessment not required	No
<i>Thrips dezeewi</i> Vierbergen, 2014 [Thripidae]	Ethiopia (ThripsWiki 2018; Vierbergen 2014).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	15	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips flavus</i> Schrank, 1776 [Thripidae]	Widespread across Eurasia from Britain to China, Japan, Taiwan (Australian Government Department of Agriculture and Water Resources 2017; Hoddle, Mound & Paris 2012), India, England (ThripsWiki 2018), Iran, Malaysia, Nepal, Pakistan, Philippines, Thailand, France, Italy, Spain, Switzerland and UK (CABI 2018a).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips florum</i> Schmutz, 1913 [Thripidae]	Widespread across Asia and Pacific, Florida, the Caribbean Islands (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), Sri	Present, NT, Qld, NT and WA (ABRS 2009; Government of Western Australia	1 & 14	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Lanka, Indonesia, USA (ThripsWiki 2018) and India (CABI 2018a).	2017; Mound, Tree & Paris 2018; Plant Health Australia 2018).				
<i>Thrips fuscipennis</i> Haliday, 1836 [Thripidae]	Europe and North America (Australian Government Department of Agriculture and Water Resources 2017; ThripsWiki 2018), including Greece, Italy and the Netherlands (CABI 2018a).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1, 6 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips gowdeyi</i> Bagnall, 1919 [Thripidae]	Kenya (Letter from KEPHIS on 29/01/2018), Uganda and Zimbabwe (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 2, Kenya	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips hawaiiensis</i> (Morgan, 1913) [Thripidae]	Widespread across Asia and the Pacific Islands, Southern USA, Jamaica (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), Indonesia, Japan, Sri Lanka, Fiji (ThripsWiki 2018), China, India, Iran, Republic of Korea, Malaysia, Pakistan, Philippines, Singapore, Taiwan, Thailand, Vietnam, Uganda, Mexico, USA, France, Spain, New Zealand, Papua New Guinea, Vanuatu	Present, NT, Qld, NSW, WA, SA and Vic. (ABRS 2009; Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1,3,7,9 & 14	Assessment not required	Assessment not required	No

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	(CABI 2018a) and Ethiopia (Vierbergen 2014).					
<i>Thrips imaginis</i> Bagnall, 1926 Misspelling: <i>Thrips imagines</i> [Thripidae]	Oceania (Australian Government Department of Agriculture and Water Resources 2017) including New Caledonia, New Zealand (Mound, Tree & Paris 2018), Fiji and Papua New Guinea (CABI 2018a).	Present, all states (ABRS 2009; Government of Western Australia 2017; Mound & Houston 1987; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1,5 & 14	Assessment not required	Assessment not required	No
<i>Thrips konoii</i> Nakahara, 1994 [Thripidae]	USA (Nakahara 1994).	No record found (ABRS)	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017)	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017). Additional publications also show that this species of Thrips feeds on a wide range of different plant species including <i>Aralia</i> sp., <i>Carex</i> sp., <i>Iris</i> sp., <i>Pinus</i> sp., and <i>Vitis</i> sp. (Nakahara 1994).	Yes
<i>Thrips major</i> Uzel, 1895 [Thripidae]	Europe (Australian Government Department of Agriculture and Water Resources 2017); England	No record found (ABRS 2009;	1 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	(ThripsWiki 2018) and Italy (CABI 2018a).	Mound, Tree & Paris 2018).		of Agriculture and Water Resources 2017).	Department of Agriculture and Water Resources 2017).	
<i>Thrips microchaetus</i> Karny, 1920 [Thripidae]	Kenya (Letter from KEPHIS on 29/01/2018), Morocco (ThripsWiki 2018) and Ethiopia (Vierbergen 2014).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 2, Kenya	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips nigropilosus</i> Uzel, 1895 [Thripidae]	Present, worldwide (ABRS 2009) in temperate areas including parts of Africa, New Zealand, USA (Mound, Tree & Paris 2018; ThripsWiki 2018), Kenya (Letter from KEPHIS on 29/01/2018), Japan, Egypt, Ethiopia, Tanzania, Belgium, France, the Netherlands, Switzerland, UK and Fiji (CABI 2018a).	Present, Qld, Vic., NSW, WA and SA (Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1 & 2, Kenya	Assessment not required	Assessment not required	No
<i>Thrips obscuratus</i> (Crawford 1941) [Thripidae]	New Zealand (Australian Government Department of Agriculture and Water Resources 2017; ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1,3,6 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips palmi</i> Karny, 1925 [Thripidae]	Widespread in tropical countries – Asia, northern Australia, the Caribbean, southern Florida and	Present (Mound, Tree & Paris 2018).	1,3,7,9 & 14	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine	Yes (NT, SA, VIC, WA)/regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Africa (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), Indonesia, India, Taiwan (ThripsWiki 2018), China, Japan, Republic of Korea (limited distribution), Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam, Mauritius, Mexico, USA, British Virgin Islands, Colombia, Belgium, France, the Netherlands, Portugal, UK, New Caledonia and Papua New Guinea (CABI 2018a).	Declared pest by WA (Government of Western Australia 2017).  Host plants regulated by NT (DPIF 2013) and SA (PIRSA 2017a).  Listed as an exotic pest under Victoria's Plant Biosecurity Act 2010 (DEDJTR 2017).		orthotospoviruses vectored by this thrips have potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	orthotospoviruses vectored by this thrips have potential for consequences (Australian Government Department of Agriculture and Water Resources 2017).	
<i>Thrips parvispinus</i> (Karny, 1922) [Thripidae]	Widespread in south east Asia, Australia, Greece (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), Thailand, Indonesia, Taiwan (ThripsWiki 2018), India, Malaysia, Singapore, Taiwan and Thailand (CABI 2018a).	Present, widespread across northern and western Australia: Qld, NT, NSW and WA (Government of Western Australia 2017; Mound, Tree & Paris 2018; Plant Health Australia 2018).	1 & 14	Assessment not required	Assessment not required	No

<b>Pest</b>	<b>Geographical Distribution</b>	<b>Present within Australia</b>	<b>Potential to be on pathway</b>	<b>Potential for establishment and spread</b>	<b>Potential for economic consequences</b>	<b>Quarantine pest/Regulated article</b>
<i>Thrips pillichii</i> Priesner, 1924 [Thripidae]	Europe (Australian Government Department of Agriculture and Water Resources 2017; ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips pretiosus</i> Priesner, 1938 [Thripidae]	Congo (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips priesneri</i> Hood, 1932 [Thripidae]	Cameroon (ThripsWiki 2018).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips pusillus</i> Bagnall, 1926 [Thripidae]	Kenya (Letter from KEPHIS on 29/01/2018) and Ethiopia (Vierbergen 2014).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	1 & 2, Kenya	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic	Yes



Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
				(Australian Government Department of Agriculture and Water Resources 2017).	consequences (Australian Government Department of Agriculture and Water Resources 2017).	
<i>Thrips samoensis</i> (Moulton, 1944) Synonym: <i>Taeniothrips samoensis</i> Moulton, 1944 Misspelling: <i>Taeniothrips samdensis</i> [Thripidae]	American Samoa (ThripsWiki 2018)	No record found (ABRS 2009; Mound, Tree & Paris 2018).	3 & 4	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips scotti</i> (Moulton, 1928) [Thripidae]	Ethiopia (ThripsWiki 2018; Vierbergen 2014).	No record found (ABRS 2009; Mound, Tree & Paris 2018).	15	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips setosus</i> Moulton, 1928 [Thripidae]	Japan, Republic of Korea (Australian Government Department of Agriculture and Water Resources 2017; Mound 2005; ThripsWiki 2018), Indonesia, France, the Netherlands, UK (EPPO 2018) and	No record found (ABRS 2009; Mound 2005).	1,2, Kenya & 14	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine orthotospoviruses vectored by this thrips have potential for establishment and spread	<b>Yes.</b> Assessed in the thrips group PRA, and the emerging quarantine orthotospoviruses vectored by this thrips have potential for consequences	Yes/regulated article

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
	Kenya (Letter from KEPHIS on 29/01/2018).			(Australian Government Department of Agriculture and Water Resources 2017).	(Australian Government Department of Agriculture and Water Resources 2017).	
<i>Thrips simplex</i> (Morison, 1930) [Thripidae]	Widespread around the world (Australian Government Department of Agriculture and Water Resources 2017; Mound 2005), including France, South Africa (ThripsWiki 2018), China, India, Indonesia, Israel, Japan, Malaysia, Philippines, Saudi Arabia, Sri Lanka, Taiwan, Egypt, Ethiopia, Kenya, Mauritius, Morocco, Uganda, Zimbabwe, Mexico, USA (Hawaii), Argentina, Chile, Colombia, Peru, Italy, the Netherlands, Portugal, Spain, Switzerland, UK, New Caledonia, New Zealand and Papua New Guinea (CABI 2018a).	Present (ABRS 2009; Mound 2005).	1,9 & 14	Assessment not required	Assessment not required	No
<i>Thrips solari</i> (Mound, 2010) [Thripidae]	Nigeria (ThripsWiki 2018).	No record found (ABRS 2009; Mound 2005).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes

Pest	Geographical Distribution	Present within Australia	Potential to be on pathway	Potential for establishment and spread	Potential for economic consequences	Quarantine pest/Regulated article
<i>Thrips tabaci</i> Lindeman, 1889 [Thripidae]	Worldwide, but rare in wet tropics (Australian Government Department of Agriculture and Water Resources 2017; Mound, Tree & Paris 2018), including Kenya (letter from KEPHIS on 29/01/2018), Ethiopia (letter from MANR on 06/03/2018)(Vierbergen 2014), Ecuador (letter from Agrocalidad on 23/03/2019), USA, India, UK, Japan, France (ThripsWiki 2018), China, Indonesia, Iran, Israel, Republic of Korea, Pakistan, Philippines, Saudi Arabia, Singapore, Taiwan, Thailand, Vietnam, Egypt, Madagascar, Malawi, Mauritius, Morocco, South Africa, Tanzania, Uganda, Zimbabwe, Mexico, Argentina, Chile, Colombia, Ecuador, Peru, Belgium, Italy, Portugal, Spain, Switzerland, Fiji, New Caledonia, New Zealand and Papua New Guinea (CABI 2018a).	Present, all states (ABRS 2009; Government of Western Australia 2017; Mound 2005; Plant Health Australia 2018).	1,2,Kenya and Ethiopia, 3,9 & 14	Not applicable to vector. However, the emerging quarantine orthotospoviruses vectored by this thrips have potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	Not applicable to vector. However, the emerging quarantine orthotospoviruses vectored by this thrips have potential for consequences (Australian Government Department of Agriculture and Water Resources 2017).	No/regulated Article
<i>Thrips trehernei</i> Priesner, 1927 [Thripidae]	Widespread across Europe and North America (Hoddle, Mound & Paris 2012), Japan (ThripsWiki 2018) and Argentina (de Borbón 2009).	Present, NSW and ACT (ABRS 2009; Mound 2005).	1	Assessment not required	Assessment not required	No
<i>Thrips urticae</i> Fabricius, 1781 [Thripidae]	Japan, Europe (Australian Government Department of Agriculture and Water Resources 2017; Masumoto & Okajima 2013; ThripsWiki 2018) and Bangladesh (Ali et al. 2016).	No record found (ABRS 2009; Mound 2005).	5 & 14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes

<b>Pest</b>	<b>Geographical Distribution</b>	<b>Present within Australia</b>	<b>Potential to be on pathway</b>	<b>Potential for establishment and spread</b>	<b>Potential for economic consequences</b>	<b>Quarantine pest/Regulated article</b>
<i>Thrips validus</i> Uzel, 1895 [Thripidae]	Europe and USA (Australian Government Department of Agriculture and Water Resources 2017; ThripsWiki 2018).	No record found (ABRS 2009; Mound 2005).	14	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> Assessed in the thrips group PRA (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Thrips vulgatissimus</i> Haliday, 1836 [Thripidae]	New Zealand, Europe and North America (Mound 2005), including UK, Switzerland (ThripsWiki 2018), Iceland and Italy (CABI 2018a).	Present, southern Vic., Tas. and NSW (ABRS 2009; Mound 2005; Plant Health Australia 2018).  Declared pest, prohibited in WA (Government of Western Australia 2017).	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes
<i>Trichromothrips caespitis</i> (Priesner, 1932) [Thripidae]	Egypt (ThripsWiki 2019).	No record found (ABRS)	1	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for establishment and spread (Australian Government Department of Agriculture and Water Resources 2017).	<b>Yes.</b> The thrips group PRA identified members of the family Thripidae as having the potential for economic consequences (Australian Government Department of Agriculture and Water Resources 2017).	Yes

**Table XVIII Criteria for inclusion of pest species in Table XVII**

<b>Criterion</b>	<b>Description</b>
1	Species intercepted at Australian points of entry on cut flower and foliage consignments (unpublished)
2	Australia has been notified that species is on this pathway as either BCA or common pest in country of notification.
3	Identified as a species of biosecurity concern through government pest risk analysis – unpublished data.
4	Identified as a species of biosecurity concern in publication (MPI 2016).
5	Identified as a species of biosecurity concern in publication (OGTR 2006)
6	Identified as a species of biosecurity concern in publication (PHA 2016)
7	Identified as a species of biosecurity concern in publication (Biosecurity Australia 2010)
8	Identified as a species of biosecurity concern in publication (Ali et al. 2016)
9	Identified as a species of biosecurity concern in publication (DAFF 2013)
10	Identified as a species of biosecurity concern in publication (ICA 2017a)
11	Identified as a species of biosecurity concern in publication (ICA 2017b)
12	Identified as a species of biosecurity concern in publication (ICA 2017c)
13	Identified as a species of biosecurity concern in publication (Miller & Stoetzel 1997)
14	Identified as a species of biosecurity concern in publication (Australian Government Department of Agriculture and Water Resources 2017)
15	Identified as a species of biosecurity concern in publication (Vierbergen 2014)
16	Identified as a species of biosecurity concern in publication (Mehrparvar, Mansouri & Hatami 2016)
17	Identified as a species of biosecurity concern in publication (Otera-Colina et al. 2018)

## Appendix G List of quarantine and regulated mites, aphids and thrips

Table XIX Mites, aphids and thrips of biosecurity concern to Australia on imported cut flowers and foliage (as at June 2019)

Pest	Present within Australia	Quarantine pest/Regulated article
<b>MITES</b>		
<b>Acari: Astigmata</b>		
<i>Histiostoma humiditatis</i> [Histiostomatidae]	Yes	No
<b>Acari: Mesostigmata</b>		
<i>Amblydromalus limonicus</i> [Phytoseiidae]	Yes	No
<i>Amblyseius largoensis</i> [Phytoseiidae]	Yes	No
<i>Amblyseius sinuatus</i> [Phytoseiidae]	No	Yes
<i>Amblyseius swirskii</i> [Phytoseiidae]	No	Yes
<i>Amblyseius tamatavensis</i> [Phytoseiidae]	Yes	No
<i>Androlaelaps casalis</i> [Laelapidae]	Yes	No
<i>Asca spicata</i> [Ascidae]	No	Yes
<i>Blattisocius dentriticus</i> [Blattisociidae]	Yes	No
<i>Blattisocius keegani</i> [Blattisociidae]	Yes	No
<i>Lasioseius lindquisti</i> [Blattisociidae]	No	Yes
<i>Lasioseius subterraneus</i> [Blattisociidae]	Yes	No
<i>Lasioseius sugawarai</i> [Blattisociidae]	No	Yes
<i>Lasioseius youcefi</i> [Blattisociidae]	No	Yes
<i>Macrocheles robustulus</i> [Macrochelidae]	Yes	No
<i>Neoseiulus barkeri</i> [Phytoseiidae]	Yes	No
<i>Neoseiulus bicaudus</i> [Phytoseiidae]	No	Yes
<i>Neoseiulus californicus</i> [Phytoseiidae]	Yes	No
<i>Neoseiulus cucumeris</i> [Phytoseiidae]	Yes	No
<i>Neoseiulus fallacis</i> [Phytoseiidae]	Yes	No
<i>Neoseiulus longisiphonulus</i> [Phytoseiidae]	No	Yes
<i>Neoseiulus longispinosus</i> [Phytoseiidae]	Yes	No
<i>Ornithonyssus bacoti</i> [Macronyssidae]	Yes	No
<i>Proprioseiopsis lenis</i> [Phytoseiidae]	Yes	No
<i>Phorytocarpais americanus</i> [Parasitidae]	Yes	No
<i>Phytoseius hongkongensis</i> [Phytoseiidae]	Yes	No
<i>Phytoseiulus persimilis</i> [Phytoseiidae]	Yes	No
<i>Pneumolaelaps marginalis</i> [Laelapidae]	No	Yes
<i>Pneumolaelaps minutissima</i> [Laelapidae]	No	Yes
<i>Proctolaelaps bickleyi</i> [Melicharidae]	Yes	No
<i>Proctolaelaps pygmaeus</i> [Melicharidae]	Yes	No
<i>Rhabdocarpais consanguineous</i> [Parasitidae]	No	Yes
<b>Acari: Trombidiformes</b>		
<i>Acaropsella volgini</i> [Cheyletidae]	No	Yes

Pest	Present within Australia	Quarantine pest/Regulated article
<i>Aceria paradianthi</i> [Eriophyidae]	Yes	No
<i>Anystis baccarum</i> [Anystidae]	Yes	No
<i>Bakerdania operosus</i> [Microdispidae]	No	Yes
<i>Bdella distincta</i> [Bdellidae]	No	Yes
<i>Brevipalpus californicus</i> [Tenuipalpidae]	Yes	No
<i>Brevipalpus chilensis</i> [Tenuipalpidae]	No	Yes
<i>Brevipalpus obovatus</i> [Tenuipalpidae]	Yes	No
<i>Brevipalpus phoenicis</i> [Tenuipalpidae]	No	Yes
<i>Bryobia vasiljevi</i> [Tetranychidae]	Yes	Yes (WA)
<i>Callyntrotus schlehtendali</i> [Eriophyidae]	No	Yes
<i>Cheletogenes ornatus</i> [Cheyletidae]	Yes	No
<i>Cheletomorpha lepidopterorum</i> [Cheyletidae]	Yes	No
<i>Eotetranychus lewisi</i> [Tetranychidae]	No	Yes
<i>Eriophyes eremus</i> [Eriophyidae]	No	Yes
<i>Lorryia formosa</i> [Tydeidae]	No	Yes
<i>Odontoscirus haramotoi</i> [Bdellidae]	No	Yes
<i>Oligonychus yothersi</i> [Tetranychidae]	No	Yes
<i>Phyllocoptes fructiphilus</i> Keifer, 1940	No	Yes
<i>Polyphagotarsonemus latus</i> [Tarsonemidae]	Yes	No
<i>Rubroscirus africanus</i> [Cunaxidae]	No	Yes
<i>Schizotetranychus asparagi</i> [Tetranychidae]	No	Yes
<i>Schizotetranychus kaspari</i> [Tetranychidae]	No	Yes
<i>Siteroptes cerealium</i> [Siteroptidae]	No	Yes
<i>Spinibdella cronini</i> [Bdellidae]	Yes	No
<i>Tarsonemus bilobatus</i> [Tarsonemidae]	No	Yes
<i>Tarsonemus confusus</i> [Tarsonemidae]	No	Yes
<i>Tenuipalpus pacificus</i> [Tenuipalpidae]	Yes	Yes (WA)
<i>Tetranychus evansi</i> [Tetranychidae]	Yes	Yes (WA)
<i>Tetranychus kanzawai</i> [Tetranychidae]	Yes	Yes (WA)
<i>Tetranychus lambi</i> [Tetranychidae]	Yes	No
<i>Tetranychus ludeni</i> [Tetranychidae]	Yes	No
<i>Tetranychus piercei</i> [Tetranychidae]	No	Yes
<i>Tetranychus shihlinensis</i> [Tetranychidae]	No	Yes
<i>Tetranychus urticae</i> [Tetranychidae]	Yes	No
<i>Tydeus californicus</i> [Tydeidae]	Yes	No
<i>Tydeus caudatus</i> [Tydeidae]	No	Yes
<i>Tydeus kochi</i> [Tydeidae]	No	Yes
<b>Acari: Sarcoptiformes</b>		
<i>Aleuroglyphus ovatus</i> [Acaridae]	Yes	Yes (WA)
<i>Glycyphagus domesticus</i> [Glycyphagidae]	Yes	No
<i>Lepidoglyphus destructor</i> [Glycyphagidae]	Yes	No
<i>Procalvolia zacheri</i> [Winterschmidtidae]	No	Yes

<b>Pest</b>	<b>Present within Australia</b>	<b>Quarantine pest/Regulated article</b>
<i>Rhizoglyphus caladii</i> [Acaridae]	No	Yes
<i>Rhizoglyphus echinopus</i> [Acaridae]	Yes	No
<i>Rhizoglyphus minutus</i> [Acaridae]	No	Yes
<i>Rhizoglyphus robini</i> [Acaridae]	Yes	Yes (WA)
<i>Rhizoglyphus setosus</i> [Acaridae]	No	Yes
<i>Rhizoglyphus singularis</i> [Acaridae]	No	Yes
<i>Schwiebea cuncta</i> [Acaridae]	No	Yes
<i>Schwiebea taiwanensis</i> [Acaridae]	No	Yes
<i>Tyrophagus curvipenis</i> [Acaridae]	Yes	No
<i>Tyrophagus longior</i> [Acaridae]	Yes	No
<i>Tyrophagus neiswanderi</i> [Acaridae]	Yes	Yes (WA)
<i>Tyrophagus putrescentiae</i> [Acaridae]	Yes	No
<i>Tyrophagus similis</i> [Acaridae]	Yes	No
<b>APHIDS</b>		
<b>Hemiptera: Aphididae</b>		
<i>Acyrtosiphon gossypii</i> [Aphididae]	No	Yes/potential regulated article
<i>Amphorophora catharinae</i> [Aphididae]	No	Yes/potential regulated article
<i>Aphis alstroemeriae</i> [Aphididae]	No	Yes/potential regulated article
<i>Aphis craccivora</i> [Aphididae]	Yes	No/potential regulated article
<i>Aphis fabae</i> [Aphididae]	No	Yes/potential regulated article
<i>Aphis gossypii</i> [Aphididae]	Yes	No/potential regulated article
<i>Aphis nasturtii</i> [Aphididae]	No	Yes/potential regulated article
<i>Aphis nerii</i> [Aphididae]	Yes	No/potential regulated article
<i>Aphis spiraeicola</i> [Aphididae]	Yes	No/potential regulated article
<i>Aulacorthum circumflexum</i> [Aphididae]	Yes	Yes (WA)/potential regulated article
<i>Aulacorthum rufum</i> [Aphididae]	No	Yes/potential regulated article
<i>Aulacorthum solani</i> [Aphididae]	Yes	No/potential regulated article
<i>Brachycaudus cardui</i> [Aphididae]	No	Yes/potential regulated article
<i>Brachycaudus helichrysi</i> [Aphididae]	Yes	No/potential regulated article
<i>Brachycaudus (Acaudus) persicae</i> [Aphididae]	Yes	No/potential regulated article
<i>Brevicoryne brassicae</i> [Aphididae]	Yes	No/potential regulated article
<i>Cavariella aegopodii</i> [Aphididae]	Yes	No/potential regulated article
<i>Cerataphis orchidearum</i> [Aphididae]	Yes	Yes (WA)/potential regulated article
<i>Chaetosiphon tetraerhodum</i> [Aphididae]	Yes	No/potential regulated article
<i>Chaetosiphon thomasi</i> Hille [Aphididae]	No	Yes/potential regulated article
<i>Coloradoa rufomaculata</i> [Aphididae]	Yes	No/potential regulated article
<i>Diuraphis noxia</i> [Aphididae]	Yes	Yes/potential regulated article
<i>Dysaphis apiifolia</i> [Aphididae]	Yes	No/potential regulated article
<i>Dysaphis foeniculus</i> [Aphididae]	Yes	No/potential regulated article
<i>Hyadaphis foeniculi</i> [Aphididae]	Yes	No/potential regulated article
<i>Hysteroneura setariae</i> [Aphididae]	Yes	No/potential regulated article
<i>Idiopterus nephrolepidis</i> [Aphididae]	Yes	No/potential regulated article



<b>Pest</b>	<b>Present within Australia</b>	<b>Quarantine pest/Regulated article</b>
<i>Macrosiphoniella sanborni</i> [Aphididae]	Yes	No/potential regulated article
<i>Macrosiphoniella subterranea</i> [Aphididae]	No	Yes/potential regulated article
<i>Macrosiphoniella tanacetaria</i> [Aphididae]	No	Yes/potential regulated article
<i>Macrosiphum euphorbiae</i> [Aphididae]	Yes	No/potential regulated article
<i>Macrosiphum pallidum</i> [Aphididae]	No	Yes/potential regulated article
<i>Macrosiphum rosae</i> [Aphididae]	Yes	No/potential regulated article
<i>Metopolophium dirhodum</i> [Aphididae]	Yes	Yes (WA)/potential regulated article
<i>Myzaphis rosarum</i> [Aphididae]	Yes	No/potential regulated article
<i>Myzus ascalonicus</i> [Aphididae]	Yes	Yes (WA)/potential regulated article
<i>Myzus cymbalariae</i> [Aphididae]	Yes	Yes (WA)/potential regulated article
<i>Myzus ornatus</i> [Aphididae]	Yes	No/potential regulated article
<i>Myzus persicae</i> [Aphididae]	Yes	No/potential regulated article
<i>Pleotrichophorus chrysanthemi</i> [Aphididae]	Yes	No/potential regulated article
<i>Pseudaphis abyssinica</i> [Aphididae]	No	Yes/potential regulated article
<i>Pseudomegoura magnoliae</i> [Aphididae]	No	Yes/potential regulated article
<i>Rhodobium porosum</i> [Aphididae]	Yes	No/potential regulated article
<i>Rhopalosiphoninus staphyleae</i> ( [Aphididae]	Yes	No/potential regulated article
<i>Rhopalosiphum maidis</i> [Aphididae]	Yes	No/potential regulated article
<i>Rhopalosiphum nymphaeae</i> [Aphididae]	Yes	No/potential regulated article
<i>Rhopalosiphum padi</i> [Aphididae]	Yes	No/potential regulated article
<i>Rhopalosiphum rufiabdominale</i> [Aphididae]	Yes	No/potential regulated article
<i>Sitobion luteum</i> [Aphididae]	Yes	No/potential regulated article
<i>Toxoptera aurantii</i> [Aphididae]	Yes	No/potential regulated article
<i>Toxoptera citricidus</i> [Aphididae]	Yes	No/potential regulated article
<i>Toxoptera odinae</i> [Aphididae]	No	Yes/potential regulated article
<i>Wahlgreniella nervata</i> [Aphididae]	No	Yes/potential regulated article
<b>THRIPS</b>		
<b>Thysanoptera</b>		
<i>Aeolothrips collaris</i> [Aeolothripidae]	No	Yes
<i>Aeolothrips fasciatus</i> [Aeolothripidae]	Yes	No
<i>Aeolothrips tenuicornis</i> [Aeolothripidae]	No	Yes
<i>Aleurodothrips fasciapennis</i> [Phlaeothripidae]	Yes	No
<i>Anaphothrips dubius</i> [Thripidae]	Yes	No
<i>Anaphothrips latis</i> [Thripidae]	No	Yes
<i>Anaphothrips obscurus</i> [Thripidae]	Yes	No
<i>Anaphothrips sudanensis</i> [Thripidae]	Yes	No
<i>Apterothrips apteris</i> [Thripidae]	Yes	No
<i>Arorathrips mexicanus</i> [Thripidae]	Yes	No
<i>Caliothrips fasciatus</i> [Thripidae]	No	Yes
<i>Ceratothripoides brunneus</i> [Thripidae]	No	Yes
<i>Chaetanaphothrips orchidii</i> [Thripidae]	Yes	Yes (WA)
<i>Chaetanaphothrips signipennis</i> [Thripidae]	Yes	Yes (WA)

<b>Pest</b>	<b>Present within Australia</b>	<b>Quarantine pest/Regulated article</b>
<i>Chirothrips manicatus</i> [Thripidae]	Yes	No
<i>Desmothrips propinquus</i> [Aeolothripidae]	Yes	No
<i>Dichromothrips corbetti</i> [Thripidae]	Yes	Yes (WA)
<i>Dichromothrips dendrobii</i> [Thripidae]	No	Yes
<i>Dichromothrips smithi</i> [Thripidae]	No	Yes
<i>Echinothrips americanus</i> [Thripidae]	Yes	Yes (WA)
<i>Elixothrips brevisetis</i> [Thripidae]	Yes	Yes (WA)
<i>Ernothrips lobatus</i> [Thripidae]	No	Yes
<i>Frankliniella borinquen</i> [Thripidae]	No	Yes
<i>Frankliniella cephalica</i> [Thripidae]	No	Yes
<i>Frankliniella fusca</i> [Thripidae]	No	Yes/regulated article
<i>Frankliniella intonsa</i> [Thripidae]	No	Yes/regulated article
<i>Frankliniella lilivora</i> [Thripidae]	No	Yes
<i>Frankliniella minuta</i> [Thripidae]	No	Yes
<i>Frankliniella occidentalis</i> [Thripidae]	Yes	Yes (NT)/regulated article
<i>Frankliniella panamensis</i> [Thripidae]	No	Yes
<i>Frankliniella schultzei</i> [Thripidae]	Yes	No/regulated article
<i>Frankliniella tenuicornis</i> [Thripidae]	No	Yes
<i>Frankliniella tritici</i> [Thripidae]	No	Yes
<i>Frankliniella williamsi</i> [Thripidae]	Yes	Yes (WA)
<i>Franklinothrips megalops</i> [Aeolothripidae]	No	Yes
<i>Gynaikothrips ficorum</i> [Phlaeothripidae]	Yes	No
<i>Haplothrips aculeatus</i> [Phlaeothripidae]	No	Yes
<i>Haplothrips biformis</i> [Phlaeothripidae]	No	Yes
<i>Haplothrips chinensis</i> [Phlaeothripidae]	No	Yes
<i>Haplothrips clarisetis</i> [Phlaeothripidae]	No	Yes
<i>Haplothrips collyerae</i> [Phlaeothripidae]	Yes	No
<i>Haplothrips ganglbaueri</i> [Phlaeothripidae]	No	Yes
<i>Haplothrips gowdeyi</i> [Phlaeothripidae]	Yes	No
<i>Haplothrips kurdjumovi</i> [Phlaeothripidae]	No	Yes
<i>Haplothrips leucanthemi</i> [Phlaeothripidae]	Yes	Yes (WA)
<i>Haplothrips nigricornis</i> [Phlaeothripidae]	No	Yes
<i>Haplothrips tenuipennis</i> [Phlaeothripidae]	No	Yes
<i>Helionothrips errans</i> [Thripidae]	Yes	No
<i>Heliothrips haemorrhoidalis</i> [Thripidae]	Yes	No
<i>Hercinothrips femoralis</i> [Thripidae]	Yes	No
<i>Hoplandrothrips flavipes</i> [Phlaeothripidae]	Yes	No
<i>Hydatothrips adolfifriderici</i> [Thripidae]	No	Yes
<i>Kenyattathrips katarinae</i> [Thripidae]	No	Yes
<i>Kurtomathrips morrilli</i> [Thripidae]	No	Yes
<i>Limothrips cerealium</i> [Thripidae]	Yes	No
<i>Liothrips vaneckei</i> [Phlaeothripidae]	Yes	Yes (WA)

<b>Pest</b>	<b>Present within Australia</b>	<b>Quarantine pest/Regulated article</b>
<i>Megalurothrips distalis</i> [Thripidae]	No	Yes
<i>Megalurothrips sjostedti</i> [Thripidae]	No	Yes
<i>Megalurothrips usitatus</i> [Thripidae]	Yes	No
<i>Microcephalothrips abdominalis</i> [Thripidae]	Yes	No
<i>Mycterothrips chaetogastra</i> [Thripidae]	No	Yes
<i>Mycterothrips laticauda</i> [Thripidae]	No	Yes
<i>Neohydatothrips samayunkur</i> [Thripidae]	Yes	No
<i>Nesothrips propinquus</i> [Phlaeothripidae]	Yes	No
<i>Oxythrips uncinatus</i> [Thripidae]	No	Yes
<i>Parthenothrips dracaenae</i> [Thripidae]	Yes	No
<i>Podothrips lucasseni</i> [Phlaeothripidae]	Yes	No
<i>Retithrips syriacus</i> [Thripidae]	No	Yes
<i>Rhipidothrips brunneus</i> [Aeolothripidae]	Yes	No
<i>Rhipiphorothrips cruentatus</i> [Thripidae]	No	Yes
<i>Scirtothrips albomaculatus</i> [Thripidae]	Yes	Yes (WA)
<i>Scirtothrips aurantii</i> [Thripidae]	Yes	Yes (WA)
<i>Scirtothrips dorsalis</i> [Thripidae]	Yes	No/regulated article
<i>Scirtothrips fulleri</i> [Thripidae]	No	Yes
<i>Scirtothrips kenyanensis</i> [Thripidae]	No	Yes
<i>Scirtothrips mangiferae</i> [Thripidae]	No	Yes
<i>Scirtothrips oligochaetus</i> [Thripidae]	No	Yes
<i>Scirtothrips spinosus</i> [Thripidae]	No	Yes
<i>Scolothrips rhagebianus</i> [Thripidae]	Yes	No
<i>Sigmothrips aotearoana</i> [Thripidae]	No	Yes
<i>Tenothrips frici</i> [Thripidae]	Yes	No
<i>Thrips abyssiniae</i> [Thripidae]	No	Yes
<i>Thrips acaciae</i> [Thripidae]	No	Yes
<i>Thrips alatus</i> [Thripidae]	No	Yes
<i>Thrips angusticeps</i> [Thripidae]	No	Yes
<i>Thrips australis</i> [Thripidae]	Yes	No
<i>Thrips bourbonensis</i> [Thripidae]	No	Yes
<i>Thrips brevicornis</i> [Thripidae]	No	Yes
<i>Thrips cacuminis</i> [Thripidae]	No	Yes
<i>Thrips coloratus</i> [Thripidae]	Yes	No
<i>Thrips dezeuwi</i> [Thripidae]	No	Yes
<i>Thrips flavus</i> [Thripidae]	No	Yes
<i>Thrips florum</i> [Thripidae]	Yes	No
<i>Thrips fuscipennis</i> [Thripidae]	No	Yes
<i>Thrips gowdeyi</i> [Thripidae]	No	Yes
<i>Thrips hawaiiensis</i> [Thripidae]	Yes	No
<i>Thrips imuginis</i> [Thripidae]	Yes	No
<i>Thrips kono</i> [Thripidae]	No	Yes

<b>Pest</b>	<b>Present within Australia</b>	<b>Quarantine pest/Regulated article</b>
<i>Thrips major</i> [Thripidae]	No	Yes
<i>Thrips microchaetus</i> [Thripidae]	No	Yes
<i>Thrips nigropilosus</i> [Thripidae]	Yes	No
<i>Thrips obscuratus</i> [Thripidae]	No	Yes
<i>Thrips palmi</i> [Thripidae]	Yes	Yes (NT, SA, VIC, WA)/regulated article
<i>Thrips parvispinus</i> [Thripidae]	Yes	No
<i>Thrips pillichii</i> [Thripidae]	No	Yes
<i>Thrips pretiosus</i> [Thripidae]	No	Yes
<i>Thrips priesneri</i> [Thripidae]	No	Yes
<i>Thrips pusillus</i> [Thripidae]	No	Yes
<i>Thrips samoensis</i> [Thripidae]	No	Yes
<i>Thrips scotti</i> [Thripidae]	No	Yes
<i>Thrips setosus</i> [Thripidae]	No	Yes/regulated article
<i>Thrips simplex</i> [Thripidae]	Yes	No
<i>Thrips solari</i> [Thripidae]	No	Yes
<i>Thrips tabaci</i> [Thripidae]	Yes	No/regulated article
<i>Thrips trehernei</i> [Thripidae]	Yes	No
<i>Thrips urticae</i> [Thripidae]	No	Yes
<i>Thrips validus</i> [Thripidae]	No	Yes
<i>Thrips vulgatissimus</i> [Thripidae]	Yes	Yes (WA)
<i>Trichromothrips caespitis</i> [Thripidae]	No	Yes

**WA:** Pest of quarantine concern for Western Australia. **NT:** Pest of quarantine concern for the Northern Territory. **SA:** pest of concern for South Australia. **Vic.:** Pest of concern for Victoria.

## Appendix H Issues raised in stakeholder comments

Written submissions were received from 24 stakeholders in response to the Draft PRA. These submissions contained comments of a technical nature relating to the PRA, in addition to comments that were non-technical and related to aspects of the cut flower and foliage trade and departmental operations.

The department has considered all submissions of a technical nature and, after consideration and further review of literature, has made a number of changes to the risk analysis. This appendix summarises the key technical comments received during consultation on the Draft PRA, and the department's responses.

Additional information on other issues commonly raised by stakeholders, which are outside the scope of this technical report, is available on the department's website.

### **Comment 1: Concerns about allowing entry of already established pests into Australia because of pesticide resistance and vectoring potential.**

Response: In general, stakeholders who made this comment expressed concern, but did not provide details about particular arthropod species or pesticides. Two individual species were mentioned, *Tetranychus urticae*, the two-spotted mite, and *Myzus persicae*, the green peach aphid.

*Tetranychus urticae* is an important pest of horticultural crops worldwide (CABI 2018a). A wide range of insecticides and acaricides are used for the control of *T. urticae*, and the species is well known for developing resistance—the pesticide resistance database ranks this species among the most resistant of arthropods with 512 cases recorded worldwide (Michigan State University 2019). There are also a number of scientific publications about Australian *T. urticae* resistance to many different chemical types (see (Manners 2015) for a recent summary), including most recently the detection of resistance to etoxazole (Herron et al. 2018), one of the more recently developed acaricides deployed as a spider mite control (Herron et al. 2018). Manners (2015) also states that there is a likelihood that resistance will develop for any given product, particularly if products are overused. The department has determined that there is not sufficient evidence to regulate resistant strains of *T. urticae* at this time. The department will consider specific evidence of pesticide resistance if this becomes available, and may further review this situation if there is evidence that the pests or phytosanitary status of these organisms has changed, or is likely to change.

*Myzus persicae* has a wide host range, and feeding damage can cause significant yield losses (CABI 2015). The species is well known for developing pesticide resistance, with 469 cases recorded worldwide (Michigan State University 2019). There are also a number of scientific publications about *M. persicae* resistance to pesticides in Australia (see Umina (2016) for a summary). For the same reason given for *T. urticae*, the department has determined that there is insufficient evidence to regulate pesticide resistance in *M. persicae* at this time. However, *M. persicae* is a well-known virus vector, transmitting over 100 plant viruses (Harris, Smith & Duffus 2001), and this species, and all other aphid species on this importation pathway, are potential regulated articles as discussed in the following paragraph.

The vectoring potential of aphids and thrips is discussed in sections 6.1.2 and 6.1.3 respectively. At this stage, all aphid species, regardless of whether they are already present in Australia, are considered to be potential regulated articles due to their potential to vector quarantine viruses and will be managed appropriately at the border if found in imported cut flower and foliage consignments. The department will review this situation, and consider specific evidence of aphid vectoring potential, if required in specific import scenarios. The vectoring potential of thrips species was assessed in the Group Thrips PRA, and those with known vectoring potential for quarantine orthospoviruses are also considered regulated articles and actioned accordingly on arrival. No change has been made to this Final PRA in response to these comments.

**Comment 2: Concerns that the biosecurity risks posed by imported cut flowers and foliage to the Australian horticultural and other industries are not adequately addressed.**

Response: The biosecurity risk posed by imported cut flowers and foliage to other Australian industries has been taken into account in this PRA. The methodology used for this risk analysis (given in full in Appendix E) explains that the likelihood of entry, establishment and spread and the consequence assessment both contribute to the biosecurity risk of an organism. Importantly, the consequence assessment step considers direct and indirect pest effects and their economic and environmental consequences. This assessment is not limited to the host that the pest is imported on, but encompasses other potential host plants and industries.

For example, the pest biology review (Section 6.1) in this report includes information on the broad host ranges of many of the mite, aphid and thrips species considered to be plant pests. The pest risk assessment (Section 6.3) includes discussion of this information in the context of assigning economic consequences ratings to the pest groups. The pest categorisation section (Appendix F) of this document also recognises instances where species have broader host ranges than cut flowers and foliage, and this information is used in the assessment of the economic consequences.

**Comment 3: Concerns about non-provision of compliance and interception information that demonstrates the rates of compliance since revised import conditions were implemented on 1 March 2018.**

Response: The most recent interception data from 1 March 2018 to 30 April 2019 has been incorporated into this Final PRA, predominantly in the pest categorisation table (Appendix F) and Section 5.4.

This information has resulted in additions of species to the pest categorisation table—adding 17 species (11 mites, three aphids and three thrips), seven of which have been categorised as quarantine pests for Australia, two as regulated articles or potential regulated articles, one as both a quarantine pest and a regulated article, and seven as non-quarantine pests. This information has also been incorporated in other parts of the report.

Information on country compliance with the revised import conditions is included in Section 5.4 of this Final PRA. The historic information previously included in the Draft PRA showed levels of interceptions per consignment prior to 1 March 2018. It is important to note that this was not classified as non-compliance, as all consignments at this time were subject to onshore fumigation (unless exempt—as discussed in Section 4.2.1). This historic information was

presented to demonstrate the need to revise the import conditions because of the high numbers of arthropod pests arriving in Australia.

The updated information shows that the revised import conditions have been effective in reducing the approach rate of live quarantine pests in some circumstances and for some countries. Some countries have had greater success using the systems approach option than others, but the pre-export methyl bromide fumigation option is giving the best overall results (Figure 6).

**Comment 4: Stakeholders questioned the regulation of all thrips known to vector orthotospoviruses in all plants used in the cut flower and foliage trade from all countries.**

Response: The *Final Group PRA for thrips and orthotospoviruses on fresh fruit, vegetable, cut flower and foliage imports* (Australian Government Department of Agriculture and Water Resources 2017) identified emerging risks associated with quarantine orthotospoviruses (Chapter 6.2). It is likely that quarantine orthotospoviruses will continue to be recognised in crops and plants not previously known to be susceptible. This is because (i) there is current uncertainty about the host plant ranges of many newly described orthotospoviruses and (ii) the host range of the thrips vectors is generally much wider than that of the virus it transmits. For example, *Scirtothrips dorsalis* feeds on 150 host plant species, but the three quarantine orthotospoviruses it transmits (Table 4.3; (Australian Government Department of Agriculture and Water Resources 2017)) have been recorded on 10 or fewer plant species. This indicates that there is a large potential pool of plants from which other orthotospoviruses may be acquired.

It is also likely that recognised quarantine orthotospoviruses will continue to expand their global distribution. There is often a delay between the first recognition of an orthotospovirus in the field and the subsequent reporting of this occurrence in the scientific literature (Table 4.1, (Australian Government Department of Agriculture and Water Resources 2017)). For example, *Melon yellow spot virus* (MYSV) had probably been present in Japan since 1992, but was only reported in the literature in 1999. This virus has now expanded its distributional range from Japan to mainland China, Taiwan and Thailand in Asia, and Ecuador in South America.

Thrips vectors that are present on a commodity can also be infected with a quarantine orthotospovirus irrespective of whether or not the commodity is a known virus host, because they could have already acquired the virus from infected plants in the field. Thrips vectors can retain and transmit acquired viruses for life, which increases the risk that they may transmit a virus to a susceptible host plant if introduced into Australia.

Consequently, should an export country not have measures in place to prevent the entry of an orthotospovirus/thrips vector, the orthotospovirus is likely to enter, establish and spread in that country. Where a country has measures in place to prevent the introduction of the orthotospovirus and/or thrips vectors, the NPPPO may provide a technical submission that supports a claim for freedom from the virus. The department will consider these submissions on a case-by-case basis.

**Comment 5: A stakeholder questioned whether importation and distribution likelihoods were assessed correctly, given factors that increase those risks for the cut flower pathway.**

Response: The department reviewed the evidence presented in the report, and concluded that the assessed likelihood of importation for mites, aphids and thrips on the cut flower and foliage pathway is appropriate. All three pest groups have been assessed at the maximum likelihood value for importation, ‘High’. As described in the PRA methodology (Appendix E), the likelihood of importation is an assessment of the likelihood of the pest arriving in Australia on a particular commodity. The rating of ‘High’ was determined taking into account the high degree of association of these pest groups with fresh cut flowers and foliage, the fact that harvesting and processing do not remove all of the arthropods from the commodity, and because the department’s interception records of these arthropods arriving on this pathway is consistent with this assessment.

The distribution likelihood for mites and aphids was also assessed at the maximum likelihood of ‘High’, whereas for thrips this was assessed as ‘Moderate’. The department reviewed the evidence presented in the Draft PRA, and that presented in the distribution assessment (Section 5.2) of the *Final Group PRA for thrips and orthotospoviruses on fresh fruit, vegetable, cut flower and foliage imports* (Australian Government Department of Agriculture and Water Resources 2017). The department considers there is no evidence to substantiate elevating the distribution likelihood for thrips on the cut flower and foliage pathway from ‘Moderate’ to ‘High’.

There is, however, justification to support downgrading the distribution likelihoods for mites and aphids from ‘High’ to ‘Moderate’, given the similarities in the dispersal mechanisms of these arthropods with those of thrips. The Group Thrips PRA (Section 5.2 of that document) states that cut flowers and foliage deteriorate quickly and there may be thrips mortality before they are able to reach a host. The thrips would need to launch themselves into flight from a height which may or may not be available at the site, rather than being active fliers. These factors can limit the ability of thrips to successfully transfer to a host.

Similarities in this scenario include the deterioration of the cut flowers and foliage causing mite and aphid mortality before they are able to successfully reach a host. Some mite species can balloon in wind currents using silken threads, and winged aphids are able to move using wind dispersal. These circumstances are reliant on wind currents being present. Aphids are also only able to survive for short periods without food, and only the winged forms of adult aphids are able to move using wind dispersal. In addition, a distribution rating of ‘Moderate’ for mites and aphids aligns more closely with ratings assigned in previous risk assessments for these pests, which were between ‘Low’ to ‘Moderate’ (previous ratings are presented in Table 6.1).

In reviewing this information, the department also reassessed the likelihood of spread for mites, and elevated this rating from ‘Moderate’ to ‘High’. Justification for this change includes the ability of mites to be spread by the wind, as well as human-assisted spread on nursery stock, clothing and farm machinery, and by hitchhiking on insects, birds and animals. The likelihood of spread rating for aphids and thrips is assessed as ‘High’, and the department considers that these ratings are still appropriate.

Importantly, in following the PRA methodology (Appendix E), these changes in ratings do not change the unrestricted risk estimate for mites and aphids, and these remain above Australia’s



ALOP at 'Low' to 'Moderate' on this pathway. These updates have been made in Section 6.3 of this report.

**Comment 6: Stakeholders questioned the unrestricted risk estimate for thrips in comparison to those for mites and aphids, given the higher proportion of thrips intercepted.**

Response: The interception data presented in this Final PRA are fundamental in determining the likelihood of importation of a pest. The department's assessment of the likelihood of importation of thrips reflects the high rate of interceptions, with thrips assessed at the maximum likelihood value for importation, 'High'. Consistent with the PRA methodology (Appendix E), there are other factors considered in assessing a pest's establishment and spread potential, and its potential economic consequences. All of these assessments are then factored into the determination of the unrestricted risk estimate (URE) for a pest. The differences in URE ratings for mites and aphids (Low to Moderate) in comparison to the URE for thrips (Low) is due to the consequence rating for thrips being assessed as 'Low', in comparison to the consequence assessments for mites and aphids being 'Low to Moderate'. No change has been made to this report.

**Comment 7: Stakeholders requested an analysis of biosecurity risk by flower type and country as not all are equal in terms of biosecurity risk.**

Response: The department has conducted further analysis using its interception data on the correlation between pest type and flower type and country of origin, and this information is incorporated in Section 5.3 of this report. Heatmap analysis (Figure 5) of these variables demonstrates that mites, aphids and thrips have been widely intercepted across multiple flower types from multiple countries, with the exception of a number of foliage types. As foliage is often combined in mixed consignments with cut flowers, this evidence supports the department's approach in grouping all flower and foliage types for the purpose of this PRA, particularly as the phytosanitary measures recommended in Chapter 7 are generic for the pest groups of mites, aphids and thrips.

The department has also conducted heatmap analysis of interception rates by flower type and country of origin. This analysis supports the approach taken to this risk analysis, in that mites, aphids and thrips are widely intercepted from all countries across multiple flower types. This analysis is not presented in this document due to trade sensitivities, however is being used by the department to assist future engagement with countries on cut flower and foliage exports.

Australia has ensured it has acted consistently with its international obligations in undertaking the pest risk analysis for fresh cut flowers and foliage imports. The World Trade Organization (WTO) Sanitary and Phytosanitary (SPS) Agreement requires Members to ensure that their SPS risk analyses are appropriate to the circumstances and take into account risk analysis techniques developed by the relevant international organisations. The International Standard for Phytosanitary Measures (ISPM 2 Framework for pest risk analysis) recognises that the analysis of groups of pests, where individual species share common biological characteristics, is a valid approach to risk analysis. This pest risk analysis has been undertaken in accordance with the risk analysis techniques developed by the relevant international organisations—in this case ISPM 11 (Pest risk analysis for quarantine pests). The pest risk analysis has identified the pests, and groups of pests, associated with cut flowers and foliage imports that are of biosecurity

concern to Australia. The level of biosecurity risk posed by many of these pests does not achieve the appropriate level of protection for Australia and therefore risk management measures are required. The pest risk analysis recommends phytosanitary measures that are known to be effective in managing the biosecurity risks posed by these pests and pest groups.

**Comment 8: Concerns that the three recommended phytosanitary measures given in the draft report are not adequate to achieve Australia's appropriate level of protection.**

Response: As discussed in the response to Comment 3, compliance results since 1 March 2018 have been incorporated into Section 5.4 of this report. The revised import conditions are designed to significantly reduce the incidence of pests arriving with cut flower and foliage shipments at Australia's border by requiring that biosecurity risks are appropriately managed in the exporting country. The most recent interception data demonstrates that the numbers of arriving arthropod pests in imported cut flowers and foliage has reduced, although further reduction is needed for some countries.

The Draft PRA noted (Section 7.1.1) that the department is continuing to verify arriving flower consignments through documentation checks and physical inspections, and that countries' compliance with import conditions had shown incremental improvements. Since November 2018, when the Draft PRA was released, the rate of improvement has varied with country of origin and the measure used, but has demonstrated that risk management measures used by certain countries are effective. Some countries have achieved greater success using a systems approach than others, but the pre-export methyl bromide fumigation option is giving the best overall results. These data also support the view put forward in the Draft PRA that the three measures proposed, if implemented correctly, should reduce the likelihood of entry for these pests to achieve Australia's ALOP.

If live quarantine arthropods are found through the department's verification inspection of arriving consignments, the department, at its discretion, can order those consignments for remedial treatment, therefore also ensuring that the consignment achieves Australia's ALOP.

**Comment 9: Questions about actions the department will take if countries continue to have high non-compliance rates, and requests for the department to consider additional and/or differentiated import measures to those given in the Draft PRA.**

Response: The department has informed countries and importers that highly non-compliant pathways will require import permits, as a method of regulating non-compliance, unless significant improvement is identified. This situation is being closely monitored by the department, and regular reports are being provided to countries and importers. The highly non-compliant pathways potentially subject to this differentiated import measure are likely to be those using the systems approach that have been unable to reduce non-compliance rates since the revised measures were implemented on 1 March 2018. These countries also have the option of using the pre-export methyl bromide fumigation, or alternative disinfestation treatment measure in the absence of the systems approach measure.

This Final PRA (Section 7.1.1) states that the department may consider other specific risk management measures in the future to address high rates of non-compliance. Since the Draft PRA document was released for public consultation on 14 November 2018, the department has

been working to initiate a system of import permits that will allow trade to continue. Operation of import permits has been included in this Final PRA (Section 7.1.1) as an alternative measure.

In the event that cut flower and foliage consignments are repeatedly non-compliant, the department reserves the right to suspend imports (either all imports, or imports from specific pathways) and conduct an audit of the risk management systems. Imports will recommence only when the department is satisfied that appropriate corrective action has been undertaken.

**Comment 10: Stakeholders raised questions about how a country might continue to trade, or how trade using a systems-approach pathway might be reinstated, if that country has been moved onto an import permit system because of high previous non-compliance.**

Response: There are several ways that a country may continue to trade. For example, if the country has been informed that import permits are required, the country can no longer use the NPPO-approved systems approach measure. Australian importers could instead apply to the department for import permits, allowing continued trade, and allowing greater assurance and oversight by the department.

Countries could also use one of the two other main phytosanitary measures—pre-export methyl bromide fumigation, or another treatment that has been shown to be efficacious. Should the country not have access to methyl bromide fumigation facilities it may be possible to have consignments fumigated in a third country, noting however that those consignments would need to be certified by the NPPO of the country where that fumigation is applied. Importers considering this option should contact the department first for advice.

Over the longer term, an exporting country's NPPO may apply to have a systems approach option reinstated. Submissions based on modifications to systems approaches and/or post-harvest treatments will be subject to formal evaluation by the department, and may require an in-country audit by the department to verify the efficacy of proposed measures and the NPPO's phytosanitary system. Further detail incorporating this information has been included in Section 7 of this report.

**Comment 11: Questions relating to audits of risk management systems in exporting countries.**

Response: It is the responsibility of the NPPO of an exporting country to instigate a system of operational procedures to maintain and verify the phytosanitary status of exports of cut flowers and foliage to Australia. Details of appropriate systems are included in Section 7.2 of this report. The department is, however, considering audits of these export pathways as part of its program of overseas audits of other export pathways to Australia. Such audits may be prioritised where a country has applied to have a previous export measure reinstated (discussed in Section 7.1.1).

**Other issues**

The department has made a number of changes to the report following consideration of stakeholder comments on the draft report and subsequent review of the literature. These include:

- amendments to the pest categorisation table (Appendix F) to recognise the regional pest status of 12 species for the state of Western Australia (the 12 species were elevated from

non-quarantine pest to quarantine pest status). Amendments were also made to the global distribution of some species, on advice from NPPOs.

- amendments to the text in the pest categorisation table (Appendix F) to include 17 additional species (11 mites, three aphids and three thrips) that were intercepted between 1 March 2018 and 28 February 2019. Eight of these have been assessed as quarantine pests for Australia, three as regulated articles or potential regulated articles, and seven as non-quarantine pests.
- deletion of *Tetranychus truncatus* from the pest list, based on department information that the single specimen was misidentified.
- addition of an appendix (Appendix A) listing the taxa of cut flowers and foliage that were permitted entry into Australia at the time of publication of this Final PRA.
- addition of organisation names of representatives on the department's cut flowers and foliage regulation working group.
- updates to Australian production statistics and import volumes and amendments to the value of imported cut flowers and foliage in Australia.
- minor corrections, rewording and editorial changes for consistency, clarity and web-accessibility.

## 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 or regulated articles (FAO 2019).
Approach rate	Proportion of units that are not compliant with import conditions.
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).
Appropriate level of protection (ALOP) for Australia	The <i>Biosecurity Act 2015</i> defines the appropriate level of protection (or ALOP) for Australia as a high level of sanitary and phytosanitary protection aimed at reducing biosecurity risks to very low, but not to zero.
Arboreal	Organism that lives in trees.
Area	An officially defined country, part of a country or all or parts of several countries (FAO 2019).
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.
Australian territory	Australian territory as referenced in the <i>Biosecurity Act 2015</i> refers to Australia, Christmas Island and Cocos (Keeling) Islands.
Biological control agents (BCAs)	A biological control agent is an organism, such as an insect or plant disease, that is used to control a pest species. Before a biological control agent is released into the Australian environment, it must be established, via risk analysis, that the risk associated with its release, including host specificity, achieves the appropriate level of protection (ALOP) for Australia.
Biosecurity	The prevention of the entry, establishment or spread of unwanted pests and infectious disease agents to protect human, animal or plant health or life, and the environment.
Biosecurity measures	The <i>Biosecurity Act 2015</i> defines biosecurity measures as measures to manage any of the following: biosecurity risk, the risk of contagion of a listed human disease, the risk of listed human diseases entering, emerging, establishing themselves or spreading in Australian territory, and biosecurity emergencies and human biosecurity emergencies.
Biosecurity import risk analysis (BIRA)	The <i>Biosecurity Act 2015</i> defines a BIRA as an evaluation of the level of biosecurity risk associated with particular goods, or a particular class of goods, that may be imported, or proposed to be imported, into Australian territory, including, if necessary, the identification of conditions that must be met to manage the level of biosecurity risk associated with the goods, or the class of goods, to a level that achieves the ALOP for Australia. The risk analysis process is regulated under legislation.
Biosecurity risk	The <i>Biosecurity Act 2015</i> refers to biosecurity risk as the likelihood of a disease or pest entering, establishing or spreading in Australian territory, and the potential for the disease or pest causing harm to human, animal or plant health, the environment, economic or community activities.
Bulbils	A tiny secondary bulb that forms in the angle between a leaf and stem or in place of flowers on certain plants.

Term or abbreviation	Definition
Cilia	Small fine hairs.
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 2019).
Contaminating pest	A pest that is carried by a commodity, packaging, conveyance or container, or present in a storage place and that, in the case of plants and plant products, does not infest them (FAO 2019).
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO 2019).
Corrective action plan	Documented plan of phytosanitary actions to be implemented in an area officially delimited for phytosanitary purposes if a pest is detected or a tolerance level is exceeded or in the case of faulty implementation of officially established procedures (FAO 2019).
Cut flowers and branches	Fresh parts of plants intended for decorative use and not for planting (FAO 2019).
Devitalisation	A procedure rendering plants or plant products incapable of germination, growth or further reproduction (FAO 2019).
Diapause	Period of suspended development/growth occurring in some insects, in which metabolism is decreased.
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 2019).
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 2019).
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO 2019).
Fresh	Living; not dried, deep-frozen or otherwise conserved (FAO 2019).
Fumigation	A method of pest control that completely fills an area with gaseous pesticides to suffocate or poison the pests within.
Fungivore	An animal that gets its energy from eating fungi.
Genus	A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature the genus name is used, either alone or followed by a Latin adjective or epithet, to form the name of a species.
Goods	The <i>Biosecurity Act 2015</i> defines goods as an animal, a plant (whether moveable or not), a sample or specimen of a disease agent, a pest, mail or any other article, substance or thing (including, but not limited to, any kind of moveable property).
Herbivore	An animal that gets its energy from eating plants.
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 2019).

<b>Term or abbreviation</b>	<b>Definition</b>
Import permit	Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2019).
Incursion	An isolated population of a pest recently detected in an area, not known to be established, but expected to survive for the immediate future (FAO 2019).
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 2019).
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 2019).
Intended use	Declared purpose for which plants, plant products, or other regulated articles are imported, produced or used (FAO 2019).
Interception (of a pest)	The detection of a pest during inspection or testing of an imported consignment (FAO 2019).
International Plant Protection Convention (IPPC)	The IPPC is an international plant health agreement, established in 1952, that aims to protect cultivated and wild plants by preventing the introduction and spread of pests. The IPPC provides an international framework for plant protection that includes developing International Standards for Phytosanitary Measures (ISPMs) for safeguarding plant resources.
International Standard for Phytosanitary Measures (ISPM)	An international standard adopted by the Conference of the Food and Agriculture Organization, the Interim Commission on Phytosanitary Measures or the Commission on Phytosanitary Measures, established under the IPPC (FAO 2019).
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO 2019).
Larva	A juvenile form of animal with indirect development, undergoing metamorphosis (for example, insects or amphibians).
Lot	A number of units of a single commodity, identifiable by its homogeneity of composition, origin et cetera, forming part of a consignment (FAO 2019).
Mutualism	A relationship between two organisms in which both benefit.
National Plant Protection Organization (NPPO)	Official service established by a government to discharge the functions specified by the IPPC (FAO 2019).
Natural enemy	An organism which lives at the expense of another organism in its area of origin and which may help to limit the population of that organism. This includes parasitoids, parasites, predators, phytophagous organisms and pathogens (FAO 2019).
Non-regulated risk analysis	Refers to the process for conducting a risk analysis that is not regulated under legislation (Biosecurity import risk analysis guidelines 2016).
Obligate predator	An animal that can only survive by eating other animals.
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 2019).
Parasite	An organism which lives on or in a larger organism, feeding upon it (FAO 2019).

<b>Term or abbreviation</b>	<b>Definition</b>
Parasitoid	An insect parasitic only in its immature stages, killing its host in the process of its development, and free living as an adult (FAO 2019).
Parthenogenetic	A form of asexual reproduction where offspring are produced without fertilization.
Pathogen	A biological agent that can cause disease to its host.
Pathway	Any means that allows the entry or spread of a pest (FAO 2019).
Pest	Any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products (FAO 2019).
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 2019).
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 2019).
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 2019).
Pest free production site	A production site in which a specific pest is absent, as demonstrated by scientific evidence, and in which, where appropriate, this condition is being officially maintained for a defined period (FAO 2019).
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 2019).
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 2019).
Pest risk assessment (for regulated non-quarantine pests)	Evaluation of the probability that a pest in plants for planting affects the intended use of those plants with an economically unacceptable impact (FAO 2019).
Pest risk management (for quarantine pests)	Evaluation and selection of options to reduce the risk of introduction and spread of a pest (FAO 2019).
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 2019).
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 2019).
Petal	A unit of the corolla or inner floral envelope of a flower, usually coloured and more or less showy.
Phytosanitary	Phytosanitary relates to the health of plants.
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 2019).
Phytosanitary certification	Use of phytosanitary procedures leading to the issue of a Phytosanitary Certificate (FAO 2019).



<b>Term or abbreviation</b>	<b>Definition</b>
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 2019). In this risk analysis the term ‘phytosanitary measure’ and ‘risk management measure’ may be used interchangeably.
Phytosanitary procedure	Any official method for implementing phytosanitary measures including the performance of inspections, tests, surveillance or treatments in connection with regulated pest (FAO 2019).
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 2019).
Polyphagous	Feeding on a relatively large number of hosts from different plant family and/or genera.
PRA area	Area in relation to which a pest risk analysis is conducted (FAO 2019).
Predator	A natural enemy that preys and feeds on other animal organisms, more than one of which are killed during its lifetime (FAO 2019).
Production site	In this report, a production site is a continuous planting of cut flowers and foliage treated as a single unit for pest management purposes. If a production area is subdivided into one or more units for pest management purposes, then each unit is a production site. If the production area is not subdivided, then the area is also the production site.
Propagatable	Plants that can be propagated.
Phytophagous	Plant-feeding.
Pupa	An inactive life stage that only occurs in insects that undergo complete metamorphosis, for example butterflies and moths (Lepidoptera), beetles (Coleoptera) and bees, wasps and ants (Hymenoptera).
Quarantine	Official confinement of regulated articles, pests or beneficial organisms for inspection, testing, treatment, observation or research (FAO 2019).
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 2019).
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 2019).
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 2019).
Regulated pest	A quarantine pest or a regulated non-quarantine pest (FAO 2019).
Restricted risk	Restricted risk is the risk estimate when risk management measures are applied.
Risk analysis	Refers to the technical or scientific process for assessing the level of biosecurity risk associated with the goods, or the class of goods, and if necessary, the identification of conditions that must be met to manage the level of biosecurity risk associated with the goods, or class of goods to a level that achieves the ALOP for Australia.

<b>Term or abbreviation</b>	<b>Definition</b>
Risk management measure	Are conditions that must be met to manage the level of biosecurity risk associated with the goods or the class of goods, to a level that achieves the ALOP for Australia. In this risk analysis, the term ‘risk management measure’ and ‘phytosanitary measure’ may be used interchangeably.
Saprophyte	An organism deriving its nourishment from dead organic matter.
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO 2019).
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.
Stylet	Modified insect mouthparts for piercing.
Surveillance	An official process which collects and records data on pest occurrence or absence by surveying, monitoring or other procedures (FAO 2019).
Systems approach(es)	A pest risk management option that integrates different measures, at least two of which act independently, with cumulative effect (FAO 2019).
Taxon/taxa	Unit used in the science of biological classification.
The department	The Australian Government Department of Agriculture.
Trash	Soil, splinters, twigs, leaves and other plant material, other than fruit as defined in the scope of this risk analysis. For example, stem and leaf material, seeds, soil, animal matter/parts or other extraneous material.
Treatment	Official procedure for the killing, inactivation or removal of pests, or for rendering pests infertile or for devitalisation (FAO 2019).
Unrestricted risk	Unrestricted risk estimates apply in the absence of risk management measures.
Vector	An organism that does not cause disease itself, but which causes infection by conveying pathogens from one host to another.
Verification visit	Visit to verify production system.
Viable	Alive, able to germinate or capable of growth.

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