Australian Government
Department of Agriculture, Fisheries and Forestry

Passionfruit from Vietnam: biosecurity import requirements final report

March 2024

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Acknowledgement of Country

We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

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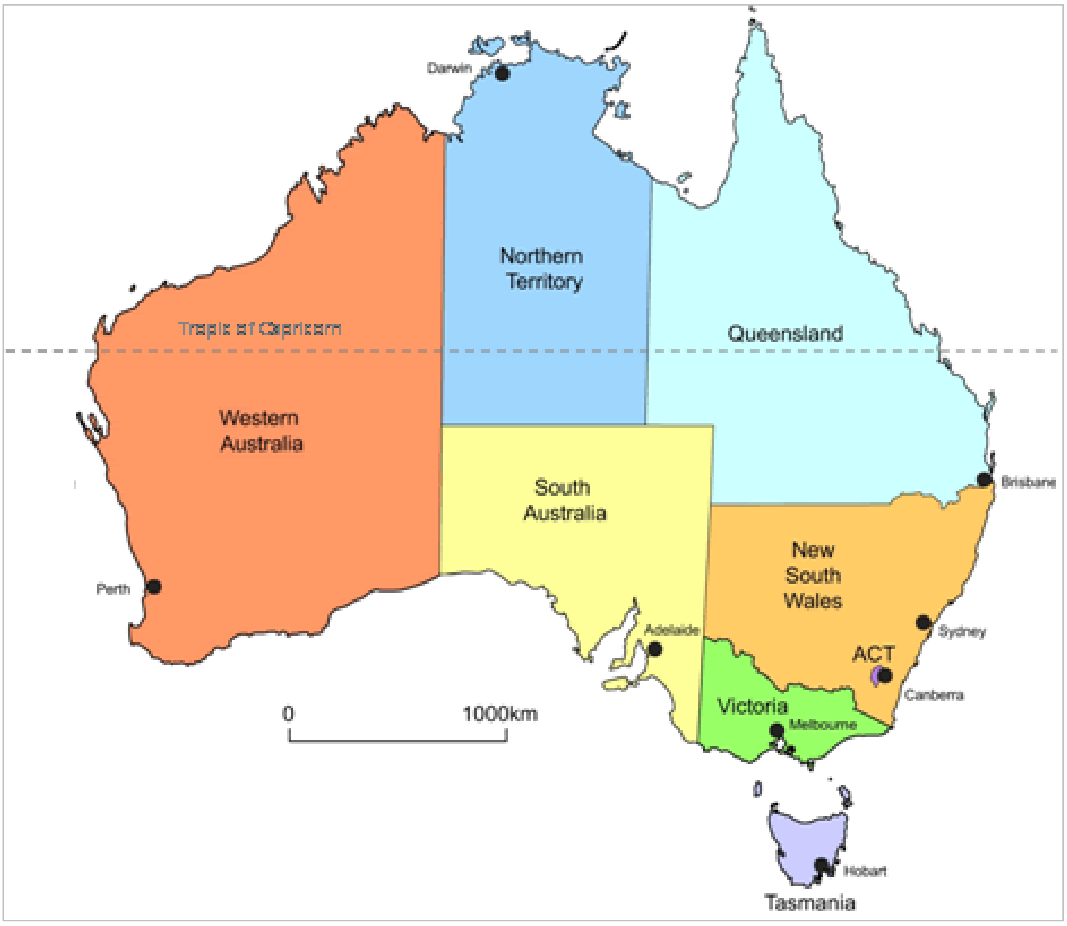

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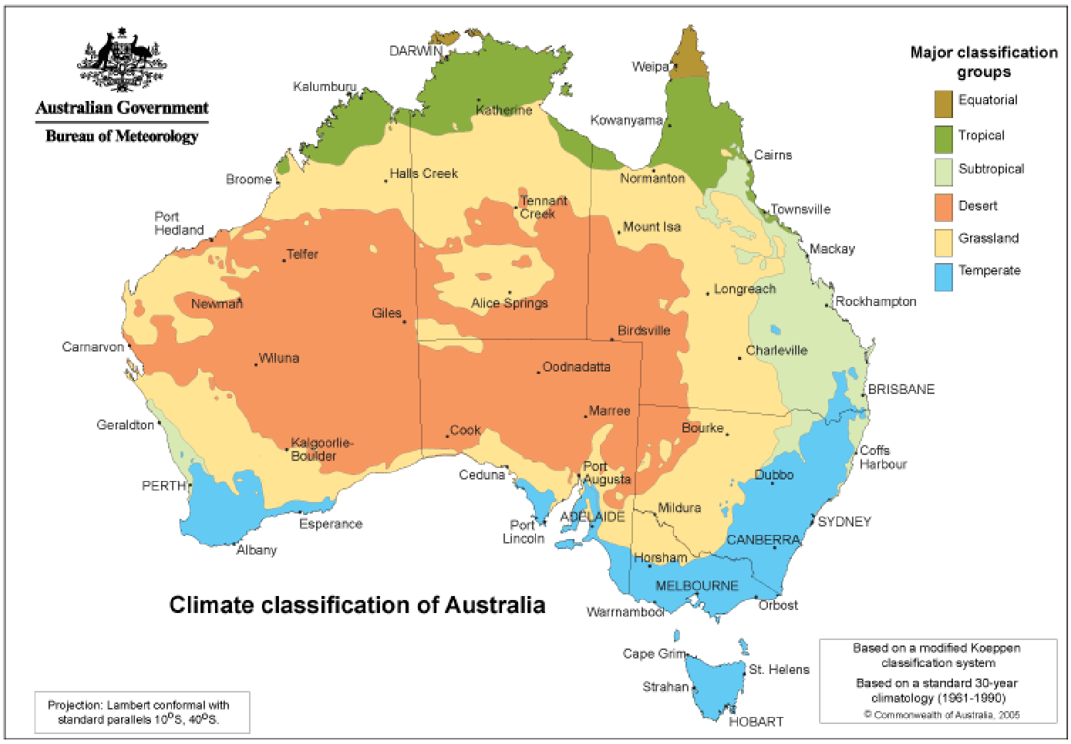


Summary

The Australian Government Department of Agriculture, Fisheries and Forestry (the department) has prepared this final report to assess the proposal by Vietnam for market access to Australia for fresh passionfruit for human consumption.

Australia currently permits the importation of passionfruit from New Zealand for human consumption, provided Australian biosecurity import conditions are met.

This final report determines that the importation of commercially produced passionfruit to Australia from all commercial production areas of Vietnam can be permitted, subject to a range of biosecurity requirements.

This final report contains details of plant pests that are of biosecurity concern to Australia and are potentially associated with the importation of fresh passionfruit from Vietnam. The term 'pests' includes both arthropod pests and pathogens. This report also contains risk assessments for the identified quarantine pests and regulated articles, and, where required, recommended risk management measures to reduce the biosecurity risk to an acceptable level, that is, to achieve the appropriate level of protection (ALOP) for Australia.

Twelve pests have been identified in this risk analysis as requiring risk management measures to reduce the biosecurity risk to an acceptable level. These pests are:

- false spider mites: *Brevipalpus phoenicis* species complex
- fruit flies: Oriental fruit fly (*Bactrocera dorsalis*), melon fly (*Zeugodacus cucurbitae*) and pumpkin fruit fly (*Zeugodacus tau*)
- mealybug: Pacific mealybug (*Planococcus minor*)
- scale insects: dictyospermum scale (*Chrysomphalus dictyospermi*), mulberry scale (*Pseudaulacaspis pentagona*) and West Indian red scale (*Selenaspidus articulatus*)
- spider mite: *Tetranychus piercei*
- thrips: melon thrips (*Thrips palmi*), cotton thrips (*Frankliniella schultzei* species complex) and chilli thrips (*Scirtothrips dorsalis*).

Of these 12 pests:

- eleven are quarantine pests, of which 3 are also regulated articles, including
  - melon thrips and cotton thrips, which were also identified as regulated articles as they are capable of harbouring and spreading emerging orthotospoviruses that are quarantine pests for Australia
  - false spider mites, which were also identified as regulated articles as they are capable of vectoring viruses that are quarantine pests for Australia. However, there are no reports of the quarantine viruses vectored by false spider mites being present in Vietnam. Therefore, the regulated article aspect of false spider mites is not applicable to the passionfruit from Vietnam pathway.
- one is a non-quarantine pest (chilli thrips) but is identified as a regulated article as it is capable of harbouring and spreading quarantine orthotospoviruses.

The identified pests are the same, or of the same pest groups, as those associated with other horticultural commodities that have been analysed previously by the department.

The recommended risk management measures take account of regional differences in pest distribution within Australia. Four pests requiring risk management measures, *Planococcus minor*, *Chrysomphalus dictyospermi*, *Pseudaulacaspis pentagona* and *Thrips palmi,* have been identified as regional quarantine pests for Western Australia, and *Thrips palmi* has also been identified as a regional quarantine pest for South Australia. These pests are considered regional quarantine pests as interstate quarantine regulations and enforcement are in place to prevent the introduction and distribution of these pests into the respective jurisdictions.

In this final report the department recommends a range of risk management measures, combined with operational systems, to reduce the risks posed by the 12 identified pests to achieve the ALOP for Australia. The recommended measures are:

- for fruit flies:
  - pest free areas, pest free places of production or pest free production sites; or
  - fruit treatment considered to be effective against fruit flies such as irradiation
- for false spider mites, mealybug, scale insects, spider mite and thrips:
  - pre-export visual inspection, and if found, remedial action.

Written comments on the draft report were received from 7 stakeholders. The department has made changes to the risk analysis following consideration of the stakeholder comments and a subsequent review of literature. These changes include:

- amendments to Chapter 3 ‘Pest risk assessments for quarantine pests’
  - The risk assessment for thrips in section 3.9 includes the *Frankliniella schultzei* species complex, which has been assessed as a quarantine pest and a regulated article.
  - Addition in section 3.4 of a risk assessment for the *Brevipalpus phoenicis* species complex, which has been assessed as a quarantine pest and a regulated article.
  - The mealybug species *Rastrococcus invadens* has been removed as a quarantine pest requiring specific risk management measures on the passionfruit from Vietnam pathway because there was insufficient evidence that *Passiflora edulis* is a host for the species. *Rastrococcus invadens* remains a quarantine pest for Australia. Should *R. invadens* be detected on the passionfruit from Vietnam pathway, it would require remedial action and may trigger a re-assessment for this species on this pathway. Similarly, a re-assessment for *R. invadens* would also be required if evidence becomes available that *Passiflora edulis* is a host.
- amendments to Chapter 4 ‘Pest risk management’ to include additional information on pest interceptions in section 4.1.1 ‘Analysis of pest interception data’, and addition of the *Frankliniella schultzei* species complex and the *Brevipalpus phoenicis* species complex to section 4.1.2 ‘Risk management measures for quarantine pests and regulated articles associated with passionfruit from Vietnam’
- amendments to Appendix B ‘Initiation and categorisation for pests of passionfruit from Vietnam’ to include additional information and references
  - *Cassida obtusata*, *Xylosandrus compactus*, *Euproctis scintillans*, *Tiracola plagiata*, *Acraea terpsicore*, *Frankliniella schultzei* species complex, *Aspergillus flavus*, *Colletotrichum acutatum*, *Colletotrichum boninense*, *Colletotrichum plurivorum*, *Corynespora cassiicola* and *Curvularia australiensis* have been added to the table.
  - Additional information and clarification have been added for the *Brevipalpus phoenicis* species complex, and phytoplasmas and viruses that can be vectored by insects.

  - Changes have been made to the potential to enter on pathway for *Rastrococcus invadens*.
- addition of Appendix C 'Stakeholder comments', which summarises key technical issues raised by stakeholders, and how the department has considered these issues in this final report
- minor corrections, rewording and editorial changes for consistency, accuracy, 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 Australia's agricultural industries that are relatively free from serious pests.

The risk analysis process is an important part of Australia's biosecurity policy development. It enables the Australian Government to formally consider the level of biosecurity risk that may be associated with proposals to import goods into Australia. If the biosecurity risks do not achieve the appropriate level of protection (ALOP) for Australia, risk management measures are recommended 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 or developed.

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 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 (BIRA) 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 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 website at agriculture.gov.au/biosecurity-trade/policy/risk-analysis/guidelines.

1.2 This risk analysis

1.2.1 Background

Vietnam's Plant Protection Department (PPD) within the Ministry of Agriculture and Rural Development (MARD) formally requested market access to Australia for passionfruit for human consumption in a submission received in June 2016. This submission provided information on the pests associated with passionfruit in Vietnam, including the plant parts affected. Information was also provided on the standard commercial production practices for passionfruit in Vietnam.

On 30 August 2022, the department notified stakeholders of the decision to progress a request for market access for passionfruit from Vietnam as a review of biosecurity import requirements. This analysis is conducted in accordance with the *Biosecurity Act 2015*.

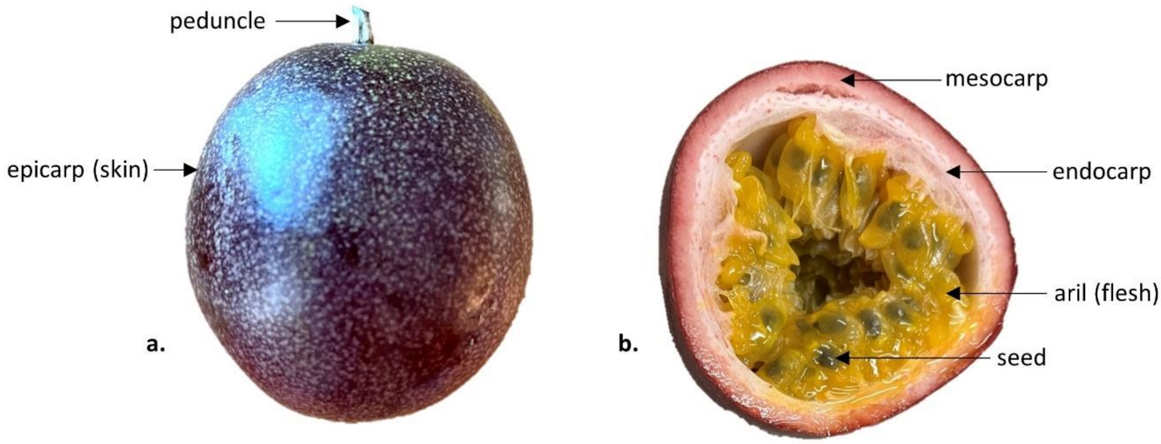
In November 2022, officers from the department visited production areas for passionfruit from Vietnam. The objective of this visit was to observe commercial production, pest management and other export practices.

1.2.2 Scope

The scope of this risk analysis is to consider the biosecurity risk that may be associated with the pathway of imported passionfruit (*Passiflora edulis*) from Vietnam, produced using standard commercial production practices as described in Chapter 2, for human consumption in Australia.

In this risk analysis, passionfruit are defined as the entire fruit with the skin, flesh, seeds, and potentially a small portion of the peduncle (Figure 1.1). This risk analysis covers all cultivars of commercially produced passionfruit from all production regions in Vietnam.

Figure 1.1 Diagram of passionfruit morphology



a. External morphology of the mature passionfruit. **b.** Internal morphology of the mature passionfruit.

1.2.3 Existing policy

International policy

Import policy exists for fresh passionfruit from New Zealand. Australia has import policies for the following horticultural commodities from Vietnam: longan (DAWR 2019b), dragon fruit (DAWR 2017c), lychees (DAFF 2013) and mangoes (DAWR 2015).

The biosecurity import conditions for these commodity pathways can be found in the Biosecurity Import Conditions (BICON) system on the department's website at bicon.agriculture.gov.au/BiconWeb4.0.

A preliminary assessment has identified that the potential pests of biosecurity concern for passionfruit from Vietnam are the same, or of the same pest groups, as those associated with these and other horticultural commodities that have been assessed previously by the department, and for which risk management measures are established.

The department has reviewed all the pests and pest groups previously identified in existing policies and, where relevant, the information in those assessments has been considered in this risk analysis. The department has also reviewed the latest scientific literature and other information and, where relevant, the department has included this new information in this risk analysis.

The biosecurity risk posed by thrips and the orthotospoviruses they transmit was previously assessed for all countries in the *Final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports* (thrips Group PRA) (DAWR 2017a).

The biosecurity risk posed by mealybugs and the viruses they transmit was previously assessed for all countries in the *Final group pest risk analysis for mealybugs and the viruses they transmit on fresh fruit, vegetable, cut-flower and foliage imports* (mealybugs Group PRA) (DAWR 2019a).

The biosecurity risk posed by soft and hard scale insects was previously assessed for all countries in the *Final group pest risk analysis for soft and hard scale insects on fresh fruit, vegetable, cut-flower and foliage imports* (scales Group PRA) (DAWE 2021).

These Group policies are applicable for the passionfruit from Vietnam pathway. The department has determined that the information in these Group policies can be adopted for the species under consideration in this risk analysis.

Domestic arrangements

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

1.2.4 Contaminating pests

In addition to the pests of passionfruit from Vietnam that are assessed in this risk analysis, other organisms may arrive with the imported commodity. These organisms may include pests considered not to be associated with the fruit pathway, pests of other crops, or predators and parasitoids of arthropods. The department considers these organisms to be contaminating pests (‘contaminants’) that could pose sanitary (to human or animal life or health) or phytosanitary (to plant life or health) risks. These risks are identified and addressed using existing operational procedures that require an inspection of all consignments during processing and preparation for export. Consignments will also undergo a verification process on arrival in Australia. The department will investigate whether any pest identified through import verification processes may be of biosecurity concern to Australia and may thus require remedial action.

1.2.5 Consultation

On 30 August 2022, the department notified stakeholders, in Biosecurity Advice 2022-P08, of the commencement of a review of biosecurity import requirements to assess a proposal by Vietnam for market access to Australia for passionfruit for human consumption.

Prior to, and following the announcement of this decision, the department engaged with the Australian passionfruit industry through Passionfruit Australia Inc.

The department has also consulted with the government of Vietnam and Australian state and territory governments during the preparation of this report.

The draft report was released on 13 July 2023 (Biosecurity Advice 2023-P04) for a 60-day stakeholder consultation period that concluded on 11 September 2023.

The department received 7 written submissions on the draft report. All submissions received during the consultation period, and issues raised by stakeholders throughout the risk analysis process, were carefully considered and, where relevant, changes were made to the final report. A summary of key technical stakeholder comments and how they were considered is provided in Appendix C.

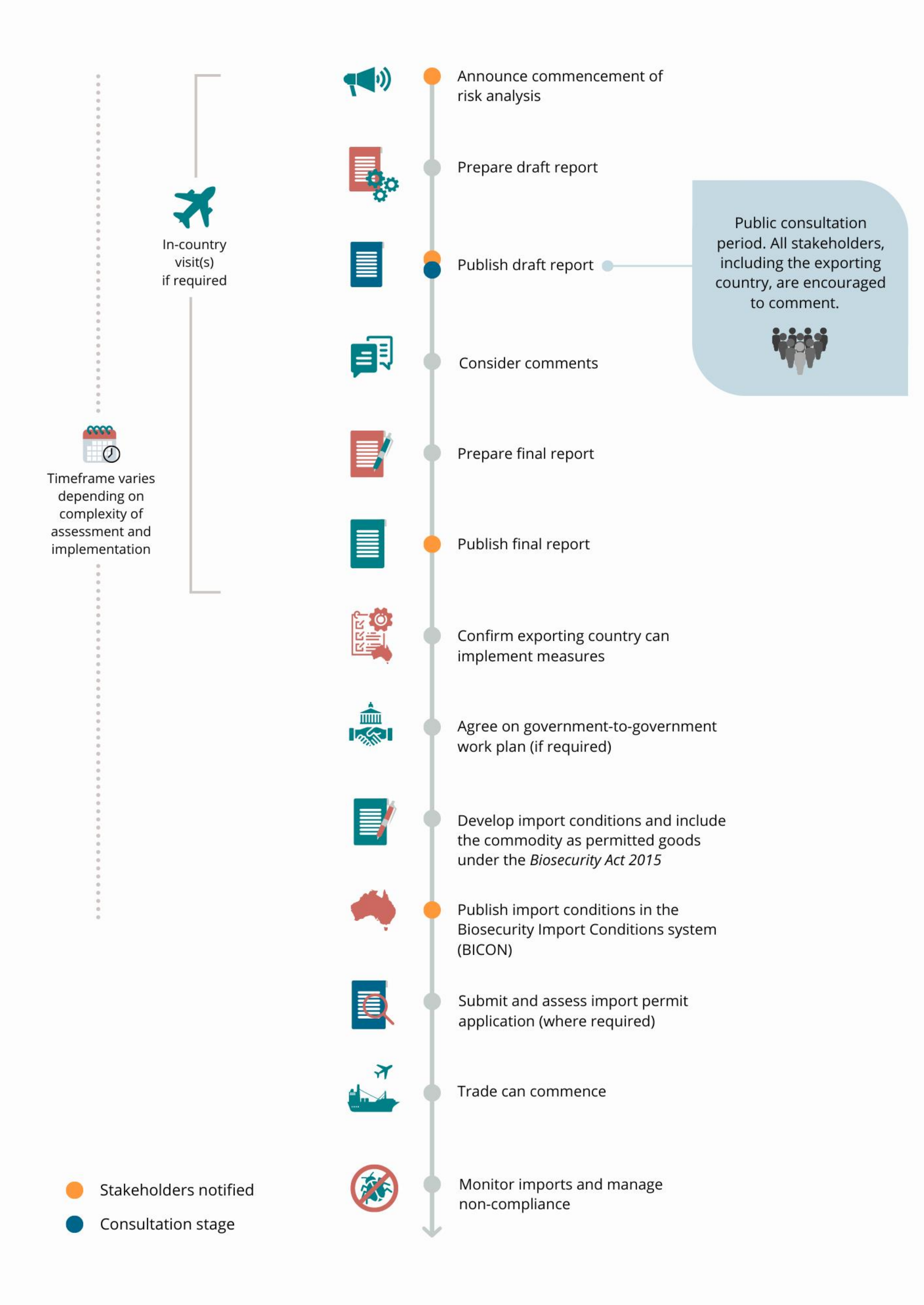
1.2.6 Overview of this pest risk analysis

A pest risk analysis (PRA) is 'the process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it'. A pest is ‘any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products’ (FAO 2023a). This definition is also applied in the *Biosecurity Act 2015*.

The department conducted this PRA in accordance with Australia’s method for pest risk analysis (Appendix A), which is consistent with the International Standards for Phytosanitary Measures (ISPMs), including ISPM 2: *Framework for pest risk analysis* (FAO 2019a) and ISPM 11: *Pest risk analysis for quarantine pests* (FAO 2019b), and the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement) (WTO 1995).

A summary of the process used by the department to conduct a risk analysis is provided in Figure 1.2.

Figure 1.2 Process flow diagram for conducting a risk analysis and implementing trade



The PRA was conducted in the following 3 consecutive stages:

1) Initiation—identification of:
   - the pathway being assessed in the risk analysis
   - the pest(s) that have potential to be associated with the pathway and are of biosecurity concern and should be considered for analysis in relation to the identified PRA area.
2) Pest risk assessment—this was conducted in 2 sequential steps:
   2a. Pest categorisation: examination of each pest identified in stage 1 to determine whether it is a quarantine pest and requires further pest risk assessment.
   2b. Further pest risk assessment: evaluation of the likelihoods of the introduction (entry and establishment) and spread, and the magnitude of the potential consequences of the quarantine pest(s). The combination of the likelihoods and consequences gives an overall estimate of the biosecurity risk of the pest, known as the unrestricted risk estimate (URE).
3) Pest risk management—the process of identifying and proposing/recommending required phytosanitary measures to reduce the biosecurity risk to achieve the ALOP for Australia where the URE is determined as not achieving the ALOP for Australia. Restricted risk is estimated with these phytosanitary measure(s) applied.

A phytosanitary measure is 'any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests' (FAO 2023a).

For further information on the:

- method for PRA see: Appendix A
- terms used in this risk analysis see: Glossary, acronyms and abbreviations at the end of this report
- pathway being assessed in this risk analysis see: section 1.2.2
- initiation and pest categorisation see: Appendix B
- commercial production practices of passionfruit in Vietnam and its export capability see: Chapter 2
- pest risk assessments for pests/pest groups identified in Appendix B as requiring further pest risk assessment see: Chapter 3
- risk management measures for pests/pest groups assessed in Chapter 3 as not achieving the ALOP for Australia see: Chapter 4.

1.2.7 Next steps

The final report will be published on the department's website along with a notice advising stakeholders of the release. The department will also notify the proposer, the registered stakeholders and the WTO Secretariat about the release of the final report. Publication of the final report represents the end of the risk analysis process.

Before any trade in passionfruit from Vietnam commences, the department will verify that Vietnam can implement the required pest risk management measures (as specified in section 4.1), and operational system for the assurance, maintenance and verification of phytosanitary status (as specified in section 4.2). On verification of these requirements, the import conditions for passionfruit from Vietnam will be published on BICON.

2 Commercial production practices for passionfruit in Vietnam

This chapter provides information on the pre-harvest, harvest and post-harvest practices considered to be standard practices in Vietnam for the production of passionfruit for export. It also outlines the export capability of Vietnam.

2.1 Considerations used in estimating unrestricted risk

Vietnam provided a technical market access submission and additional information to Australia that included information on commercial production practices of passionfruit in Vietnam.

In November 2022, the department visited passionfruit producing areas in the provinces of Gia Lai and Son La, and passionfruit packing houses in these provinces and Ho Chi Minh City. The department's observations during the visit, and additional information provided during and after the visit, confirmed the production, harvest, processing and packing procedures described in this chapter as standard commercial production practices for passionfruit for export.

The information provided by Vietnam and gathered by the department during the visit has been supplemented with data from published literature and other sources and has been taken into consideration when estimating the unrestricted risks of pests that may be associated with import of this commodity.

In estimating the likelihood of pest introduction, it was considered that the pre-harvest, harvest and post-harvest production practices for passionfruit, as described in this chapter, are implemented by all growers and packing houses for all varieties of passionfruit produced for export.

2.2 Production areas of passionfruit

Commercial production of passionfruit in Vietnam occurs predominantly in the Central Highlands (provinces of Gia Lai, Dak Nong, Dak Lak, Kon Tum and Lam Dong), the North West region (provinces of Hoa Binh and Son La), the North East region (provinces of Ha Giang, Cao Bang and Lang Son), and the North Central Coast region (province of Nghe An) (MARD 2016, 2021). These production areas are identified in Map 3.

The commercial production of passionfruit in Vietnam is a relatively new and expanding industry that commenced in 2007 (MARD 2016). The total area planted to passionfruit in 2019 was 10,500 ha, with around 70% of plantings occurring in the Central Highlands region (Table 2.1) (MARD 2021).

The area grown to passionfruit continues to increase as the industry grows (MARD 2016). Production of passionfruit per hectare has also increased in recent years due to improvements and efficiencies in production methods (MARD 2016).

Map 3 The main passionfruit growing provinces within regions of Vietnam

Source: Adapted from OnTheWorldMap (2023)

Table 2.1 Production area of passionfruit in Vietnam in 2019

Regions (Provinces)	Production area (ha)
North East and North West regions (Hoa Binh, Son La, Cao Bang, Ha Giang and Lang Son provinces)	2,494
North Central Coast region (Nghe An province)	385
Central Highlands region (Gia Lai, Lam Dong, Dak Nong, Dak Lak and Kon Tum provinces)	7,351
Other provinces	270
Total	**10,500**

2.3 Climate in production areas

Vietnam has both tropical and temperate climate zones, with central and southern parts of the country experiencing a tropical climate, and northern parts experiencing a temperate climate (World Bank Group 2021). There is a rainy season in the north and south from May to October and in the central regions from September to January. The rainy seasons correspond to the annual monsoon effect (World Bank Group 2021).

Northern parts of the country have mean monthly temperatures ranging from 17°C to 36°C, whereas southern parts experience a narrower mean monthly temperature range of 23°C to 35°C (World Weather Online 2023). The annual mean rainfall in Vietnam ranges from approximately 1,700 to 1,900 mm (World Bank Group 2021).

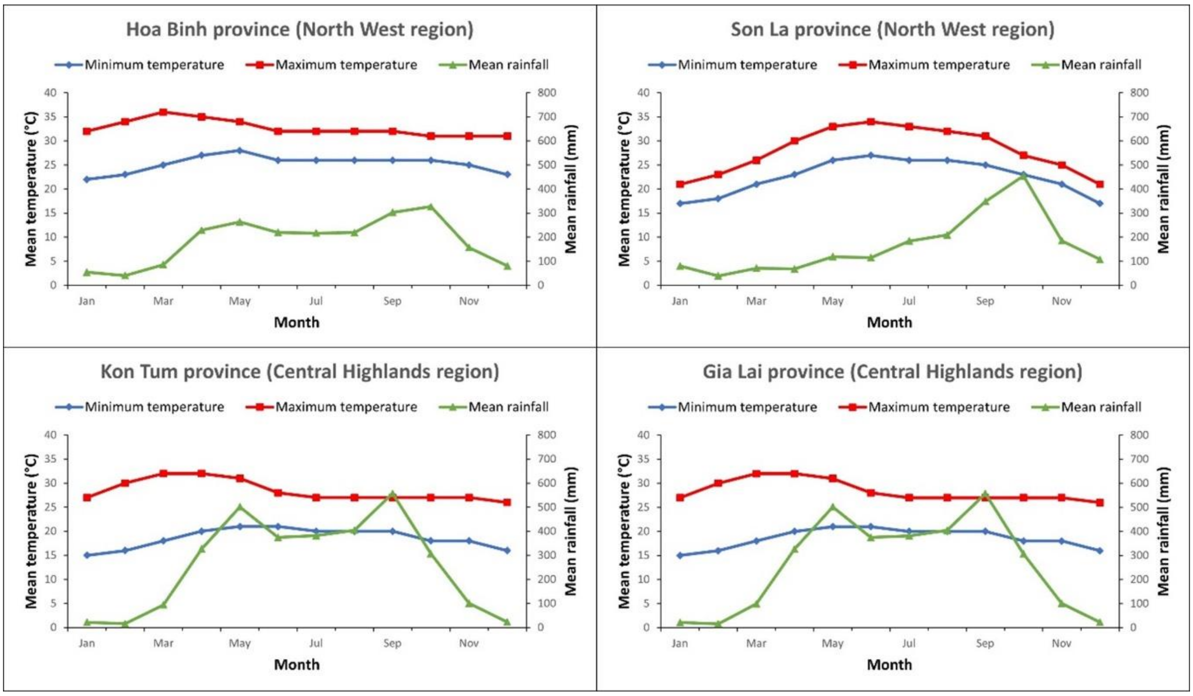
The North East and North West regions include areas with elevations of 2,000 m to 3,000 m above sea level. These regions have a rainy season from April to September, with most rain occurring from June to August and drought often occurring during November to April (MARD 2021).

The North Central Coast region has a tropical monsoon climate with a hot, humid summer with abundant rainfall and a cold winter with little rainfall. Annual rainfall in the North Central Coast region ranges from 1,200 mm to 2,000 mm, with 123 to 152 rainy days per year (MARD 2021).

The Central Highlands region consists of a series of fertile plateaus, ranging from 500 m to 1,500 m above sea level, surrounded by high mountain ranges. This region has a dry season and a rainy season (MARD 2021).

Figure 2.1 summarises the mean monthly minimum and maximum temperatures, and mean monthly rainfall in some of the main passionfruit production areas.

Figure 2.1 Mean monthly minimum and maximum temperatures and mean monthly rainfall in the main production areas of passionfruit in Vietnam



Mean monthly minimum (— ◆ —) and maximum (—■—) temperatures (°C) and mean monthly rainfall (millimetres) (—▲—) in provinces of Vietnam. Source: World Weather Online (2023)

2.4 Pre-harvest

2.4.1 Cultivars

The passionfruit plant is a member of the family Passifloraceae. It is a short-lived perennial, shallow-rooted and woody, self-climbing vine. The leaves are alternate, oval-shaped when young, and develop into deeply 3-lobed, approximately 7.5 cm to 20 cm in length when mature (Morton 1987). The young stems, tendrils and leaves may be tinged with red or purple. A single flower is borne at each node on new growth. Each flower, which contains both male and female parts, is 5 cm to 7.5 cm wide and is composed of 5 petals, 5 sepals and 5 anthers (Bailey et al. 2021; Morton 1987).

After pollination, the ovum, located below the 3-pointed stigma, grows into the fruit (Figure 1.1). The fruit is round to ovoid (Bailey et al. 2021; Morton 1987). Botanically the fruit is a berry, filled with black seeds that are covered by membranous orange pulpy sacs (arils), all surrounded by a white pith (Bailey et al. 2021) and a tough outer rind (Bailey et al. 2021). When mature, the rind ranges in colour from green to yellow, red or purple and is smooth and waxy in appearance (Bailey et al. 2021; Morton 1987).

The main cultivar of passionfruit that is currently grown in Vietnam is Dai Nong 1, which is a hybrid of yellow and purple passionfruit varieties. This cultivar, also known as the Tainung no. 1 cultivar, was developed by the Taiwan Agricultural Research Institute (Chang et al. 2017). It is reddish-purple when ripe, has low acidity, a fragrant aroma, and a smooth, glossy skin (Chang et al. 2017). Dai Nong 1 accounts for 95% of commercially grown passionfruit in Vietnam (MARD 2021).

Further cultivars are being trialled for potential commercial production. Yellow passionfruit are also grown, but these are largely used as a rootstock for grafting Dai Nong 1 plants or for producing fruit for the Vietnamese market.

2.4.2 Cultivation practices

Production of seedlings

Passionfruit seedlings for commercial planting are grown, from disease-free seed or as grafted plants, in nurseries accredited by Vietnam's Crop Production Department within MARD (Figure 2.2).

The Dai Nong 1 variety is generally grafted onto a yellow passionfruit rootstock, which provides improved vigour and disease resistance. The rootstock may be grown from seed or cuttings. To provide protection from harmful insects, especially virus vectors, the parent plants for production of the grafting buds, and seeds and cuttings for rootstocks are maintained in insect-proof facilities (MARD 2023). Disease screening - for example, testing for viruses by reverse transcriptase polymerase chain reaction and polymerase chain reaction methods - is conducted prior to the seedlings being released from the nursery for planting on farms (MARD 2023).

Since 2021, all passionfruit seedlings have been produced in Vietnam (MARD 2023). Prior to 2021, nurseries sourced passionfruit seed and seedlings from within Vietnam and through importation from Taiwan (Chang et al. 2017). Seedlings previously sourced from Taiwan required strict pathogen testing at the nursery in Taiwan prior to export (Chang et al. 2017; Red Pine International 2023), as well as clearance through quarantine on arrival in Vietnam (MARD 2014).

Figure 2.2 Passionfruit seedlings growing in a nursery

Source: MARD (2016)

Planting

Land preparation

Passionfruit can be grown on any terrain. The plant prefers soil that is porous and rich in organic matter, such as a red basalt soil. Soils that are too acidic or too alkaline impact plant growth and development.

Land preparation prior to planting involves removal of weeds, raking and levelling the area, and creation of drainage ditches to minimise soil erosion. Holes are dug for planting of new seedlings and plastic matting may be laid down prior to planting (MARD 2021).

In areas of steep terrain, passionfruit are planted along contour lines, in combination with other plants that assist in preventing soil erosion.

Planting techniques and timing

Each passionfruit seedling is placed into a hole, the roots are covered with soil, and the plant is watered. Poles and other support materials are placed around the seedling to prevent wind damage.

Depending on the soil type, topographical location and the cropping intensity, passionfruit may be planted with a density of 850 plants/ha (3 m x 4 m) to 1,660 plants/ha (3 m x 2 m) (MARD 2021).

While passionfruit can be planted year-round in Vietnam, the predominant time for planting is at the start of the rainy season in the respective region (MARD 2016).

Plant management

Plant growth and production

Passionfruit plants are grown on a trellis, 1.8 m to 2.0 m in height, with cross wires to support the growing vines (Figure 2.3). The trellis enhances flowering and fruiting through provision of increased light exposure for the plant. It also allows for an increase in the canopy surface to reduce disease development.

Passionfruit plants commence cropping when approximately 6 months of age and become full-bearing within 18 months (Dirou 2004). The productive life of a passionfruit plant is approximately 3 to 4 years (Dirou 2004), but plants are usually replaced in Vietnam when they are 2 years old. This practice maintains farms with optimal plant vigour and productivity (Chang et al. 2017).

Fertilisation

Fertiliser applications of nitrogen, phosphorus and potassium are applied during the planting period and regularly throughout the year (MARD 2021). An example of a fertiliser regime is provided in Table 2.2.

Figure 2.3 Trellis supports for passionfruit plants in Vietnam

Table 2.2 Example of a fertiliser regime for passionfruit in Vietnam

Phase	Fertiliser	Frequency
Pre-planting	Animal compost or microbial organic fertiliser Phosphorus and limestone powder	One application
1-6 months	Nitrogen/Phosphorus/Potassium	Nitrogen and Potassium are applied 20 days after planting, and then every 15 days. Phosphorus is separately applied twice, 60 days and 150 days after planting.
7 months onwards	Nitrogen/Phosphorus/Potassium Other foliar fertilisers containing Calcium, Magnesium, Sulfur, Boron, Molybdenum, and Iron are also applied to support the growth, development, flowering and fruiting of the passionfruit plant.	Nitrogen and Potassium are applied 20 times/year, every 15-20 days. Phosphorus is applied 3 times every 3-6 months.

Source: MARD (2016)

Pruning, weeding and mulching

Pruning of passionfruit plants is conducted for selection and training of the main vines, for establishing an optimal plant structure, to enhance the growth, flowering and fruiting of each plant, and to reduce development of diseases. Pruning of young plants involves both canopy and layer management. Leaves near the base of the plant are removed when the plant is approximately 1 m in height (MARD 2016). When the plant is approximately 20 cm to 40 cm beneath the top platform of the trellis, pruning is conducted to retain only 5 to 6 main branches. Later pruning ensures 4 to 5 vines from each main branch are retained (MARD 2016). Once the plant covers the entire trellis, vines are either pulled down or pulled across to cover the cross wires.

Once the passionfruit plant is fully established, pruning is conducted to remove:

- thick vines
- dead vines affected by pests
- covered vines that exhibit poor flowering and fruiting
- abnormally growing vines, including those that are too long
- old vines that produced fruit in the previous season
- yellow, old and pest-affected leaves
- leaves near large fruit
- leaves on vines without fruits.

Pruning is done using sharp, clean tools and discarded leaves and vines are removed from the farms.

Weeds around the base of the passionfruit plants are removed manually to mitigate harm to the roots and prevent competition and disease development. Mulch may also be applied around the base of the plants to maintain humidity and prevent weed growth.

Irrigation

A shallow root system enables the passionfruit plant to avoid waterlogging during the rainy season. Irrigation is not required during periods of high rainfall; supplementary irrigation is often required during the dry season.

2.4.3 Pest management

Each province in Vietnam is serviced by government staff from the Crop Production Department and PPD for management of data and statistics, pest surveillance and monitoring, and pest management guidance. At the province level, local PPD officers play an important role in educating and regulating the nurseries, farms and packing houses. The local PPD officers conduct regular surveys of passionfruit farms, on at least a monthly basis (MARD 2023). Officers focus on key pests and diseases, and provide recommendations for pest management practices (MARD 2021).

The main pests reported to be of concern during production of passionfruit in Vietnam are fruit flies, scale insects, thrips, mites, nematodes, fungi, bacteria and viruses.

Biological products containing beneficial organisms such as *Trichoderma* spp., *Streptomyces* spp. and *Bacillus* spp., and saponins and alkaloids, are applied separately, or together with fertilisers, to control fungi and nematodes. Garlic and chilli sprays may be used as pest deterrents. Chemical pesticides are used only when required. Examples of pest management options for different pests of passionfruit in Vietnam are presented in Table 2.3.

To minimise the incidence of viral diseases in passionfruit farms, the common commercial practice is to use disease free planting material and sterilised tools and conduct regular inspection and removal of any plants displaying poor vigour or disease symptoms, including curl, mosaic and/or yellowing of leaves (Chang et al. 2017; Lo, Lou & Huang 2023; PPD 2021). In addition, potential insect vectors are controlled (PPD 2021). After 2 years of growth, passionfruit plants are usually replaced. This strategy is effective in suppressing any disease incidence and maintaining productivity.

Table 2.3 Examples of pest management options for passionfruit in Vietnam

Pest/pest group	Management method	Timing of application
Fruit flies	Methyl eugenol traps are used for pest surveillance Protein baits are applied when fruit flies are detected	As required
Scales	Insecticides: abamectin, abamectin + petroleum oil, emamectin benzoate, pymetrozine, spirotetramat, thiamethoxam, imidacloprid, matrine, eucalyptol, deltamethrin, acephate, propargite or sulfur	As required
Thrips	Yellow sticky traps Insecticides: abamectin, matrine, acephate or propargite	As required
Fungi (leaves, branches and fruit)	Fungicides: dimethomorph + mancozeb, propineb, difenoconazole, fosetyl aluminium, azoxystrobin, mancozeb, chlorothalonil, mandipropamid + chlorothalonil, matrine or mancozeb + metalaxyl-M Biological agent: *Bacillus* spp.	Applied when buds grow or at the beginning of the rainy season. When the weather is favourable for fungal growth, another application may be conducted 7-10 days after the first application. To prevent resistance, different active constituents are applied for any subsequent applications.
Fungi (soil-borne)	Fungicides: phosphoric acid, fosetyl-aluminium, mancozeb or metalaxyl Biological agents: *Trichoderma* spp. or *Bacillus* spp.	Applied once or twice each year, at the beginning or at the end of the rainy season, by spraying to the base of the plant or directly to fungi-affected spots. Chemical pesticides are not applied to the places where bio-products have been applied. Chemicals are used at least 20 days before bio-products.
Bacteria, Phytoplasmas & Viruses	Use of disease-free planting material Control of vectors Removal of infected plants	As required, or after approximately 2 years.
Nematodes	Nematicides: clinoptilolite, abamectin or chitosan Biological agents: *Streptomyces lydicus* or *Purpureocillium lilacinum*	On detection of nematodes
Mites	Infested shoots are removed. Miticides: abamectin, abamectin + petroleum oil, emamectin benzoate or mineral oil	If there is a high population density of mites, a rotational application of pesticides may be sprayed to leaves and other parts of passionfruit plants. A second application may be required if mites are found 3-5 days after the initial application.

Source: MARD (2016)

2.5 Harvesting and handling procedures

Multiple harvests of passionfruit from individual plants occur through the year, depending on the climate and vine productivity. In the northern provinces, harvesting can occur year-round, but the main harvesting season is from May to December. In the southern provinces, harvesting of passionfruit occurs year-round (MARD 2021).

Harvesting commences when the green fruit start to change colour indicating maturity. Harvesting is done manually, with the passionfruit being hand-snapped from the vine. Passionfruit are harvested into buckets or bags, which are then consolidated into crates or large bags (Figure 2.4), labelled with the farm name or identification number, and transported to the packing house in sealed trucks for further processing.

Passionfruit are highly perishable and are susceptible to moisture loss after harvest, leading to diminished quality, including wrinkling of the fruit surface (Kishore et al. 2011; Yumbya et al. 2014). As a result, passionfruit are transported to the packing house as soon as possible after harvest.

Figure 2.4 Harvesting of passionfruit

Harvested passionfruit being collected into a. crates and b. buckets. Source: MARD (2021)

2.6 Post-harvest

2.6.1 Packing house processes

There are a number of packing houses in Vietnam that process and pack passionfruit for export.

The processing steps for passionfruit at the packing house (Figure 2.5) involve:

1) unloading of harvested fruit from trucks and storing in the packing house holding area prior to processing
2) initial visual sorting and grading of fruit for size, quality and maturity, and removal of damaged or diseased fruit
3) removal of peduncles from fruit using scissors, snips or a sharp blade
4) brushing fruit to remove trash on fruit surface
5) washing fruit in water
6) washing fruit in 100-200 ppm chlorine for at least 1 minute

7) rinsing fruit in water
8) drying fruit with fans
9) final visual quality checks of fruit
10) weighing and packing of fruit into perforated bags in tray lined cardboard cartons or polythene wrapped trays
11) cold storage of packed fruit
12) dispatch.

The brushing, washing, rinsing and drying steps may be carried out manually and/or by machine. The passionfruit may undergo further disinfestation treatment prior to export, if required by the importing country (MARD 2016).

Figure 2.5 Passionfruit packing house processes

a. Harvested passionfruit arrive at the packing house. **b.** Passionfruit undergo initial sorting and grading. **c.** Passionfruit are washed. **d.** Passionfruit undergo further quality checks. **e.** Passionfruit are packed into boxes. **f.** Packed passionfruit ready for storage and dispatch.

2.6.2 Phytosanitary inspection

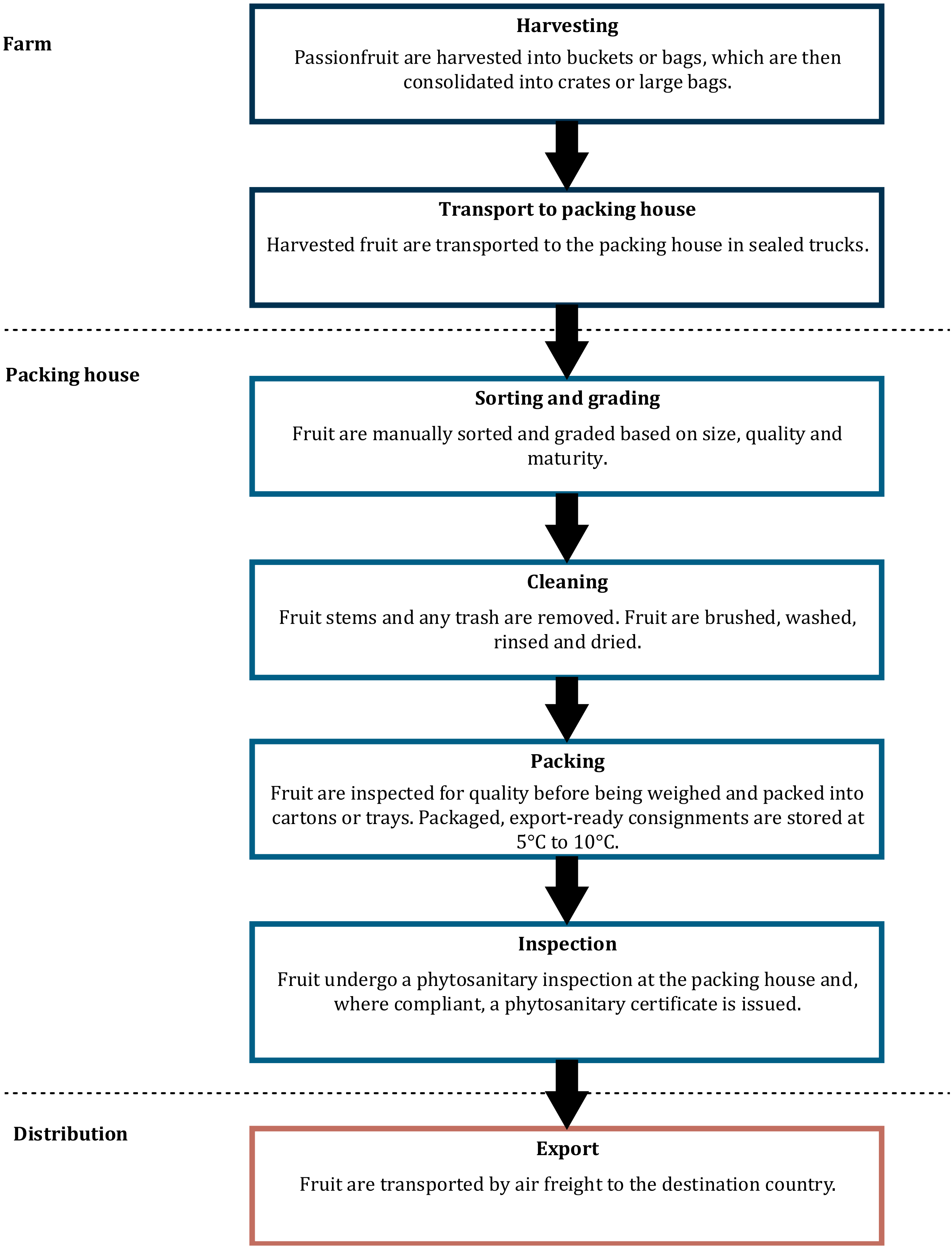
Phytosanitary inspection is performed by PPD inspection officers at a dedicated area in the packing house. PPD inspection officers randomly inspect a sample of fruit. If the consignment is found free of pests and meets the requirements of the importing country, it is issued with a phytosanitary certificate.

2.6.3 Transport

Export consignments are loaded into sealed trucks and transported directly to the airport. Shelf life of passionfruit varies from 1 week for fully-ripe fruit to 3 to 5 weeks for partially ripe fruit (Kader 1999). Recommended conditions during storage and transit are a temperature of 5°C to 10°C (Bao Long Foods 2023; Kader 1999) and humidity of up to 95% (Bao Long Foods 2023).

A summary of the operational steps for passionfruit grown in Vietnam for export is provided in Figure 2.6.

Figure 2.6 Summary of operational steps for passionfruit grown in Vietnam for export



2.7 Export capability

2.7.1 Production statistics

In 2019, Vietnam produced 222,200 tonnes of passionfruit from a total production area of 10,500 ha (MARD 2021). Due to the high economic value of passionfruit in Vietnam, the acreage and yields per hectare continue to increase.

2.7.2 Export statistics

Vietnam exports fresh passionfruit to a range of markets including China, the Netherlands, the United Arab Emirates, France, Germany, Switzerland, Spain, Singapore, Hong Kong and the Republic of Korea (MARD 2021). In 2019, the volume of fresh passionfruit exported from Vietnam totalled approximately 3,300 tonnes (MARD 2021). As a relatively new and expanding industry in Vietnam, there is potential for significant increases in passionfruit exports.

2.7.3 Export season

Export of passionfruit from Vietnam occurs year-round, with peak availability from April to September (Nafoods 2021).

3 Pest risk assessments for quarantine pests

3.1 Summary of outcomes of pest initiation and categorisation

The initiation process (Appendix B) identified 125 pests as being associated with passionfruit in Vietnam.

Of these 125 pests, the pest categorisation process (Appendix B) identified:

- 80 pests as already present in Australia and not under official control, and therefore not requiring further assessment
- 33 pests as not having potential to enter on the commercially produced passionfruit from Vietnam pathway, and therefore not requiring further assessment

The remaining 12 pests were assessed as having potential to establish, spread and cause consequences in Australia, and therefore require further pest risk assessment.

In applying the Group PRAs, 3 thrips, 1 mealybug and 3 scale insects were identified on the import pathway and listed in the pest categorisation (Appendix B). The application of the Group PRAs to this risk analysis is outlined in Appendix A in section A2.7.

3.2 Pests requiring further pest risk assessment

The 12 pests, associated with commercially produced passionfruit for export from Vietnam, identified as requiring further pest risk assessment are listed in Table 3.1.

Of these 12 pests:

- 11 are quarantine pests
  - 3 of the 11 quarantine pests are also regulated articles as they can vector quarantine viruses
  - 4 of the 11 quarantine pests are regional quarantine pests as, whilst they have been recorded in some regions of Australia, interstate quarantine regulations are in place and enforced
- 1 is a regulated article for Australia as it can vector quarantine viruses.

Table 3.1 Quarantine pests and regulated articles potentially associated with passionfruit from Vietnam, and requiring further pest risk assessment

Pest/pest group	Scientific name	Common name	Policy status/region
False spider mites [Acariformes: Tenuipalpidae]	*Brevipalpus phoenicis* species complex **a**	False spider mite	
Fruit flies [Diptera: Tephritidae]	*Bactrocera dorsalis*	Oriental fruit fly	EP
	Zeugodacus cucurbitae	Melon fly	EP
	Zeugodacus tau	Pumpkin fruit fly	EP
Mealybugs [Hemiptera: Pseudococcidae]	*Planococcus minor*	Pacific mealybug	GP, WA
Scale insects [Hemiptera: Diaspididae]	*Chrysomphalus dictyospermi*	Dictyospermum scale	GP, WA
	Pseudaulacaspis pentagona	Mulberry scale	GP, WA
	Selenaspidus articulatus	West Indian red scale	GP
Spider mite [Acariformes: Tetranychidae]	*Tetranychus piercei*		
Thrips [Thysanoptera: Thripidae]	*Frankliniella schultzei* species complex **a, b**	Cotton thrips	GP
	Scirtothrips dorsalis	Chilli thrips	GP, RA
	Thrips palmi **a**	Melon thrips	GP, SA, WA

a: Quarantine pest species that is also identified as a regulated article for Australia as it vectors quarantine viruses. **b**: Assessed in the GP as *Frankliniella schultzei*. **EP:** Species has been assessed previously and import policy already exists. **GP:** Species has been assessed previously in a Group PRA, and the Group PRA has been applied. **RA:** Regulated article. **WA:** Regional quarantine pest for Western Australia. **SA:** Regional quarantine pest for South Australia.

3.3 Overview of pest risk assessment

This chapter assesses, for each of the pests, or pest groups identified in Table 3.1, the likelihoods of entry, establishment and spread, and the associated potential consequences these species may cause if they were to enter, establish and spread in Australia.

All of the pests or pest groups in Table 3.1 have been assessed previously by the department. Where appropriate, the outcomes of the previous assessments for these pests have been adopted for this risk analysis, unless new information is available that suggests the risk would be different. The acronym 'EP' is used to identify species assessed previously and for which import policy already exists. The process relating to the adoption of outcomes from previous assessments is outlined in Appendix A in section A2.6.

The biosecurity risk posed by thrips and the orthotospoviruses they transmit was previously assessed for all countries in the thrips Group PRA (DAWR 2017a), which has been applied to this assessment of passionfruit from Vietnam.

The biosecurity risk posed by mealybugs and the viruses they transmit was previously assessed for all countries in the mealybugs Group PRA (DAWR 2019a), which has been applied to this assessment of passionfruit from Vietnam.

The biosecurity risk posed by soft and hard scale insects was previously assessed for all countries in the scales Group PRA (DAWE 2021), which has been applied to this assessment of passionfruit from Vietnam.

The acronym 'GP' is used to identify species assessed previously in a Group PRA and for which a Group PRA was applied. The application of the Group PRAs to this risk analysis is outlined in Appendix A in section A2.7. A summary of assessment from the Group PRAs is presented for the relevant quarantine pests and/or regulated articles in this chapter for convenience.

A summary of the likelihood, consequence and URE ratings obtained in each pest risk assessment is provided in Table 3.9. An overview of the decision process at the initiation, pest categorisation and pest risk assessment stages of this PRA is presented diagrammatically in Figure 3.1.

3.4 False spider mites

***Brevipalpus phoenicis* species complex**

Historically, *Brevipalpus phoenicis* was reported in Australia (APPD 2023; Smiley & Gerson 1995). However, Beard et al. (2015) showed that the species is a complex of at least 8 species, with *B. papayensis* and *B. yothersi* the only 2 species in the complex present in Australia. Therefore the *B. phoenicis* species complex is identified as a quarantine pest for Australia.

Brevipalpus phoenicis is reported in Vietnam (PPD 2010; Zhang 2021) and surrounding countries (CABI 2023; DOA Thailand 2005). Because it is not clear which species in the complex are present in Vietnam, the *B. phoenicis* species complex present in Vietnam is considered to be of biosecurity concern to Australia.

The *B. phoenicis* species complex is also identified as a regulated article for Australia as it is known to vector economically important cileviruses and dichorhaviruses, including passionfruit green spot virus, citrus leprosis viruses and coffee ringspot virus (Ferreira et al. 2020; Freitas Astúa et al. 2018; Kitajima et al. 2020; Kitajima, Rezende & Rodrigues 2003; Nunes et al. 2018), some of which have been assessed as quarantine pests for Australia. However, there is no report of passionfruit green spot virus, citrus leprosis viruses or coffee ringspot virus being present in Vietnam (Ramos-González et al. 2020), and therefore the risks associated with the vector component of *B. phoenicis* species complex is not assessed here. In line with Section 4.4.2, the department will assess the risk associated with the vector component of *B. phoenicis* species complex for passionfruit from Vietnam pathway if there is information to suggest that the status of quarantine viruses vectored by this species complex in Vietnam has changed.

The *B. phoenicis* species complex belongs to the family Tenuipalpidae. Tenuipalpid mites superficially appear very similar to spider mites, although they lack the ability to produce silk webbing, and are therefore commonly referred to as false spider mites or flat mites (Childers & Denmark 2011). Species in the complex are reported from many parts of the world including Africa, Asia, Europe, South America and the USA (Beard et al. 2015).

The eggs of *B. phoenicis* are approximately 0.1 mm long, oval and bright red (Hill 2008). The eggs are laid on the underside of leaves or in young bark crevices (Hill 2008). Eggs adhere to any surface and are difficult to remove from the plant (Childers & Rodrigues 2011; Haramoto 1966). Eggs hatch after about 10 days (Hill 2008).

The larva, protonymph and deutonymph stages of *B. phoenicis* are all active stages that feed and disperse (Martin Kessing & Mau 1992). There is a dormant immobile stage called a chrysalis between each of the life stages (Childers & Rodrigues 2011). The adult is also active, approximately 0.3mm long, and predominantly female, with males being rare (Haramoto 1966). The species reproduces asexually via parthenogenesis (Martin Kessing & Mau 1992).

The life cycle of the mite is approximately 6 weeks (Hill 2008). However, the duration of the life cycle is dependent on temperature, with laboratory studies recording egg to adult development from 18 days at 30°C, to 50 days at 20°C (Haramoto 1966; Martin Kessing & Mau 1992).

The species feeds predominantly on leaves (Gupta 1985; Hill 2008), but will move to feed on other parts of the host plant, including fruit, when population densities are high (Haramoto

1966). Feeding causes chlorosis, blistering, bronzing or necrotic areas on host tissues, which subsequently impacts plant growth and development (Childers, French & Rodrigues 2003).

Brevipalpus phoenicis is polyphagous and has been recorded on a number of fruit, vegetable and ornamental species, including important crops such as citrus, passionfruit, tea, stone fruit, grapes, coffee, rubber, papaya, squash, persimmon and guava (Childers, Rodrigues & Webourn 2003; Hill 2008). *Brevipalpus phoenicis* has been recorded on numerous *Passiflora* species, including *Passiflora edulis*, across 6 continents (Childers, Rodrigues & Webourn 2003; Haramoto 1966; Kitajima, Rezende & Rodrigues 2003; Womersley 1940).

The risk scenario of biosecurity concern is that the eggs, larvae, nymphs or adults of the *B. phoenicis* species complex may be present on the passionfruit from Vietnam pathway.

3.4.1 Likelihood of entry

The likelihood of entry is considered in 2 parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *Brevipalpus phoenicis* species complex will arrive in Australia with the importation of passionfruit from Vietnam is assessed as **High**.

The likelihood of importation is assessed as High because *B. phoenicis* species complex is present in Vietnam and passionfruit is a recorded host. Although false spider mites are mainly leaf feeders, they can be found on fruit when pest populations are high. Commercial production practices in the orchard and in the packing house would reduce the risk of *B. phoenicis* species complex being present on fruit. However, some life stages may be present on fruit packed for export and survive temperatures during storage and transit from Vietnam to Australia.

The following information provides supporting evidence for this assessment.

Brevipalpus phoenicis species complex is reported in Vietnam and is a pest of passionfruit.

- *Brevipalpus phoenicis* has been reported in Vietnam (PPD 2010; Zhang 2021). It is not clear which species in the *B. phoenicis* species complex are present in Vietnam. Due to this uncertainty, it is assumed that the *B. phoenicis* species complex present in Vietnam is of biosecurity concern to Australia until information that suggests otherwise becomes available.
- *Brevipalpus phoenicis* has been recorded on passionfruit in many continents (Childers, Rodrigues & Webourn 2003; Kitajima, Rezende & Rodrigues 2003).
- Passionfruit is grown commercially in tropical and sub-tropical climates of Vietnam (MARD 2016), and such climates are suitable for the survival and development of *B. phoenicis* (Haramoto 1966; Hill 2008).

Although *B. phoenicis* generally feeds on leaves, they can be found on host fruit.

- *Brevipalpus phoenicis* feeds predominantly on leaves (Hill 2008), but will move to feed on other parts of the host plant, including fruit, when population densities are high (Haramoto 1966).
- *Brevipalpus phoenicis* has been reported feeding on the fruits of citrus (Ferreira et al. 2020; Kaur et al. 2020; Nickel 1958), papaya (Haramoto 1966) and guava (Rivero et al. 2010).

Pest management practices in the orchard are likely to reduce mite numbers on passionfruit plants and reduce the risk of fruit infestation.

- Vietnamese farmers manage mites in passionfruit orchards under the guidance of government plant protection officers (MARD 2016).
- Vietnamese farmers regularly monitor mites and other pests and apply relevant pesticides, as necessary. These practices are likely to reduce the risk of *B. phoenicis* species complex being on fruit (MARD 2016).

Harvest and post-harvest processes are unlikely to remove all mites from the fruit.

- Life stages of *B. phoenicis* are almost microscopic and may not be detected during post-harvest processes. Adults are approximately 0.3 mm long, and eggs are about 0.1 mm in diameter (Haramoto 1966).
- Post-harvest processes in the packing house, such as brushing and washing, would remove a number of mites on the surface of the fruit. However, some mites may survive these processes and remain on the fruit (Childers & Rodrigues 2011).
- Inactive juvenile stages, known as chrysalis stages, could anchor on the fruit surface (Childers & Rodrigues 2011) and may not be removed during packing house processes.

Adults and immature stages on fruit may survive cold temperatures during storage and while in transit from Vietnam to Australia.

- Due to the fruit's relatively short shelf life (Kader 1999), passionfruit are likely to be stored for only short periods in Vietnam prior to export, and be transported to Australia by air freight to maximise the quality and shelf life of the fruit.
- The recommended temperature for storage and transport of passionfruit is between 5°C and 10°C (Kader 1999).
- Larvae and adult females of *B. phoenicis* have been shown to survive temperatures as low as 10°C for up to one week and 23 days, respectively. (Haramoto 1966). When returned to a more favourable temperature of 25°C, larvae continued development and adults were able to produce eggs.

For the reasons outlined, the likelihood that *B. phoenicis* will arrive in Australia in a viable state with the importation of passionfruit from Vietnam is assessed as **High**.

Likelihood of distribution

The likelihood that *B. phoenicis* species complex will be distributed within Australia in a viable state as a result of the processing, sale or disposal of passionfruit from Vietnam, and subsequently transfer to a susceptible part of a host is assessed as **Moderate**.

The likelihood of distribution is assessed as Moderate because *B. phoenicis* species complex may survive cold temperatures during storage and transport prior to sale. Any mites on fruit are most likely to enter the external environment through the disposal of fruit waste. The species complex is polyphagous and several host plants are widely available in Australia. However, transfer of false spider mites to a host in Australia is likely to be moderated by their limited movement and survival capacity on discarded fruit waste.

The following information provides supporting evidence for this assessment.

Passionfruit imported from Vietnam will be distributed throughout Australia for retail sale. Prior to sale, fruit are likely to be stored and transported at cold temperatures for a short period of time, and any mites on fruit may survive.

- Passionfruit would be distributed for sale to various destinations in Australia. They may be distributed through large fresh produce wholesale markets and then to supermarkets or other sellers, or directly to smaller retailers and then to consumers. Prior to sale, fruit will likely be stored and transported at the recommended temperature between 5°C and 10°C (Kader 1999).
- Any mites on fruit may survive cold temperatures during storage and transport as there is evidence that life stages of *B. phoenicis* have some cold tolerance capacity.
- *Brevipalpus phoenicis* larvae and adult females can survive at 10°C for up to one week and 23 days, respectively (Haramoto 1966). When returned to a more favourable temperature of 25°C, larvae continued development and females were able to produce eggs.

False spider mites are most likely to enter the external environment through the disposal of fruit waste. Although most passionfruit waste will likely be discarded into managed waste systems, some fruit waste may be discarded into the environment near a suitable host. *Brevipalpus phoenicis* species complex has a wide range of hosts and several hosts are widely available in Australia. However, their life stages have limited capacity to transfer to a new host.

- Most fruit waste would likely be disposed of via municipal waste facilities (Pickin et al. 2022) where host plants are generally not available.
- However, consumers may discard small quantities of fruit waste in a variety of urban, rural and natural environments. Some of this waste could be discarded near suitable host plants.
- The *B. phoenicis* species complex is polyphagous, feeding on many fruit, vegetable and ornamental host plants, including citrus, passionfruit, tea, stone fruit, grapes, coffee, rubber, papaya, squash, persimmon, guava, clematis, oleander, geranium and azalea (Childers, Rodrigues & Webourn 2003; Hill 2008). Many host plants are widely available in Australia.
- False spider mites have limited capacity to move to a new host as they can only crawl short distances (Alves, Casarin & Omoto 2005; Haramoto 1966). False spider mites also have limited wind dispersal capacity as they lack the ability to produce silk (Childers & Denmark 2011), unlike spider mites which can disperse using silk threads (Bell et al. 2005).
- Transfer to a new host is further limited as life stages cannot live without food for more than 3 days, and they are vulnerable to death by desiccation and predation (Childers & Rodrigues 2011; Haramoto 1966).

For the reasons outlined, the likelihood that *B. phoenicis* species complex will be distributed within Australia in a viable state as a result of processing, sale or disposal of passionfruit from Vietnam, and subsequently transfer to a susceptible part of a host is assessed as Moderate.

Likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation with the likelihood of distribution using the matrix of rules in Table A.2.

The likelihood that *B. phoenicis* species complex will enter Australia as a result of trade in passionfruit from Vietnam and be distributed in a viable state to a susceptible part of a host is assessed as **Moderate**.

Likelihood of establishment

The likelihood that *B. phoenicis* species complex will establish within Australia, based on a comparison of factors in the source and destination areas that affect pest survival and reproduction, is assessed as **High**.

The likelihood of establishment is assessed as High because hosts are widely available. Species in the complex are found throughout the world, including in Australia, and many parts of Australia have climates that are likely to be suitable for establishment. *Brevipalpus phoenicis* species complex reproduces asexually and can develop rapidly under suitable conditions, which would be likely to assist establishment.

The following information provides supporting evidence for this assessment.

Host plant species of the *B. phoenicis* species complex are widely available in Australia.

- *Brevipalpus phoenicis* is polyphagous and has been recorded on many fruit, vegetable and ornamental host plants, including citrus, passionfruit, tea, stone fruit, grapes, coffee, rubber, papaya, squash, persimmon, guava, clematis, oleander, geranium and azalea (Childers, Rodrigues & Webourn 2003; Hill 2008).
- Many of these hosts are widely grown in Australia, including in home gardens, parks and commercial farms.

Many areas of Australia are likely to be suitable for *B. phoenicis* species complex.

- Species in the *B. phoenicis* species complex are found throughout the world including Africa, Asia, Europe, South America and the USA (Denmark 2018).
- The two species in the complex that are present in Australia, *B. papayensis* and *B. yothersi*, have been reported from many parts of Australia (Akyazi, Ueckermann & Liburd 2017; APPD 2023; Beard et al. 2015).
- Australia is likely to have suitable climates and environments to enable establishment of other species in the complex.

Brevipalpus phoenicis species complex reproduces asexually and can develop rapidly, which would be likely to assist establishment.

- *Brevipalpus phoenicis* reproduces asexually via parthenogenesis (Martin Kessing & Mau 1992) and therefore, a single adult female is sufficient to lead to establishment of a new population in an area.
- *Brevipalpus phoenicis* can develop rapidly and undergo many generations per year under suitable conditions (Haramoto 1966; Kennedy et al. 1996).

For the reasons outlined, the likelihood that *B. phoenicis* species complex will establish within Australia is assessed as **High**.

Likelihood of spread

The likelihood that *B. phoenicis* species complex will spread within Australia, based on a comparison of factors in the source and destination areas that affect the expansion of the geographic distribution of the pest, is assessed as **High**.

The likelihood of spread is assessed as High because hosts are widely available in Australia. Although larvae, nymphs and adults are active, they are unable to move long distances naturally. However, mites can be spread over long distances via human-assisted movement, including trade, of infested plants or plant parts.

The following information provides supporting evidence for this assessment.

Host plant species of *B. phoenicis* species complex are widely available in Australia.

- *Brevipalpus phoenicis* is polyphagous and has been recorded on a number of species including citrus, passionfruit, tea, stone fruit, grapes, coffee, rubber, papaya, squash, persimmon, guava, clematis, oleander, geranium and azalea (Childers, Rodrigues & Webourn 2003; Hill 2008).
- Many of these hosts are widely grown in Australia, including in home gardens, parks and commercial farms, which would assist spread.

Spread via active movement will be limited, but human-mediated movement of infested plants and plant parts may facilitate spread over long distances.

- Although false spider mite larvae, nymphs and adults have legs and can crawl, they have limited capacity to actively move to new hosts. Laboratory experiments using closely spaced plants showed low levels of active dispersal of *B. phoenicis* adults from heavily infested plants to uninfested plants (Haramoto 1966).
- False spider mites also have limited wind dispersal capacity as they lack the ability to produce silk (Childers & Denmark 2011), unlike spider mites which can disperse in the wind using silk threads (Bell et al. 2005).
  - Laboratory and field studies of *B. phoenicis* on citrus reported low levels of wind dispersal of adults to new host plants, even at wind speeds of 30 to 40 km per hour (Alves, Casarin & Omoto 2005).
  - Haramoto (1969) recorded successful dispersal of *B. phoenicis* adults to new host plants, up to 15 m downwind of infested papaya plants.
- Human-mediated movement of infested host plants, plant parts and propagative material could facilitate spread of these mites over long distances within Australia.

For the reasons outlined, the likelihood that *B. phoenicis* species complex will spread within Australia is assessed as **High**.

Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the individual likelihoods of entry, establishment and spread using the matrix of rules in Table A.2.

The overall likelihood that *B. phoenicis* species complex will enter Australia as a result of trade in passionfruit from Vietnam, be distributed in a viable state to a susceptible part of a host, establish in Australia and subsequently spread within Australia is assessed as **Moderate**.

Consequences

The potential consequences of the establishment of *B. phoenicis* species complex in Australia has been estimated according to the methods described in Figure A.1.

Based on the decision rules described in Table A.3, that is, where the potential consequences of a pest with respect to one or more criteria are 'D', the overall consequences are estimated to be 'Low'.

Criterion	Estimate and rationale
Direct	
The life or health of plants and plant products	D – Significant at the district level False spider mites in the *B. phoenicis* species complex feed on many plants including fruit trees, vegetable crops and ornamentals (Childers, Rodrigues & Webourn 2003; Hill 2008). Hosts such as citrus, passionfruit, stone fruit and grapes are widely grown and economically important crops in Australia. False spider mites feed on leaves, soft twigs and fruits (Gupta 1985; Haramoto 1966; Hill 2008; Vacante 2010), causing chlorosis, blistering, bronzing or necrotic areas on the infested host tissues, subsequently impacting plant growth and development (Childers, French & Rodrigues 2003). Establishment and spread of *B. phoenicis* species complex in Australia could potentially impact production and profitability of various crops. The *B. phoenicis* species complex is known to transmit cileviruses and dichorhaviruses, including passionfruit green spot virus, citrus leprosis viruses and coffee ringspot virus (Ferreira et al. 2020; Freitas Astúa et al. 2018; Kitajima et al. 2020; Kitajima, Rezende & Rodrigues 2003; Nunes et al. 2018). Although these viruses are not present in Vietnam or Australia, entry, establishment and spread of additional mite vectors in Australia may increase the potential for such viruses to become established if they were introduced.
Other aspects of the environment	B – Minor significance at the local level The introduction of *B. phoenicis* species complex may have a minor impact on native mite species by competing for the same or similar resources. The *B. phoenicis* species complex is not likely to reduce abundance of keystone plant species, or plant species that are major components of ecosystems.
Indirect	
Eradication, control	D – Significant at the district level It is expected that efforts would be required to contain and possibly eradicate an incursion of the *B. phoenicis* species complex within Australia. It is likely that eradicating *B. phoenicis* species complex could be difficult due to their wide host range and the commonly delayed period to detection. Where eradication is not considered feasible, efforts would be required to control and manage the species complex on an ongoing basis. Control of false spider mites usually involves cultural, physical, biological and chemical control methods. The introduction of an exotic false spider mite in a cropping system will likely require initial investigation and ongoing additional research to determine what modifications to existing pest management regimes are required, and to evaluate their effectiveness. The indirect effects of eradication or control as a result of the introduction of false spider mites may include a large increase in costs for containment, eradication and control at the local level. Containment and eradication activities are costly and would also cause significant disruption to agribusiness at the district level. The costs associated with the initial response to an incursion and ongoing control of the introduced false spider mites, including any additional research requirement, would be expected to be of minor significance at the regional level.
Domestic trade	C – Minor significance at the district level An incursion of *B. phoenicis* species complex could lead to a moderate reduction of trade or loss of domestic markets at the local level. Biosecurity measures would likely be enforced to prevent the movement of infested plant material out of the initial incursion area, which would have significant economic impact on host crop industries and business at the local level. The introduction of a new pest to a district would be likely to disrupt intra- and/or interstate trade due to biosecurity restrictions on the domestic movement of affected commodities. This would be expected to be of minor significance at the district level.
International trade	C – Minor significance at the district level

Criterion	Estimate and rationale
	Many countries require phytosanitary measures to mitigate the risk posed by their tenuipalpid quarantine species. Should exotic species within the *B. phoenicis* species complex become established on host crops grown for export markets, Australia's trading partners may impose phytosanitary measures, resulting in additional export costs and/or disruption to the existing trade. The impact would be expected to threaten economic viability through a moderate reduction and/or disruption of trade and export markets at the local level and have a minor impact on affected industries at the district level. Resources would also be required to support affected industries in regaining market access or in implementing the additional phytosanitary measures.
Non-commercial and environmental	B – Minor significance at the local level Any additional usage of chemical sprays may affect the environment. However, this is unlikely to impact on the environment to any greater extent than already occurs due to control measures for other pests.

Unrestricted risk estimate

Unrestricted risk is the result of combining the overall likelihood of entry, establishment and spread with the outcome of overall consequences. The likelihood and consequences are combined using the risk estimation matrix in Table A.4

Unrestricted risk estimate for *B. phoenicis* species complex	
Overall likelihood of entry, establishment and spread	Moderate
Consequences	Low
Unrestricted risk	**Low**

The URE for *B. phoenicis* species complex on the passionfruit from Vietnam pathway is assessed as Low, which does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for *B. phoenicis* species complex on the passionfruit from Vietnam pathway.

3.5 Fruit flies

***Bactrocera dorsalis* (EP), *Zeugodacus cucurbitae* (EP) and *Zeugodacus tau* (EP)**

Bactrocera dorsalis (Oriental fruit fly), *Zeugodacus cucurbitae* (melon fly) and *Z. tau* (pumpkin fruit fly) belong to the Tephritidae family, a group of fruit flies considered to be amongst the most damaging pests of horticultural crops (White & Elson-Harris 1994). These species are serious pests of a range of commercial fruit crops in parts of Asia (White & Elson-Harris 1994), and all 3 species are present in Vietnam (Drew & Romig 2013; Leblanc et al. 2018).

Bactrocera dorsalis, *Z. cucurbitae* and *Z. tau* are not reported in Australia and therefore are quarantine pests for all of Australia.

Bactrocera invadens (Drew, Tsuruta & White), *B. papayae* Drew & Hancock and *B. philippinensis* Drew & Hancock have been synonymised with *B. dorsalis* (Schutze et al. 2014). References to these previously accepted species are now considered to be references to *B. dorsalis*, and this is reflected in the assessment of fruit flies for passionfruit from Vietnam.

On the basis of phylogenetic relationship analysis, *Bactrocera cucurbitae* and *B. tau* have been placed in the genus *Zeugodacus* (De Meyer et al. 2015; Doorenweerd et al. 2018; Plant Health Australia 2023; Virgilio et al. 2015). Current and past literature refers to these species under both the former (*B. cucurbitae* and *B. tau*) and current (*Z. cucurbitae* and *Z. tau*) scientific names. This assessment uses the currently accepted names of *Z. cucurbitae* and *Z. tau*.

Bactrocera dorsalis, *Z. cucurbitae* and *Z. tau* have been grouped together in this assessment as they have common biological characteristics and behaviours, and are considered to pose similar biosecurity risks. In this assessment, the term 'fruit flies' is used to refer to these 3 species as a group. The scientific name is used when the information relates to a specific species.

Tephritid fruit flies have 4 life stages: egg, larva, pupa and adult. Adult females lay eggs in clutches under the skin of host fruits. Once the eggs hatch, the larvae feed on the flesh of the host fruit. On reaching maturity, the fruit fly larvae usually leave the fruit, drop to the ground and pupate in the soil under the host plant (Christenson & Foote 1960). Tephritid fruit flies can produce several generations each year, depending primarily on temperature. Adults begin mating within 1 to 2 weeks following emergence, and may live from 1 to 3 months, or up to 12 months in cool conditions (Christenson & Foote 1960). The major dispersal mechanism of tephritid flies is by human-mediated activities through transportation of infested fruit (Louzeiro et al. 2021; Putulan et al. 2004). However, dispersal by adult flight is also possible (Fletcher 1989; Qureshi et al. 1975).

All 3 species of fruit flies have been assessed previously in the policies for mangoes from Taiwan (Biosecurity Australia 2006) and India (Biosecurity Australia 2008, 2011). Other fresh fruit policies that have assessed one or more of these 3 species include lychees from Taiwan and Vietnam (DAFF 2013), mangoes from Indonesia, Thailand and Vietnam (DAWR 2015), dragon fruit from Indonesia (DAWR 2018), longan fruit from Vietnam (DAWR 2019b) and fresh jujubes from China (Department of Agriculture 2020). In these policies, the UREs for *B. dorsalis* and *Z. cucurbitae* did not achieve the ALOP for Australia and specific risk management measures were required for *B. dorsalis* and *Z. cucurbitae* on those pathways. In the previous policies that assessed *Z. tau*, mango and longan fruit were not considered hosts for *Z. tau*. The assessment outcomes for *Z. tau* therefore did achieve the ALOP for Australia and specific risk management measures were not required for *Z. tau* on those pathways.

The assessment for *B. dorsalis*, *Z. cucurbitae* and *Z. tau* for passionfruit from Vietnam builds on the previous assessments for *B. dorsalis* and/or *Z. cucurbitae.* Previous assessments for *Z. tau* were not considered relevant as the fruits assessed (mango and longan) were determined to be non-hosts for *Z. tau*, whereas passionfruit is a recorded host for *Z. tau*.

There may be differences in commercial production practices, climatic conditions, fruit biology and pest prevalence between the previously assessed commodity/country pathways and passionfruit from Vietnam. These potential differences make it necessary to re-assess the likelihood that these assessed fruit flies will arrive in Australia in a viable state with the importation of passionfruit from Vietnam.

The assessments of *B. dorsalis* and/or *Z. cucurbitae* on the lychees from Taiwan and Vietnam, mangoes from Indonesia, Thailand and Vietnam, dragon fruit from Indonesia, longan fruit from Vietnam and fresh jujubes from China pathways rated the likelihood of distribution of these fruit fly species as High. Passionfruit from Vietnam are expected to be distributed in Australia in a similar way to these previously assessed pathways.

It is expected that once passionfruit arrives in Australia from Vietnam, they will be distributed to various destinations throughout Australia for wholesale and retail sale. Most fruit waste would likely be disposed of via municipal waste facilities (Pickin et al. 2022) reducing the risk of fruit flies distributing to a host. However, small quantities may be discarded in the environment. Any fruit flies present in discarded passionfruit may disperse to new hosts, as adult fruit flies are highly mobile and could fly to nearby host plants. Fruit flies have wide host ranges and there will likely be hosts present year-round in Australia. On this basis, the same rating of High for the likelihood of distribution of these fruit flies in previous assessments is adopted for the passionfruit from Vietnam pathway.

The likelihoods of establishment and spread of fruit flies in Australia from the passionfruit from Vietnam pathway have been assessed as similar to those of the previous assessments of High and High, respectively. Those likelihoods relate specifically to events that occur in Australia and are essentially independent of the import pathway. The consequences of the entry, establishment and spread of fruit flies in Australia are also independent of the import pathway and have been assessed as being similar to those previous risk assessments of High. The existing ratings for the likelihoods of establishment and spread, and the rating for the overall consequences for *B. dorsalis* and/or *Z. cucurbitae* in previous assessments have been adopted for *B. dorsalis*, *Z. cucurbitae* and *Z. tau* on the passionfruit from Vietnam pathway.

In addition, the department has reviewed the latest literature – for example, Follett, Haynes and Dominiak (2021), Huang et al. (2020b), Li et al. (2020), Louzeiro et al. (2021), Michel et al. (2021) and Zeng et al. (2018). No new information has been identified that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for *B. dorsalis* and/or *Z. cucurbitae* in the existing policies.

The risk scenario of biosecurity concern considered here is that eggs or larvae of *B. dorsalis*, *Z. cucurbitae* and *Z. tau* may be present within passionfruit imported from Vietnam and may successfully develop and emerge as adults in Australia.

3.5.1 Likelihood of entry

The likelihood of entry is considered in 2 parts, the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *B. dorsalis*, *Z. cucurbitae* and *Z. tau* will arrive in Australia in a viable state with the importation of passionfruit from Vietnam is assessed as **High.**

The likelihood of importation is assessed as High because *B. dorsalis*, *Z. cucurbitae* and *Z. tau* are present in Vietnam and are likely to be present in passionfruit production areas. There is evidence of *B. dorsalis*, *Z. cucurbitae* and *Z. tau* infesting passionfruit under field conditions. Both immature and mature passionfruit are prone to fruit fly infestation. Infested immature fruit tend to develop signs of injury, and wither and drop from the vine. However, fruit fly infestation of mature passionfruit may not be visibly evident at harvest. Cold temperatures during storage and transport of passionfruit may delay or temporarily halt development, and may affect survival of immature stages of fruit flies within passionfruit. However, due to its highly perishable nature, storage and transport period of passionfruit is likely to be short. The development of surviving immature stages of fruit flies may recommence when favourable temperatures are reinstated.

The following information provides supporting evidence for this assessment.

Bactrocera dorsalis, *Z. cucurbitae* and *Z. tau* are present in Vietnam.

- *Bactrocera dorsalis*, *Z. cucurbitae* and *Z. tau* are present and widespread in Vietnam (Dien, Huy & Dung 2021; Drew & Romig 2013; Thuy 1998). Areas where one or more of these fruit fly species are present include in Ba Be, Me Linh, Tam Dao (Leblanc et al. 2018), Tuyen Quang and Phu Tho (Shi, Kerdelhué & Ye 2014) in northern Vietnam, Bach Ma in central Vietnam (Leblanc et al. 2018), the Mekong Delta in southern Vietnam (Dien, Huy & Dung 2021) and Binh Duong, Dong Nai, and Binh Thuan in south-eastern Vietnam (Thuy, Duc & Vu 2000).
- A trapping survey for adult fruit flies was conducted in Vietnam in 2015 and 2017 whereby individual traps were maintained for 3 to 5 days at 220 sites in forest reserves and national parks. *Bactrocera dorsalis* was the predominant species trapped in areas of northern Vietnam, central Vietnam and southern Vietnam (Leblanc et al. 2018). *Zeugodacus tau* and *Z. cucurbitae* also occurred in all 3 areas of Vietnam but at lower levels compared to *B. dorsalis* (Leblanc et al. 2018).

Biotic and abiotic factors in Vietnam will support fruit fly populations in passionfruit production areas.

- A wide variety of tropical fruits are grown in Vietnam, and overlapping harvest times provide a continuous source of suitable host material for the development of multiple fruit fly generations throughout the year (Thuy, Duc & Vu 2000).
- Fruit fly populations have been positively correlated with high rainfall and temperature (Allwood & Drew 1997; Bess & Haramoto 1961; Hasyim, Muryati & de Kogel 2008; Hossain et al. 2019; Win et al. 2014).
  - In a field survey of a dragon fruit growing area in southern Vietnam in 2016 to 2018, higher numbers of adult fruit fly species, including *B. dorsalis* were caught in methyl eugenol traps in the wet periods, from March to September, with population peaks in May to June (Hien et al. 2020).

  - Similarly, in a field survey conducted in 2005 of a passionfruit growing area in nearby Thailand, the number of *Z. tau* adult males caught in traps peaked in July, with the population showing a significant positive correlation with high rainfall and high temperatures (Hasyim, Muryati & de Kogel 2008).
- Temperatures and rainfall in areas of Vietnam are conducive to fruit fly survival and development.
  - Vietnam experiences a rainy season (World Bank Group 2021) and above average annual precipitation (1,700 to 1,900 mm) (TheGlobalEconomy.com 2018; World Bank Group 2021).
  - The northern region has mean monthly temperatures ranging from 17°C to 36°C. The southern region experiences a narrower mean monthly temperature range of 23°C to 35°C (World Weather Online 2023).

Passionfruit is a host for *B. dorsalis*, *Z. cucurbitae* and *Z. tau*, although there is evidence that morphological and physiological attributes of passionfruit may affect fruit fly oviposition, development and survival.

- Passionfruit is a host for *B. dorsalis* (Leblanc, Vueti & Allwood 2013; Steiner 1955; Vargas et al. 2012), *Z. cucurbitae* (Aye & Thaung 2002; Tsuruta et al. 1997) and *Z. tau* (Hasyim, Muryati & de Kogel 2008; Suputa et al. 2010) under field conditions.
- Passionfruit is grown and harvested year-round in Vietnam (MARD 2016). Both immature passionfruit with a soft rind and mature, ripe passionfruit with a hardened rind are attractive to ovipositing female fruit flies (Steiner 1955).
- However, there is evidence that the thick skin of passionfruit provides some resistance to oviposition by, and development of, tephritid fruit flies.
  - Steiner, in Christenson and Foote (1960), observed unspecified fruit flies penetrating extremely hard-skinned fruits such as passionfruit with their ovipositor; however, this required a prolonged effort.
  - Subhagan, Dhalin and Kumar (2020) indicated that while fruit fly oviposition scars were present on ripening passionfruit, they generally did not contain living larvae of *Bactrocera* spp.
  - Yang et al. (2023) reported that oviposition of *B. dorsalis*, *Z. cucurbitae* and *Z. tau* eggs into the mesocarp of passionfruit induced the passionfruit to naturally release hydrogen cyanide. Exposure of the fruit fly eggs to this toxin stopped embryonic development, resulting in death of the eggs (Yang et al. 2023). Of 131 field-collected passionfruit samples showing oviposition puncture sites, Yang et al. (2023) reported 130 samples contained eggs of *B. dorsalis*, *Z. cucurbitae* and/or *Z. tau*, but produced no larvae. Only 1 sample contained larvae, which were raised until adult emergence and identified as *B. dorsalis*.
- Resistance to fruit fly oviposition and development may lessen as the fruit ripens. Morton (1987) indicated that cyanogenic glycoside, the precursor of toxic hydrogen cyanide (Yang et al. 2023), is present in the pulp at all stages of development of the passionfruit, but is highest in very young unripe fruits and lowest in fallen, wrinkled fruits - the latter being so low that it is of no toxicological significance. This suggests that mature passionfruit around harvest may be more likely to support fruit fly development than immature passionfruit.

While immature fruit injured by fruit fly may be removed from the pathway, mature passionfruit infested by fruit fly larvae or eggs may not be detected during harvest and post-harvest processing.

- Passionfruit injured by fruit fly oviposition in the immature fruit stage develop a small woody crater around the puncture site as they ripen, causing disfigurement of the outer appearance of the fruit (Akamine et al. 1974).
- Immature passionfruit injured by fruit fly oviposition are likely to shrivel and fall from the vine. However, if fruit are well developed when injured by ovipositing fruit flies, the passionfruit may grow to maturity (Akamine et al. 1974).
- Ovipositional punctures by fruit flies may provide an entrance point for various other decay organisms, resulting in further damage and decomposition of the punctured passionfruit (Bess & Haramoto 1961).
- Passionfruit showing visible signs of fruit fly infestation are likely to be detected and removed during standard commercial grading and packing processes.
- However, ripe passionfruit infested by fruit flies shortly prior to harvest may not develop visible signs of infestation by the time they enter the packing house. Under experimental conditions, ripe passionfruit infested by *B. dorsalis* up to 14 days prior to harvest could not be distinguished from uninfested fruit at the time of harvest (Moquet & Delatte 2021). Therefore, infested passionfruit may remain undetected during harvest and post-harvest procedures and may be packed for export.

Short term storage and transit of fruit at cold temperatures is likely to affect survival and halt development of immature stages of fruit flies in passionfruit. However, any surviving fruit flies are likely to recommence development when fruit are no longer stored at cold temperatures.

- The optimum storage conditions for passionfruit, providing a storage life of up to 5 weeks, are a temperature between 5°C to 10°C and a relative humidity of 90% to 95% (Kader 1999). Chilling injury to the fruit occurs at temperatures below 5°C (Kader 1999).
- Due to the relatively short shelf life of up to 5 weeks, passionfruit are likely to be imported into Australia by air freight as soon as possible after harvest to maximise fruit quality and commercial shelf life. As a result, fruit may only be maintained at cold temperatures for short periods.
- Temperatures between 5°C and 10°C are likely to halt development and may affect survival of fruit flies in infested passionfruit.
  - The development time of fruit flies is inversely dependent on temperature, with development time increasing at lower ambient temperature (Duyck, Sterlin & Quilici 2004; Fletcher 1989; Mkiga & Mwatawala 2015).
  - Mkiga and Mwatawala (2015) estimated the lower developmental thresholds for eggs and larvae of *Z. cucurbitae* to be 15.8°C and 13.4°C, respectively.
  - Danjuma et al. (2014) reported a strong and positive linear relationship between temperature and developmental rate in *B. dorsalis* (as *B. papayae*), with lower development thresholds of 12.1°C and 10.5°C for eggs and larvae, respectively.
  - Michel et al. (2021) showed that eggs of *B. dorsalis* do not hatch when held at a constant temperature of 10°C. Similarly, Ahn, Choi and Huang (2022) reported that eggs of *Z. cucurbitae* did not develop into larvae when subjected to a constant temperature of 12.0°C.

- Fruit flies (*Z. tau* and *Z. cucurbitae*) have been shown to survive short term (12-hour) cold shocks at temperatures at or below the optimum storage temperature of 5°C to 10°C (Huang et al. 2020b).
- The temperatures for optimum cold storage of passionfruit (Kader 1999) are higher than cold disinfestation treatment temperatures for tephritid fruit flies.
  - Cold disinfestation treatment schedules against fruit flies, including *B. dorsalis*, *Z. cucurbitae* and *Z. tau*, in various fruit commodities, require core fruit temperatures to be maintained between ≤−0.55°C to 1.67°C for between 11 and 24 days, with the temperature and duration dependent on the fruit species and the target fruit fly pests (Dohino et al. 2017).
  - Cold treatment schedules for *B. dorsalis*, *Z. cucurbitae* and/or *Z. tau* in the USDA Treatment Manual range from 0°C for 12 days to 1.67°C for 22 days (USDA 2016).
- The recommended storage and transport temperatures for passionfruit indicate that fruit flies may not be able to develop during this time and that there may be some mortality. However, upon reaching temperatures capable of supporting development, such as in retail settings, the surviving eggs and larvae in fruit may be able to continue and complete development.

For the reasons outlined, the likelihood of importation of *B. dorsalis*, *Z. cucurbitae* and *Z. tau* on imported passionfruit from Vietnam is assessed as High.

Likelihood of distribution

The likelihood that *B. dorsalis*, *Z. cucurbitae* and *Z. tau* will be distributed within Australia in a viable state, as a result of the processing, sale or disposal of passionfruit from Vietnam, and subsequently transfer to a susceptible part of a host, is likely to be similar to *B. dorsalis* and/or *Z. cucurbitae* on previously assessed pathways. The same rating of **High** for the likelihood of distribution for *B. dorsalis* and/or *Z. cucurbitae* on the previously assessed pathways is adopted for *B. dorsalis*, *Z. cucurbitae* and *Z. tau* on the passionfruit from Vietnam pathway.

Likelihood of entry

The likelihood of entry is determined as **High** by combining the re-assessed likelihood of importation of High with the adopted likelihood of distribution of High, using the matrix of rules in Table A.2.

3.5.2 Likelihoods of establishment and spread

The likelihoods of establishment and spread for *B. dorsalis*, *Z. cucurbitae* and *Z. tau* are independent of the import pathway and are considered similar to those in previously assessed pathways.

Based on the existing import policies for *B. dorsalis* and/or *Z. cucurbitae*, the likelihoods of establishment and spread for *B. dorsalis*, *Z. cucurbitae* and *Z. tau* are assessed as **High** and **High**, respectively.

3.5.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the individual likelihoods of entry, of establishment and of spread using the matrix of rules in Table A.2.

The overall likelihood that *B. dorsalis*, *Z. cucurbitae* and *Z. tau* will enter Australia as a result of trade in passionfruit from Vietnam, be distributed in a viable state to a susceptible part of a host, establish in Australia and subsequently spread within Australia is assessed as **High**.

3.5.4 Consequences

The potential consequences of the entry, establishment and spread of *B. dorsalis*, *Z. cucurbitae* and *Z. tau* in Australia are similar to those in the previously assessed pathways. The overall consequences for *B. dorsalis* and/or *Z. cucurbitae* in the previous assessments were assessed as High. The overall consequences for *B. dorsalis*, *Z. cucurbitae* and *Z. tau* on the passionfruit from Vietnam pathway are also assessed as **High**.

3.5.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the overall likelihood of entry, establishment and spread with the outcome of overall consequences. The likelihood and consequences are combined using the risk estimation matrix in Table A.4.

Unrestricted risk estimate for *B. dorsalis*, *Z. cucurbitae* and *Z. tau*	
Overall likelihood of entry, establishment and spread	High
Consequences	High
Unrestricted risk	**High**

The URE for *B. dorsalis*, *Z. cucurbitae* and *Z. tau* on the passionfruit from Vietnam pathway is assessed as **High**, which does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for *B. dorsalis*, *Z. cucurbitae* and *Z. tau* on this pathway.

3.6 Mealybug

***Planococcus minor* (GP, WA)**

One mealybug species was identified on the passionfruit from Vietnam pathway as a quarantine pest for Australia, *Planococcus minor* (Pacific mealybug) (Table 3.2).

Planococcus minor is not present in Western Australia and is assessed as a regional quarantine pest for that state.

The indicative likelihood of entry for all quarantine mealybugs is assessed in the mealybugs Group PRA as Moderate (DAWR 2019a). *Planococcus minor* is present in Vietnam and passionfruit is reported as a host of this pest (Williams & Watson 1988). Standard packing house processes and transportation are not expected to eliminate this mealybug from the pathway. After assessment of relevant pathway-specific factors (sections A2.6 and A2.7) for passionfruit from Vietnam, the likelihood of entry of Moderate was verified as appropriate for this mealybug species on this pathway (Table 3.2).

Table 3.2 Quarantine mealybug species for passionfruit from Vietnam

Pest	In mealybugs Group PRA	Quarantine pest	On passionfruit pathway	Likelihood of entry
Planococcus minor	Yes	Yes (WA)	Yes	Moderate

WA: Regional quarantine pest for Western Australia.

A summary of the risk assessment for quarantine mealybugs is presented in Table 3.3 for convenience.

Table 3.3 Risk estimates for quarantine mealybugs

Risk component	Rating for quarantine mealybugs
Likelihood of entry (importation x distribution)	Moderate (High x Moderate)
Likelihood of establishment	High
Likelihood of spread	High
Overall likelihood of entry, establishment and spread	Moderate
Consequences	Low
Unrestricted risk	**Low**

As assessed in the mealybugs Group PRA, the indicative URE for mealybugs is Low (Table 3.3) which does not achieve the ALOP for Australia. This indicative URE is considered to be applicable for all quarantine mealybugs present on the passionfruit from Vietnam pathway. Therefore, specific risk management measures are required for the quarantine mealybug on this pathway.

In the mealybugs Group PRA, viruses of biosecurity concern transmitted by mealybugs were assessed to have an 'indicative' URE of 'Very Low' for plant import pathways, including the fresh fruit pathway. This is because mealybugs can only transmit viruses for a short period of time (semi-persistent transmission) and these viruses also have a limited host range compared to their mealybug vectors. These biological factors make it very unlikely for the viruses vectored by mealybugs on imported fresh fruit to be transmitted to a suitable host plant in Australia. The URE of 'Very Low' achieves the ALOP for Australia, therefore, no specific risk management measures are required for the viruses transmitted by the mealybug on this pathway.

This risk assessment, which is based on the mealybugs Group PRA, applies to all quarantine mealybugs on the passionfruit from Vietnam pathway, irrespective of their specific identification in this document. This is explained in section A2.7.

3.7 Scale insects

***Chrysomphalus dictyospermi* (GP, WA), *Pseudaulacaspis pentagona* (GP, WA) and *Selenaspidus articulatus* (GP)**

Three scale insect species on the passionfruit from Vietnam pathway, *Chrysomphalus dictyospermi* (dictyospermum scale), *Pseudaulacaspis pentagona* (mulberry scale) and *Selenaspidus articulatus* (west Indian red scale), were identified as quarantine pests for Australia (Table 3.4).

Selenaspidus articulatus is not known to be present in Australia and is a quarantine pest for all of Australia. *Chrysomphalus dictyospermi* and *P. pentagona* are not present in Western Australia and are assessed as regional quarantine pests for that state.

The indicative likelihood of entry for these scale insect species is assessed in the scales Group PRA as Moderate (DAWE 2021). *Chrysomphalus dictyospermi*, *P. pentagona* and *S. articulatus* are present in Vietnam and passionfruit is reported as a host of these pests (García Morales et al. 2022; Nakahara 1982). Standard packing house processes and transportation are not expected to eliminate these scale insect species from the passionfruit from Vietnam pathway. After assessment of relevant pathway-specific factors (sections A2.6 and A2.7) for passionfruit from Vietnam, the likelihood of entry of Moderate was verified as appropriate for these scale insect species on this pathway (Table 3.4).

Table 3.4 Quarantine scale insect species for passionfruit from Vietnam

Pest	In scales Group PRA	Quarantine pest	On passionfruit pathway	Likelihood of entry
Chrysomphalus dictyospermi	Yes	Yes (WA)	Yes	Moderate
Pseudaulacaspis pentagona	Yes	Yes (WA)	Yes	Moderate
Selenaspidus articulatus	Yes	Yes	Yes	Moderate

WA: Regional quarantine pest for Western Australia.

A summary of the risk assessment for quarantine scales is presented in Table 3.5 for convenience.

Table 3.5 Risk estimates for quarantine scale insects

Risk component	Rating for quarantine scales
Likelihood of entry (importation x distribution)	Moderate (High x Moderate)
Likelihood of establishment	High
Likelihood of spread	High
Overall likelihood of entry, establishment and spread	Moderate
Consequences	Low
Unrestricted risk	**Low**

As assessed in the scale insects Group PRA, the indicative URE for hard scale insects is Low (Table 3.5) which does not achieve the ALOP for Australia. This indicative URE is considered to be applicable for the quarantine hard scale insects present on the passionfruit from Vietnam pathway. Therefore, specific risk management measures are required for the quarantine hard scale insect pests on this pathway.

This risk assessment, which is based on the scale insects Group PRA, applies to all quarantine scale insects on the passionfruit from Vietnam pathway, irrespective of their specific identification in this document. This is explained in section A2.7.

3.8 Spider mite

Tetranychus piercei

Tetranychus piercei belongs to the family Tetranychidae, which includes over 1,300 species (Migeon & Dorkeld 2023) in around 70 genera (Krantz & Walter 2009). The family has commonly been referred to as 'spider mites' due to their habit of producing copious silken webbing on host plants (Walter & Proctor 2013).

Tetranychus is one of the largest genera of Tetranychidae, representing more than 100 known species, and is considered one of the most economically important genera of mites (Seeman & Beard 2011; Walter 2006).

Tetranychus piercei has not been reported in Australia, and is a quarantine pest for Australia.

Tetranychus piercei is a tropical and warm sub-tropical pest and has been recorded in at least 14 countries in East and Southeast Asia and Australasia (Papua New Guinea). This pest has been recorded on more than 91 host species, including species from the families Convolvulaceae, Cucurbitaceae, Euphorbiaceae and Fabaceae (Migeon & Dorkeld 2022; NAPPO 2014). The major host plant species include banana, bean, cassava, eggplant, mulberry, papaya, passionfruit, peach, sweet potato and a range of ornamentals (Walter 2006).

Tetranychus piercei can develop and reproduce across a wide range of temperatures. Temperatures between 26°C to 32°C appear the most suitable for growth, survival and reproduction of *T. piercei*. The threshold temperature for complete development of a female has been estimated at 10.7°C (Fu et al. 2002).

Most spider mites, including *T. piercei*, have a similar life cycle that includes 5 life stages: egg, larva, protonymph, deutonymph and adult (Crooker 1985; Jeppson, Keifer & Baker 1975). The 3 immature stages are each followed by an intervening period of quiescence, during which moulting takes place (Crooker 1985).

Fertile eggs are laid by both unmated and mated females of *T. piercei*. Unmated females produce only male eggs and lay an average of 80 eggs during their first 27 days of life, whereas mated females produce up to 150 eggs, which may be male or female (Gutierrez, Helle & Bolland 1979). Adult females are on average 0.5 mm long and 0.3 mm wide, and larger than adult males that are on average 0.3 mm long and 0.17 mm wide (Zhang & Fu 2004a).

Spider mites disperse and exploit new feeding sites very quickly, thereby causing severe damage to agricultural and horticultural crops, and often leading to economic losses (Flechtmann & Knihinicki 2002). Spider mites primarily feed on the leaves of host plants, concentrating their activities near leaf veins. During feeding, they insert their style-like mouthparts (chelicerae) into the parenchyma cells to suck the cell contents into their body by a 'pharyngeal pump' (Botha, Bennington & Poole 2014). This results in discolouration of leaf tissue, with typical symptoms including yellow spots on the upper side of the leaf. Stippling can also occur around leaf veins or entire leaves, causing stunted and deformed growth (Botha, Bennington & Poole 2014). Mite damage to leaves can alter plant and fruit development, change the sugar content and flavour of the fruit, cause aesthetic injury and downgrade fruit quality (Botha, Bennington & Poole 2014; Fonte et al. 2020).

Motile immature stages and adults of *T. piercei* feed and form webbing on plant parts and can reduce crop yields (Ullah, Gotoh & Lim 2014). For example, on banana plants, *T. piercei* causes small brown spots on leaves, initially on the under surface. High populations result in entire leaves turning reddish brown underneath and yellow above, and then the leaves turning necrotic and dry (Fu et al. 2002).

Although there is only limited evidence of *T. piercei* feeding on fruit, spider mites are known to move from leaves to fruit when populations become high (Botha, Bennington & Poole 2014; Fonte et al. 2020; McMurtry 1985). Live spider mites are also regularly intercepted on imported fruit commodities at the Australian border (Brake, Crowe & Russell 2003).

Various tetranychid mites have been previously assessed by the department, and import policies for tetranychid mites already exist (Biosecurity Australia 2010b, a; DAFF 2012, 2022; DAWE 2020; DAWR 2017b; Department of Agriculture 2019). *Tetranychus piercei* has similar biological characteristics to 2 of those spider mite species - *T. pacificus* and *T. turkestani* - including highly polyphagous habits and distribution across a range of different climates (Bolland, Gutierrez & Flechtmann 1998; Fu et al. 2002; Praslička & Huszár 2004). *Tetranychus pacificus* and *T. turkestani* were assessed in the final import risk analysis report for stone fruit from California, Idaho, Oregon and Washington (stone fruit from the USA) (Biosecurity Australia 2010b).

Based on their similarities, outcomes of the previous risk assessment for *T. pacificus* and *T. turkestani* on stone fruit from the USA (Biosecurity Australia 2010b) have been reviewed in this risk assessment for *T. piercei* on passionfruit from Vietnam. Where the risk profile is assessed as comparable to those previously assessed situations, outcomes of previous risk assessments have been adopted in this assessment. For each of the risk components, the comparisons and bases for adopting previous assessments for spider mites on stone fruit from the USA, or for assessing the risk of spider mites specifically for passionfruit from Vietnam, are outlined below.

There are differences in commercial production practices, climatic conditions, fruit biology and pest prevalence between the previously assessed USA stone fruit pathway and passionfruit from Vietnam. These differences make it necessary to assess the likelihood that *T. piercei* will arrive in Australia in a viable state with the importation of passionfruit from Vietnam.

The assessment of spider mites on stone fruit from the USA (Biosecurity Australia 2010b) rated the likelihood of distribution as Moderate. Passionfruit are expected to be distributed in Australia, as a result of the processing, sale or disposal of the imported produce, in a similar way to stone fruit from the USA. Fruit that are unmarketable are likely to be disposed of as municipal waste (Pickin et al. 2022), from where it is unlikely that *T. piercei* will be distributed into the environment. However, fruit waste may also be deposited as litter into urban or peri-urban situations and areas of natural vegetation. *Tetranychus piercei* is polyphagous and can infest a wide range of agricultural and horticultural crops and hosts found in domestic gardens and urban environments as amenity plants or weeds. The time of year when importation occurs will not affect the likelihood of distribution for *T. piercei*. On the basis outlined, the likelihood of distribution of Moderate previously assessed for spider mites on the stone fruit from the USA pathway has been adopted for *T. piercei* on the passionfruit from Vietnam pathway.

The likelihoods of establishment and spread of *T. piercei* in Australia on the passionfruit from Vietnam pathway have been assessed as similar to those of the previous assessment of High and

High, respectively, for spider mites on stone fruit from the USA. Those likelihoods relate specifically to events that occur in Australia and are independent of the import pathway. The consequences of entry, establishment and spread of *T. piercei* in Australia are also independent of the import pathway and have been assessed as being similar to the previous risk assessment of Low. The existing ratings for the likelihoods of establishment and spread, and the rating for the overall consequences for spider mites in the previous assessment for USA stone fruit have been adopted for *T. piercei* on the passionfruit from Vietnam pathway.

In addition, the department has reviewed the latest literature – for example, Fonte et al. (2020), Kaur (2022), Kaur & Zalom (2018), Migeon & Dorkeld (2023), Pan et al. (2019), Yu et al. (2021) and Zhang et al. (2020). No new information has been identified that would significantly change the risk ratings for distribution, establishment, spread or consequences as set out for spider mites in the existing policy for USA stone fruit.

The risk scenario of biosecurity concern considered here is the potential presence of adults, juveniles or eggs of *T. piercei* on passionfruit from Vietnam imported into Australia.

3.8.1 Likelihood of entry

The likelihood of entry is considered in 2 parts: the likelihood of importation and the likelihood of distribution, which consider pre-border and post-border issues, respectively.

Likelihood of importation

The likelihood that *T. piercei* will arrive in Australia in a viable state with the importation of passionfruit from Vietnam is assessed as **High**.

The likelihood of importation is assessed as High because *T. piercei* is present in Vietnam, and the passionfruit plant is known to be a host for this spider mite. Although *T. piercei* is mainly associated with foliage, it may be present on the fruit at harvest if the infestation level is high. Pest management practices in the orchard are likely to reduce numbers of *T. piercei* on passionfruit plants and reduce the risk of fruit infestation. Harvest and post-harvest processes are likely to reduce, but not eliminate, infestation on the fruit given their small size and cryptic habits. If spider mites are present in packed fruit, they are likely to survive conditions during storage and transportation to Australia.

The following information provides supporting evidence for this assessment.

Tetranychus piercei is present in Vietnam and is a pest of passionfruit.

- *Tetranychus piercei* is present in Vietnam (Bolland, Gutierrez & Flechtmann 1998; Walter 2006).
- Passionfruit are grown commercially mainly in tropical and sub-tropical climates of Vietnam (MARD 2016), and such climates are suitable for the survival and development of *T. piercei* (Crooker 1985; Jeppson, Keifer & Baker 1975).
- *Tetranychus piercei* is recorded as a pest of passionfruit (Walter 2006).

Although spider mites like *T. piercei* mainly feed on leaves, they can be found on fruit.

- Spider mites primarily feed on leaves of host plants, concentrating their activities near leaf veins. Severe infestations can result in mites moving from the leaves to feed on the fruit, which can cause damage such as scars to fruit (Bolland, Gutierrez & Flechtmann 1998; Botha, Bennington & Poole 2014; Fonte et al. 2020).

Pest management practices in the orchard are likely to reduce numbers of *T. piercei* on passionfruit plants and reduce the risk of fruit infestation.

- Spider mite populations can rapidly increase, particularly in hot and dry conditions (UC IPM 2011).
- Vietnamese farmers manage *T. piercei* in passionfruit orchards under the guidance of government plant protection officers (MARD 2016).
- Vietnamese farmers regularly monitor *T. piercei* and other pests and apply relevant pesticides, as necessary. These practices are likely to reduce the risk of *T. piercei* being on fruit (MARD 2016).

Harvest and post-harvest processes are unlikely to remove all *T. piercei* from the fruit.

- *Tetranychus piercei* is almost microscopic and may not be detected during harvest, packing and inspection processes. Adult females and males are around 0.5 mm and 0.3 mm long, respectively, and eggs are about 0.1 mm in diameter (Zhang & Fu 2004b, a).
- Post-harvest processes in the packing house, such as brushing and washing, would remove a number of *T. piercei* on the surface of the fruit. However, some *T. piercei* may survive these processes.
- Inactive juvenile stages, known as chrysalis stages, could anchor on the fruit surface (Childers & Fasulo 1995) and may not be removed during packing house processes.

Tetranychus piercei on fruit may survive temperatures during storage and while in transit from Vietnam to Australia.

- Due to the fruit's relatively short shelf life (Kader 1999), passionfruit are likely to be stored for only short periods in Vietnam prior to export, and be transported to Australia by air freight to maximise the quality and shelf life of the fruit.
- The recommended temperature for storage and transport of passionfruit is between 5°C and 10°C (Kader 1999).
- Development of *T. piercei* would slow or cease at temperatures between 5°C and 10°C as the threshold temperature for complete development of female *T. piercei* has been estimated at 10.7°C (Fu et al. 2002).
- Although data on survival of *T. piercei* at low temperatures could not be found, it is likely that the species could survive short periods of time while fruit are stored at cold temperatures.
  - Spider mites are tolerant of cold temperatures, and this attribute is considered to be a major contributor to their successful spread (White, Bale & Hayward 2018).
  - In the closely related species *T. urticae*, temperatures between 5°C and 10°C for 2 hours are sufficient to induce physiological cold responses to enable survival of females (White, Bale & Hayward 2018).

Tetranychus piercei may be able to enter diapause to survive low temperatures during storage and transportation.

- Spider mites can enter diapause to survive low temperatures such as during winter (Suzuki et al. 2015).

- *Tetranychus* species have been shown to diapause as adult females (Botha, Bennington & Poole 2014).

For the reasons outlined, the likelihood that *T. piercei* will arrive in Australia in a viable state with the importation of passionfruit from Vietnam is assessed as High.

Likelihood of distribution

The likelihood that *T. piercei* will be distributed within Australia in a viable state as a result of the processing, sale or disposal of passionfruit from Vietnam and subsequently transfer to a susceptible part of a host, is likely to be similar to the spider mite species previously assessed on stone fruit from the USA (Biosecurity Australia 2010b). The same rating of Moderate for the likelihood of distribution for spider mite species in the previous assessment is adopted for *T. piercei* for passionfruit from Vietnam.

Likelihood of entry

The likelihood of entry is determined as **Moderate** by combining the likelihood of importation of High with the adopted likelihood of distribution of Moderate, using the matrix of rules shown in Table A.2.

3.8.2 Likelihoods of establishment and spread

The likelihoods of establishment and spread for *T. piercei* in Australia are independent of the import pathway and are considered to be similar to those for spider mites on stone fruit from the USA (Biosecurity Australia 2010b).

Based on the existing import policy for stone fruit from the USA (Biosecurity Australia 2010b), the likelihoods of establishment and spread for *T. piercei* are assessed as **High** and **High**, respectively.

3.8.3 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the likelihoods of entry, of establishment and of spread using the matrix of rules in Table A.2.

The overall likelihood that *T. piercei* will enter Australia as a result of trade in passionfruit from Vietnam, be distributed in a viable state to a susceptible part of a host, establish in Australia and subsequently spread within Australia is assessed as **Moderate.**

3.8.4 Consequences

The potential consequences of the entry, establishment and spread of *T. piercei* in Australia are similar to those in the previous assessments for spider mites on stone fruit from the USA (Biosecurity Australia 2010b). The overall consequences for spider mites in the previous assessment were assessed as Low. The overall consequences for *T. piercei* on the passionfruit from Vietnam pathway are also assessed as **Low**.

3.8.5 Unrestricted risk estimate

Unrestricted risk is the result of combining the overall likelihood of entry, establishment and spread with the outcome of overall consequences. The likelihood and consequences are combined using the risk estimation matrix in Table A.4.

Unrestricted risk estimate for *T. piercei*	
Overall likelihood of entry, establishment and spread	Moderate
Consequences	Low
Unrestricted risk	**Low**

The URE for *T. piercei* on the passionfruit from Vietnam pathway is assessed as **Low**, which does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for these spider mites on the passionfruit from Vietnam pathway.

3.9 Thrips

Frankliniella schultzei species complex (GP), *Scirtothrips dorsalis* (GP, RA) and *Thrips palmi* (GP, SA, WA)

Two thrips species on the passionfruit from Vietnam pathway, *Scirtothrips dorsalis* (chilli thrips) and *Thrips palmi* (melon thrips), as well as the *Frankliniella schultzei* species complex (cotton thrips), were identified as quarantine pests and/or regulated articles for Australia (Table 3.6).

Thrips palmi is not present in South Australia and is assessed as a regional quarantine pest for that state. *Thrips palmi* is present but not widely distributed in Western Australia and is assessed as a regional quarantine pest for all areas of Western Australia outside the Ord River Irrigation Area (Shire of Wyndham-East Kimberley).

Frankliniella schultzei is identified as a non-quarantine pest in the thrips Group PRA (DAWR 2017a). However, recent evidence indicates *F. schultzei* is a species complex with at least 8 species globally and 3 out of these species have been recorded in Australia (De Oliveira, Bitencourt & Silva Junior 2023; Hereward et al. 2017). Because at least 5 species in the complex have not been recorded in Australia, the *F. schultzei* species complex is identified as a quarantine pest of concern for Australia (PHA & NGIA 2011). Results from the thrips Group PRA are applicable to all quarantine pest thrips (DAWR 2017a) and, therefore, are applied to the *F. schultzei* species complex.

Scirtothrips dorsalis is present in Australia and is not under official control; therefore, it is not a quarantine pest for Australia.

However, *S. dorsalis* is identified as a regulated article because it is capable of harbouring and spreading (vectoring) emerging orthotospoviruses that are quarantine pests for Australia, as detailed in the thrips Group PRA (DAWR 2017a). The two quarantine pests, *T. palmi* and the *F. schultzei* species complex, are also identified as regulated articles because they are also capable of vectoring emerging quarantine orthotospoviruses.

A regulated article is defined by the IPPC 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' (FAO 2023a).

The indicative likelihood of entry for all quarantine thrips and all thrips that were identified as regulated articles is assessed in the thrips Group PRA as Moderate (DAWR 2017a).

Scirtothrips dorsalis and *T. palmi* are present in Vietnam and are associated with passionfruit (Hung 2009; Poushkova & Kasatkin 2020; PPD 2017). *Frankliniella schultzei* species complex is also present in Vietnam (Poushkova & Kasatkin 2020), however, there is currently no information on which species within the species complex are present there. Due to the uncertainty, it is considered that the *F. schultzei* species complex present in Vietnam is of potential biosecurity concern to Australia until information that indicates otherwise becomes available.

Standard packing house processes and transportation are not expected to eliminate these thrips species on the passionfruit from Vietnam pathway. After assessment of relevant pathway-specific factors (sections A2.6 and A2.7) for passionfruit from Vietnam, the likelihood of entry of Moderate was verified as appropriate for these thrips species on this pathway (Table 3.6).

Table 3.6 Thrips species identified as a quarantine pest and/or a regulated article for passionfruit from Vietnam

Pest	In thrips Group PRA	Quarantine pest	Regulated article	On passionfruit pathway	Likelihood of entry
Frankliniella schultzei species complex	Yes **a**	Yes	Yes	Yes	Moderate
Scirtothrips dorsalis	Yes	No	Yes	Yes	Moderate
Thrips palmi	Yes	Yes (SA, WA)	Yes	Yes	Moderate

SA: Regional quarantine pest for South Australia **WA**: Regional quarantine pest for Western Australia.
a: assessed in the GP as *Frankliniella schultzei*.

A summary of the risk assessment for the quarantine thrips is presented in Table 3.7 for convenience.

Table 3.7 Risk estimates for quarantine thrips

Risk component	Rating for quarantine thrips
Likelihood of entry (importation x distribution)	Moderate (High x Moderate)
Likelihood of establishment	High
Likelihood of spread	High
Overall likelihood of entry, establishment and spread	Moderate
Consequences	Low
Unrestricted risk	**Low**

As assessed in the thrips Group PRA, the indicative URE for thrips is Low (Table 3.7) which does not achieve the ALOP for Australia. This indicative URE is considered to be applicable for the quarantine thrips species present on the passionfruit from Vietnam pathway. Therefore, specific risk management measures are required for quarantine thrips species on this pathway.

As *S. dorsalis, T. palmi* and the *F. schultzei* species complex vector orthotospoviruses that are quarantine pests for Australia, a summary of the risk assessment for quarantine orthotospoviruses transmitted by these thrips is presented in Table 3.8 for convenience.

Table 3.8 Risk estimates for emerging quarantine orthotospoviruses vectored by thrips

Risk component	Rating for emerging quarantine orthotospoviruses (a)
Likelihood of entry (importation x distribution)	Low (Moderate x Moderate)
Likelihood of establishment	Moderate
Likelihood of spread	High
Overall likelihood of entry, establishment and spread	Low
Consequences	Moderate
Unrestricted risk	**Low**

a: Risk estimates for orthotospoviruses adopted from the thrips Group PRA (DAWR 2017a).

As assessed in the thrips Group PRA, the URE for emerging quarantine orthotospoviruses transmitted by thrips is Low (Table 3.8), which does not achieve the ALOP for Australia.

This URE is considered to be applicable for the emerging orthotospoviruses known to be vectored by the thrips species present on the passionfruit from Vietnam pathway. Therefore, specific risk management measures are required for these thrips species to mitigate the risks posed by emerging quarantine orthotospoviruses in order to achieve the ALOP for Australia.

This risk assessment, which is based on the thrips Group PRA, applies to all phytophagous quarantine thrips and all thrips identified as regulated articles on the passionfruit from Vietnam pathway, irrespective of their specific identification in this document. This is explained in section A2.7.

3.10 Pest risk assessment conclusions

Likelihood ratings and the consequences estimate for individual quarantine pests and regulated articles are set out in Table 3.9.

Of the 12 pests for which a further pest risk assessment was conducted:

- The UREs for the 11 quarantine pests were assessed as not achieving the ALOP for Australia, and thus specific risk management measures are required for these pests on this pathway. These pests are:
  - false spider mites (*Brevipalpus phoenicis* species complex)
  - Oriental fruit fly (*Bactrocera dorsalis*)
  - melon fly (*Zeugodacus cucurbitae*)
  - pumpkin fruit fly (*Zeugodacus tau*)
  - Pacific mealybug (*Planococcus minor*)
  - dictyospermum scale (*Chrysomphalus dictyospermi*)
  - mulberry scale (*Pseudaulacaspis pentagona*)
  - West Indian red scale (*Selenaspidus articulatus*)
  - spider mite (*Tetranychus piercei*)
  - cotton thrips (*Frankliniella schultzei* species complex)
  - melon thrips (*Thrips palmi*).
- *Brevipalpus phoenici*s species complex was also identified as a regulated article for Australia due to its potential to introduce viruses of biosecurity concern into Australia. However, there are no reports of these viruses being present in Vietnam; therefore, the risks associated with the vector component of *B. phoenicis* species complex is not assessed in this report.
- The 2 quarantine thrips (*F. schultzei* species complex and *T. palmi*) and an additional thrips species, chilli thrips (*Scirtothrips dorsalis*), were identified as regulated articles for Australia due to their potential to introduce emerging quarantine orthotospoviruses into Australia. The URE for quarantine orthotospoviruses transmitted by thrips was assessed in the thrips Group PRA (DAWR 2017a) as not achieving the ALOP for Australia, and thus specific risk management measures are required for these regulated articles on this pathway.

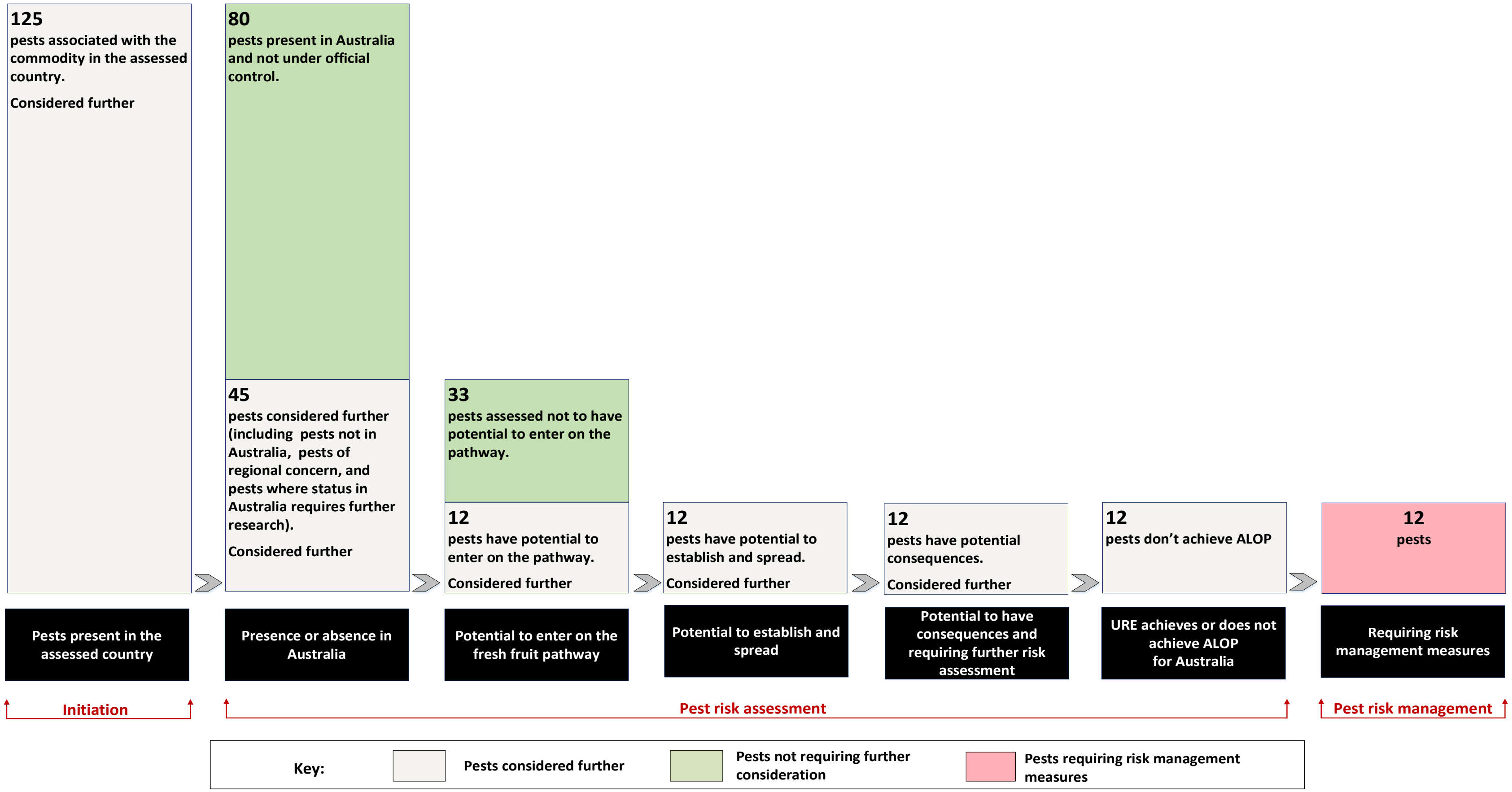
An overview of the decision process at the initiation, pest categorisation and pest risk assessment stages of the pest risk analysis for passionfruit from Vietnam is presented in Figure 3.1.

Table 3.9 Pest risk assessment conclusions for pests, and pest groups, associated with the pathway of passionfruit from Vietnam

Pest name	Likelihood of: Importation	Distribution	**Entry**	**Establishment**	**Spread**	**EES**	**Consequences**	**URE**
False spider mites [Acariformes: Tenuipalpidae]								
Brevipalpus phoenicis species complex **a**	High	Moderate	**Moderate**	High	High	Moderate	Low	**Low**
Fruit flies (Diptera: Tephritidae)								
Bactrocera dorsalis (EP)	High	High	**High**	High	High	High	High	**High**
Zeugodacus cucurbitae (EP)	High	High	**High**	High	High	High	High	**High**
Zeugodacus tau (EP)	High	High	**High**	High	High	High	High	**High**
Mealybugs [Hemiptera: Pseudococcidae]								
Planococcus minor (GP, WA)	High	Moderate	**Moderate**	High	High	Moderate	Low	**Low**
Scale insects (Hemiptera: Diaspididae)								
Chrysomphalus dictyospermi (GP, WA)	High	Moderate	**Moderate**	High	High	Moderate	Low	**Low**
Pseudaulacaspis pentagona (GP, WA)	High	Moderate	**Moderate**	High	High	Moderate	Low	**Low**
Selenaspidus articulatus (GP)	High	Moderate	**Moderate**	High	High	Moderate	Low	**Low**
Spider mite [Acariformes: Tetranychidae]								
Tetranychus piercei	High	Moderate	**Moderate**	High	High	Moderate	Low	**Low**
Thrips [Thysanoptera: Thripidae]								
Frankliniella schultzei species complex (GP) **b, c**	High	Moderate	**Moderate**	High	High	Moderate	Low	**Low**
Scirtothrips dorsalis (GP, RA)	High	Moderate	**Moderate**	N/A	N/A	N/A	N/A	**N/A**
Thrips palmi (GP, SA, WA) **b**	High	Moderate	**Moderate**	High	High	Moderate	Low	**Low**
Orthotospoviruses [Bunyavirales: Tospoviridae] vectored by Frankliniella schultzei* species complex, *Thrips palmi and Scirtothrips dorsalis								
Listed in the thrips group PRA (GP)	Moderate	Moderate	**Low**	Moderate	High	Low	Moderate	**Low**

a: Quarantine pest species that is also identified as a regulated article for Australia as it vectors quarantine viruses. However, the risks associated with the vector aspect of this species is not assessed in this document as there are no reports of these viruses being present in Vietnam. **b**: Quarantine thrips species that is also identified as a regulated article for Australia as it vectors emerging quarantine orthotospoviruses assessed in the thrips Group PRA (DAWR 2017a) as posing an unrestricted risk that does not achieve the ALOP for Australia. **c:** Assessed in the GP as *Frankliniella schultzei*. **EP:** Species has been assessed previously and import policy already exists. **GP:** Species has been assessed previously in a Group PRA, and the Group PRA has been applied. **RA:** Regulated article. **WA:** Regional quarantine pest for Western Australia. **SA:** Regional quarantine pest for South Australia. **EES:** Overall likelihood of entry, establishment and spread. **URE:** Unrestricted risk estimate.

Figure 3.1 Overview of the PRA decision process for passionfruit from Vietnam



4 Pest risk management

Pest risk management evaluates and determines options for measures for quarantine pests and regulated articles identified, in Chapter 3, as having a URE that does not achieve the ALOP for Australia. This chapter recommends specific risk management measures for those quarantine pests and regulated articles (section 4.1). It also recommends an operational system for the assurance, maintenance and verification of phytosanitary status (section 4.2). Both specific risk management measures (section 4.1) and the operational system (section 4.2) are required to reduce the risk of introduction of these quarantine pests and regulated articles to achieve the ALOP for Australia. These measures are in addition to existing commercial production practices for passionfruit in Vietnam, as described in Chapter 2, as these practices have been considered in assessing the URE.

4.1 Pest risk management measures and phytosanitary procedures

This section describes the recommended risk management measures for the 11 quarantine pests (3 of which are also regulated articles) and 1 regulated article assessed, in Chapter 3, as having a URE that does not achieve the ALOP for Australia.

Historical trade and pest interception data of similar pathways, as described in section 4.1.1, have been considered in determining the appropriate risk management measures for the importation of passionfruit from Vietnam.

4.1.1 Analysis of pest interception data

Australia currently allows the import of fresh passionfruit from New Zealand. Between 2017 and 2022 (inclusive), New Zealand exported approximately 2.5 tonnes of passionfruit to Australia. Approximately 7.1% of consignments required remedial action due to the detection of mites (family Acaridae) of biosecurity concern.

Vietnam has access to the Australian market for imported fresh fruit that present a similar risk pathway to passionfruit, including dragon fruit, longans, lychees and mangoes.

Between 2017 and 2022 (inclusive), Vietnam exported approximately 4,664 tonnes of dragon fruit to Australia. Forty-one consignments, representing approximately 4.4% of consignments, required remedial action due to the detection of mites (family Acaridae), beetles (family Anthribidae), aphids (family Aphididae), mealybugs (family Pseudococcidae), scale insects (family Diaspididae), fungi and weed seeds of biosecurity concern.

Between 2019 and 2022 (inclusive), Vietnam exported approximately 242 tonnes of longans to Australia. One consignment, representing approximately 2.0% of consignments, required remedial action for unidentified plant material of biosecurity concern.

Between 2015 and 2022 (inclusive), Vietnam exported approximately 387 tonnes of lychees to Australia. Twenty consignments, representing approximately 22.2% of consignments, required remedial action due to the detection of sucking bugs (family Geocoridae), mealybugs (family Pseudococcidae), snails and mites (family Phytoseiidae) of biosecurity concern. Most of these non-compliant consignments occurred during initial years of trade in lychees between 2015 and 2018.

Between 2016 and 2022 (inclusive), Vietnam exported approximately 589 tonnes of mangoes to Australia. Five consignments, representing approximately 3.5% of consignments, required remedial action due to the detection of mealybugs (family Pseudococcidae) and scale insects (family Coccidae) of biosecurity concern.

It is important to note that a considerable proportion of pests detected were not able to be identified to species level. Those identified to genus, family, etc. containing species that are quarantine pests and/or regulated articles for Australia, were regarded as of biosecurity concern.

4.1.2 Risk management measures for quarantine pests and regulated articles associated with passionfruit from Vietnam

Recommended specific risk management measures for the 11 quarantine pests (3 of which are also regulated articles) and 1 regulated article associated with passionfruit from Vietnam are listed in Table 4.1.

Table 4.1 Recommended risk management measures for quarantine pests and regulated articles potentially associated with passionfruit from Vietnam

Pest/pest group	Scientific name	Common name	Measures
False spider mites [Acariformes: Tenuipalpidae]	*Brevipalpus phoenicis* species complex **a**		Pre-export visual inspection and, if found, remedial action **b**
Fruit flies [Diptera: Tephritidae]	*Bactrocera dorsalis* [EP]	Oriental fruit fly	PFA, PFPP or PFPS **c** OR Fruit treatment known to be effective against fruit fly species such as irradiation
	Zeugodacus cucurbitae [EP]	Melon fly	
	Zeugodacus tau [EP]	Pumpkin fruit fly	
Mealybugs [Hemiptera: Pseudococcidae]	*Planococcus minor* [GP, WA]	Pacific mealybug	Pre-export visual inspection and, if found, remedial action **b**
Scale insects [Hemiptera: Diaspididae]	*Chrysomphalus dictyospermi* [GP, WA]	Dictyospermum scale	Pre-export visual inspection and, if found, remedial action **b**
	Pseudaulacaspis pentagona [GP, WA]	Mulberry scale	
	Selenaspidus articulatus [GP]	West Indian red scale	
Spider mite [Acariformes: Tetranychidae]	*Tetranychus piercei*		Pre-export visual inspection and, if found, remedial action **b**
Thrips [Thysanoptera: Thripidae]	*Frankliniella schultzei* species complex [GP] **d, e**	Cotton thrips	Pre-export visual inspection and, if found, remedial action **b**
	Scirtothrips dorsalis [GP, RA]	Chilli thrips	
	Thrips palmi [GP, SA, WA] **d**	Melon thrips	

a: Quarantine pest species that is also identified as a regulated article for Australia as it vectors quarantine viruses. However, the risks associated with the vector aspect of this species is not assessed in this document as there are no reports of these viruses being present in Vietnam. **b:** Remedial action may include treatment of the consignment to ensure that the pest is no longer viable or withdrawal of the consignment from export to Australia. **c:** PFA is pest free areas, PFPP is pest free places of production or PFPS is pest free production sites. **d:** Quarantine thrips species that is also identified as a regulated article for Australia as it vectors emerging quarantine orthotospoviruses assessed in the thrips Group PRA (DAWR 2017a) as posing an unrestricted risk that does not achieve the ALOP for Australia. **e**: Assessed in the GP as *Frankliniella schultzei*. **EP:** Species has been assessed previously and import policy already exists. **RA:** Regulated article. **GP:** Species has been assessed previously in a Group PRA, and the Group PRA has been applied. **SA:** Regional quarantine pest for South Australia. **WA:** Regional quarantine pest for Western Australia.

The department recommends the following specific risk management measures for the identified quarantine pests and regulated articles:

- for fruit flies
  - pest free areas, pest free places of production or pest free production sites, or
  - fruit treatment considered to be effective against fruit flies (such as irradiation)
- for mealybugs, scale insects, spider mite and thrips
  - pre-export visual inspection and, if detected, remedial action.

Measures for fruit flies

For the fruit flies *B. dorsalis*, *Z. cucurbitae* and *Z. tau* the department recommends the options of pest free areas, pest free places of production or pest free production sites, or fruit treatment considered to be effective against all life stages associated with passionfruit such as irradiation. The objective of each recommended measure is to reduce the risk associated with these fruit fly species to achieve the ALOP for Australia when applied in combination with the operational system outlined in section 4.2.

Recommended measure 1: Pest free areas, pest free places of production or pest free production sites

The requirements for establishing pest free areas (PFA) are set out in ISPM 4: *Requirements for the establishment of pest free areas* (FAO 2017) and, more specifically, ISPM 26: *Establishment of pest free areas for fruit flies (Tephritidae)* (FAO 2018). The requirements for establishing pest free places of production (PFPP) and pest free production sites (PFPS) are set out in ISPM 10: *Requirements for the establishment of pest free places of production and pest free production sites* (FAO 2016a).

Monitoring and trapping of fruit flies in the specified export farms and packing houses would be required, consistent with the procedures recommended in ISPM 26 (FAO 2018). In the event of the detection of any fruit fly species of economic importance in the identified PFA, PFPP or PFPS, Vietnam's PPD would be required to notify the department within 48 hours of detection. The department would then assess the pest species, number of flies and specific information on individual flies detected, such as life stage, sex and gravidity of females, and the circumstances of the detection before advising PPD of any action to be taken. If fruit flies were detected during pre-export inspection or during on-arrival inspection, trade under the PFA, PFPP or PFPS pathway would be suspended immediately, pending the outcome of an investigation.

Should Vietnam wish to use PFA, PFPP or PFPS as a measure to manage the risk posed by fruit flies, PPD would need to provide a submission demonstrating the establishment of these to the department. The submission demonstrating PFA must fulfil requirements as set out in ISPM 4 (FAO 2017) and ISPM 26 (FAO 2018), and the submission demonstrating PFPP or PFPS must fulfil requirements as set out in ISPM 10 (FAO 2016a). The submission is subject to approval by the department.

Recommended measure 2: Fruit treatment

Fruit treatment known to be effective against fruit flies, such as irradiation, applied pre-export may be used as a phytosanitary measure for *B. dorsalis*, *Z. cucurbitae* and *Z. tau*.

The department considers irradiation to be an effective treatment for *B. dorsalis*, *Z. cucurbitae* and *Z. tau* on the passionfruit from Vietnam pathway. The requirements for using irradiation as a phytosanitary measure are set out in ISPM 18: *Guidelines for the use of irradiation as a phytosanitary measure* (FAO 2023b). Irradiation is recognised as an effective method for pest risk management when performed in approved facilities and at specific dose rates recognised as effective for target pest groups. Food Standards Australia New Zealand permits irradiation dose rates up to a maximum of 1,000 gray for quarantine purposes for fresh fruits and vegetables including passionfruit (FSANZ 2021).

The department recommends a treatment schedule of 150 gray minimum absorbed dose, consistent with ISPM 28 Annex 7: *Irradiation treatment for fruit flies of the family Tephritidae (generic)* (FAO 2021) for *B. dorsalis*, *Z. cucurbitae* and *Z. tau*.

The use of irradiation as a phytosanitary measure is subject to the department's approval of the irradiation facilities identified by PPD. Should Vietnam wish to use irradiation as a phytosanitary measure, PPD would need to provide a submission to the department. The submission must fulfil requirements as set out in ISPM 18 (FAO 2023b).

The department recognises other treatments, such as cold, heat (e.g., vapour heat treatment) or fumigation, may also be effective treatments against *B. dorsalis*, *Z. cucurbitae* and *Z. tau* on the passionfruit from Vietnam pathway. The use of any such treatment option is subject to its approval by the department as an efficacious measure against *B. dorsalis*, *Z. cucurbitae* and *Z. tau*. Should Vietnam wish to recommend a treatment option, PPD would need to provide a submission, which includes suitable information to support the claimed efficacy of the treatment to manage *B. dorsalis*, *Z. cucurbitae* and *Z. tau* on the passionfruit from Vietnam pathway, for consideration by the department.

Measures for false spider mites, mealybug, scale insects, spider mite and thrips

The department recommends the option of pre-export visual inspection and, if found, remedial action for the species of false spider mites, mealybug, scale insects, spider mite and thrips on the passionfruit from Vietnam pathway. The method used for visual inspection must be able to detect all life stages of these pests, for example by using visual aids such as hand lens, where necessary. The inspection should be consistent with ISPM 23: *Guidelines for inspection* (FAO 2019c) and ISPM 31: *Methodologies for sampling of consignments* (FAO 2016b) and provide a 95% level of confidence that infestation greater than 0.5% will be detected. The objective of this recommended measure is to reduce the risk associated with these pests to achieve the ALOP for Australia when applied in combination with the operational system outlined in section 4.2.

Recommended measure: Pre-export visual inspection and, if found, remedial action

All passionfruit consignments for export to Australia must be inspected by PPD in accordance with ISPM 23 (FAO 2019c) and ISPM 31 (FAO 2016b). The inspection technique must be capable of detecting all life stages of these pests. Each consignment must be found free of the false spider mites *Brevipalpus phoenicis* species complex, the mealybug *Planococcus minor*, the scale insects *Chrysomphalus dictyospermi, Pseudaulacaspis pentagona* and *Selenaspidus articulatus,* the spider mite *Tetranychus piercei*, and the thrips *Frankliniella schultzei* species complex, *Scirtothrips dorsalis* and *Thrips palmi.* This requirement also applies to any other quarantine or regulated mealybugs, scale insects or thrips not specifically identified in this import risk analysis. Export consignments found to contain any of these pests must be subjected to remedial action. Remedial action may include withdrawing the consignment from export to Australia, or application of an approved treatment to ensure that the pest is no longer viable.

4.1.3 Consideration of alternative measures

Consistent with the principle of equivalence detailed in ISPM 11: *Pest risk analysis for quarantine pests* (FAO 2019b), the department will consider any alternative measure proposed by PPD. Alternative measures must demonstrably manage the target pest(s) to achieve the ALOP for Australia. Evaluation of any such measure will require a technical submission from PPD that details the proposed measure, including suitable information to support the claimed efficacy, for consideration by the department.

4.2 Operational system for the assurance, maintenance and verification of phytosanitary status

A system of operational procedures is necessary to ensure recommended specific risk management measures (section 4.1) are effectively applied, the phytosanitary status of passionfruit from Vietnam is maintained, and these can be verified.

4.2.1 A system of traceability to source farms

The objectives of this recommended procedure are to ensure that:

- passionfruit are sourced only from farms producing commercial quality fruit
- farms from which passionfruit are sourced can be identified, so that any investigation and corrective action can be targeted in the event that pests of biosecurity concern to Australia are intercepted
- where passionfruit is grown/produced in an approved PFA, PFPP or PFPS, it can be verified that all fruit were sourced from the approved area, place or site and produced and exported under the conditions for that pathway.

PPD must establish a system to enable traceability to where passionfruit for export to Australia are sourced. PPD must ensure that export passionfruit growers are aware of pests of biosecurity concern for Australia and have systems in place to produce export quality fruit that meet Australia's requirements.

Where a pest risk management measure involving pest monitoring and controls during production and at harvest (such as PFA, PFPP, PFPS or systems approach) is used, export farms must be registered with PPD before commencement of each harvest season. Records of registered farms and PPD audits must be kept by PPD and must be made available to the department upon request.

4.2.2 Registration of packing houses and treatment providers, and auditing of procedures

The objectives of this recommended procedure are to ensure that:

- commercial quality passionfruit are sourced only from packing houses that are approved by PPD
- where applicable, treatment providers are approved by PPD and capable of applying a treatment that suitably manages the target pests.

Passionfruit export packing houses are registered with PPD before the commencement of each harvest season. PPD is required to ensure that the registered packing houses are suitably equipped and have a system in place to carry out the specified phytosanitary activities. The list of registered packing houses and records of PPD audits must be kept by PPD and must be made available to the department upon request.

In circumstances where passionfruit undergo pre-export treatment, this process must be undertaken by treatment providers that have been registered with and audited by PPD for that purpose. Records of PPD registration requirements and audits must be made available to the department upon request.

The approval of treatment providers by PPD must include verification that suitable systems are in place to ensure compliance with treatment requirements. This may include:

– documented procedures to ensure passionfruit are appropriately treated and safeguarded post treatment
– staff training to ensure compliance with procedures
– record-keeping procedures
– suitability of facilities and equipment
– PPD's system of oversight of treatment application.

The department provides final approval of facilities, following review of regulatory oversight provided by PPD and the capability demonstrated by the facility. Site visits may be required for the department to have assurance that treatment can be applied accurately and consistently.

4.2.3 Packaging, labelling and containers

The objectives of this recommended procedure are to ensure that:

- passionfruit intended 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 2023a))
- unprocessed packaging material is not imported with passionfruit from Vietnam. Unprocessed packaging material is not permitted as it may vector pests identified as not being on the pathway, or pests not known to be associated with passionfruit
- all wood material associated with the consignment used in packaging and transport of passionfruit complies with the department’s import requirements, as published on BICON
- secure packaging is used for export of passionfruit from Vietnam to Australia, to prevent re-infestation during storage and transport and prevent escape of pests during clearance procedures on arrival in Australia. Packaging must meet Australia's secure packaging options published on BICON
- consignments are made insect proof and secure, by using at least one of the following secure consignment options:

  - **integral cartons**: produce may be packed in integral (fully enclosed) cartons (packages) with boxes having no ventilation holes and lids tightly fixed to the bases
  - **ventilation holes of cartons covered:** cartons (packages) with ventilation holes must have the holes covered/sealed with a mesh/screen of no more than 1.6 mm pore size and not less than 0.16 mm strand thickness. Alternatively, the vent holes may be taped over
  - **polythene liners:** vented cartons (packages) with sealed polythene liners/bags within are acceptable (folded polythene bags are acceptable)
  - **meshed or shrink wrapped pallets or Unit Load Devices (ULDs):** ULDs transporting cartons with open ventilation holes/gaps, or palletised cartons with ventilation holes/gaps must be fully covered or wrapped with polyethylene/plastic/foil sheet or mesh/screen of no more than 1.6 mm diameter pore size and not less than 0.16 mm strand thickness
  - **produce transported in fully enclosed containers:** cartons (packages) with holes as loose boxes or on pallets may be transported in fully enclosed containers. Enclosed containers include 6-sided containers with solid sides, or ULDs with tarpaulin sides that have no holes or gaps. The container must be transported to the inspection point intact
- packaged passionfruit from Vietnam must be labelled with sufficient identification for the purposes of traceability. This may include:
  - for treated product: the treatment facility name/number and treatment identification reference/number
  - for passionfruit where the measures include pre-harvest controls/freedom: the export farm reference/number
  - for passionfruit where phytosanitary measures are applied at the packing house: the packing house reference/number
- where applicable, packaged passionfruit from Vietnam that has undergone irradiation treatment is labelled with a statement that the passionfruit has been treated with ionising radiation.

Export packing houses and treatment providers (where applicable) must ensure packaging and labelling are suitable to maintain phytosanitary status of the export consignments.

4.2.4 Specific conditions for storage and movement

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

Treated and/or inspected passionfruit for export to Australia must be kept secure and segregated at all times from any fruit for domestic or other markets, and from untreated/un-inspected product, to prevent mixing or cross-contamination. The area set aside for goods to Australia must be clearly identified with signage.

4.2.5 Freedom from trash

The objective of this recommended procedure is to ensure that passionfruit for export are free from trash (for example, loose stem and leaf material, seeds, soil, animal matter/parts or other extraneous material) and foreign matter.

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

4.2.6 Pre-export phytosanitary inspection and certification by PPD

The objective of these recommended procedures is to ensure that Australia's import conditions have been met. All consignments of passionfruit from Vietnam for export to Australia must be inspected by PPD and found free of pests of biosecurity concern for Australia. Pre-export visual inspection must be undertaken by PPD in accordance with ISPM 23: *Guidelines for inspection* (FAO 2019c) and consistent with the principles of ISPM 31: *Methodologies for sampling of consignments* (FAO 2016b). Any netting or artificial wrapping material must be removed during the inspection.

All consignments must be inspected prior to export in accordance with official procedures for all visually-detectable quarantine pests and regulated articles (including trash). Sampling and inspection methods should be consistent with ISPM 23 (FAO 2019c) and ISPM 31 (FAO 2016b) and provide a 95% level of confidence that infestation greater than 0.5% will be detected. For a consignment equal to or greater than 1,000 units (one unit being a single passionfruit), this is equivalent to a 600-unit sample randomly selected across the consignment. Any netting or artificial wrapping material must be removed during the inspection.

A phytosanitary certificate must be issued for each consignment upon completion of pre-export inspection and treatment to certify that the required risk management measures have been undertaken prior to 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 disinfestation treatments (if required) which includes approved facility name and address, date of treatment and, where irradiation is used, absorbed dose (target and measured)
– additional declarations that may be required such as identification of the consignment as being sourced from a recognised pest free area, pest free place of production or pest free production site.

Some treatments (such as irradiation) may also require treatment certificates that accompany the phytosanitary certificate. BICON will describe when treatment certificates are required.

4.2.7 Phytosanitary verification inspection by the Department of Agriculture, Fisheries and Forestry

The objectives of this recommended procedure are to ensure that:

- consignments comply with Australian import requirements
- consignments are as described on the phytosanitary certificate
- 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
– verify that the biosecurity status of consignments of passionfruit from Vietnam meet Australia's import requirements. When inspecting consignments, the department will randomly sample 600 units, or equivalent, per phytosanitary certificate and apply an inspection method suitable for the commodity.

4.2.8 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, including trash, 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 requirements will be subject to suitable remedial treatment where an effective treatment is available for the identified biosecurity risks. Where an effective treatment is not available, the imported consignment will be exported or destroyed.

Other actions, including partial or complete suspension of the import pathway, may be taken depending on the identity and/or importance of the pest intercepted, for example, fruit flies of economic importance, or pests for which PFAs, PFPPs or PFPSs are established.

In the event that consignments of passionfruit from Vietnam are repeatedly non-compliant, the department may require enhanced risk management measures, including mandatory phytosanitary treatment. 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 be allowed to recommence only when the department is satisfied that appropriate corrective action has been undertaken.

4.3 Uncategorised pests

If an organism that has not been categorised, including a contaminant pest, is detected on passionfruit on arrival in Australia, it will require assessment by the department to determine its quarantine status and whether phytosanitary action is required.

Assessment is also required if the detected species was categorised as not having the potential to be on the import pathway. If the detected species was categorised as being on the pathway but assessed as having an unrestricted risk that achieves the ALOP for Australia, then it may require reassessment. The detection of any pests of biosecurity concern not already identified in the analysis may result in remedial action and/or temporary suspension of trade while a review is conducted to ensure that existing measures continue to provide the ALOP for Australia.

4.4 Review of processes

4.4.1 Verification of protocol

Prior to or during the first season of trade, the department will verify the implementation of the required import requirements including registration, operational procedures and treatment providers, where applicable. This may involve representatives from the department visiting areas in Vietnam that produce passionfruit for export to Australia.

4.4.2 Review of policy

The department will review the import policy after a suitable volume of trade has been achieved to ensure import requirements continue to be appropriate to manage the biosecurity risk of the pathway. In addition, the department reserves the right to review the import policy as deemed necessary. This may include if there is reason to believe that the pest or phytosanitary status in Vietnam has changed, or where alternative risk management or compliance-based intervention options become available.

PPD must inform the department immediately on the detection of any new pests of passionfruit in Vietnam that might be of potential biosecurity concern to Australia.

4.5 Meeting Australia’s food laws

In addition to meeting Australia's biosecurity laws, food imported for sale for human consumption must comply with the requirements of the *Imported Food Control Act 1992*, as well as Australian state and territory food laws. Among other things, these laws require all food, including imported food, to be safe and meet the standards set out in the Australia New Zealand Food Standards Code (the Code).

Food Standards Australia New Zealand (FSANZ) is responsible for developing and maintaining the Code. The Code is available at foodstandards.gov.au/code/Pages/default.aspx.

The department administers the *Imported Food Control Act 1992* which supports the inspection and testing of imported food to verify its safety and compliance with Australia's food standards, including the Code. This is undertaken through a risk-based border inspection program, the Imported Food Inspection Scheme. More information about this scheme is available at agriculture.gov.au/biosecurity-trade/import/goods/food/inspection-testing/ifis.

Standards 1.1.1, 1.1.2 and 1.4.4 of the Code specify that a food for sale must not consist of, or have as an ingredient or a component, a prohibited or restricted plant or fungus; unless expressly permitted by the Code. The prohibited and restricted plants and fungi are listed in Schedules 23 and 24 of the Code, respectively.

Standard 1.4.2 and Schedules 20, 21 and 22 of the Code set out the maximum residue limits and extraneous residue limits for agricultural or veterinary chemicals that are permitted in foods for sale, including imported food. Standard 1.1.1 of the Code specifies that a food must not have, as an ingredient or a component, a detectable amount of an agvet chemical, or a metabolite or a degradation product of the agvet chemical; unless expressly permitted by the Code.

Certain imported food, including some minimally processed horticulture products, must be covered by a food safety management certificate to be imported into Australia. The certificate provides evidence that a food has been produced through a food safety management system. This system must have appropriate controls in place to manage food safety hazards. More information about the foods that require a food safety management certificate and how to comply is available at agriculture.gov.au/biosecurity-trade/import/goods/food/lodge/safety-management-certificates.

5 Conclusion

This final risk analysis report was conducted to assess the proposal by Vietnam's PPD for market access to Australia for passionfruit for human consumption.

The risk analysis was conducted in accordance with Australia's method for pest risk analysis (Appendix A), which is consistent with the International Standards for Phytosanitary Measures (ISPMs), including ISPM 2: *Framework for pest risk analysis* (FAO 2019a) and ISPM 11: *Pest risk analysis for quarantine pests* (FAO 2019b), and the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (WTO 1995).

In conclusion, this final report recommends that the importation of commercially produced passionfruit to Australia from all commercial production areas of Vietnam can be permitted, subject to a range of biosecurity requirements outlined in Chapter 4.

The findings of this final report are based on a comprehensive analysis of scientific literature and other relevant information.

The department considers that the risk management measures recommended in this report will provide an appropriate level of protection against the quarantine pests and regulated articles identified as associated with the trade of passionfruit from Vietnam.

All fresh fruit, including passionfruit from Vietnam, have been determined by the Director of Biosecurity to be conditionally non-prohibited goods under s174 of the *Biosecurity Act 2015*. Conditionally non-prohibited goods cannot be brought or imported into Australia unless they meet specific import conditions.

This report, upon its finalisation, provides the basis for import conditions for passionfruit from Vietnam for human consumption. The import conditions will be communicated on BICON. The publication of import conditions on BICON is subject to Vietnam being able to demonstrate that processes and procedures are in place to implement the required risk management measures.

Appendix A: Method for pest risk analysis

This section sets out the method for the pest risk analysis (PRA) used by the department. This method is consistent with the International Standards for Phytosanitary Measures (ISPMs), including ISPM 2: *Framework for pest risk analysis* (FAO 2019a) and ISPM 11: *Pest risk analysis for quarantine pests* (FAO 2019b) and the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (WTO 1995).

A PRA is ‘the process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it’ (FAO 2023a). A pest is 'any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products' (FAO 2023a). A ‘quarantine pest’ is 'a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled' (FAO 2023a).

Biosecurity risk consists of 2 major components: the likelihood of a pest entering, establishing and spreading in Australia for a defined import pathway; and the consequences should this happen. These 2 components are combined to give an overall estimate of the pest risk for the defined import pathway.

Unrestricted risk is estimated taking into account, where applicable, the existing commercial production practices of the exporting country and procedures that occur on arrival in Australia. These procedures include verification by the department that the consignment received is as described on the commercial documents and its integrity has been maintained.

Restricted risk is estimated with phytosanitary measure(s) applied. A phytosanitary measure is ‘any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests’ (FAO 2023a).

A PRA is conducted in 3 consecutive stages: initiation (A1), pest risk assessment (A2) and pest risk management (A3).

A1 Stage 1: Initiation

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

A pathway is ‘any means that allows the entry or spread of a pest’ (FAO 2023a). For this risk analysis, the ‘pathway’ being assessed is defined in Chapter 1 (section 1.2.2).

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

According to ISPM 11 (FAO 2019b), the PRA process may be initiated as a result of:

- the identification of a pathway that presents a potential pest hazard. For example, international trade is requested for a commodity not previously imported into the country or a commodity from a new area or new country of origin
- the identification of a pest that may require phytosanitary measures. For example, a new pest risk is identified by scientific research, a pest is repeatedly intercepted, a request is made to import an organism, or an organism is identified as a vector of other pests
- the review or revision of a policy. For example, a country's decision is taken to review phytosanitary regulations, requirements or operations or a new treatment or loss of a treatment system, a new process, or new information impacts on an earlier decision.

The basis for the initiation of this risk analysis is defined in Chapter 1 (section 1.2.1).

The primary elements in the initiation stage are:

- identity of the pests
- potential association of each pest with the pathway being assessed.

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

The potential association of each pest with the pathway being assessed considers information on:

  - association of the pest with the host plant/commodity and
  - the presence or absence of the pest in the exporting country/region relevant to the pathway being assessed.

A2 Stage 2: Pest risk assessment

The process for pest risk assessment includes 2 sequential steps:

- pest categorisation (A2.1)
- further pest risk assessment, which includes evaluation of the likelihoods of the introduction (entry and establishment) and spread of a pest (A2.2), and evaluation of the magnitude of the associated potential consequences (A2.3).

A2.1 Pest categorisation

Pest categorisation examines the pests identified in the initiation stage (A1) to determine which of these pests meet the definition of a quarantine pest and require further pest risk assessment.

ISPM 11 (FAO 2019b) states that '*The opportunity to eliminate an organism or organisms from consideration before in-depth examination is undertaken is a valuable characteristic of the categorisation process. An advantage of pest categorisation is that it can be done with relatively little information; however information should be sufficient to adequately carry out the categorisation*'. In line with ISPM 11, the department utilises the pest categorisation step to screen out some pests from further consideration where appropriate. For each pest that is not present in Australia, or is present but under official control, the department assesses its potential to enter (importation and distribution) on the pathway being assessed and, if having potential to enter, its potential to establish and spread in the PRA area. For a pest to cause economic consequences, the pest will need to enter, establish and spread in the PRA area. Therefore, pests that do not have potential to enter on the pathway being assessed, or have potential to enter but do not have potential to establish and spread in the PRA area, are not considered further. The potential for economic consequences is then assessed for pests that have potential to enter, establish and spread in the PRA area. Further pest risk assessments are then undertaken for pests that have potential to cause economic consequences, i.e., pests that meet the criteria for a quarantine pest.

Pest categorisation uses the following primary elements to identify the quarantine pests and to screen out some pests from further consideration where appropriate for the pathway being assessed:

- presence or absence and regulatory status in the PRA area
- potential for entry, establishment and spread in the PRA area
- potential for economic consequences in the PRA area.

A2.2 Assessment of the likelihood of entry, establishment and spread

ISPM 11 (FAO 2019b) provides details of how to assess the 'probability of entry', 'probability of establishment' and 'probability of spread' of a pest. The SPS Agreement (WTO 1995) uses the term 'likelihood' rather than 'probability' for these estimates. In qualitative PRAs, the department uses the term 'likelihood' as the descriptor. The use of the term 'probability' is limited to the direct quotation of ISPM definitions.

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

A2.2.1 Likelihood of entry

The likelihood of entry describes the likelihood that a quarantine pest will enter Australia when a given commodity is imported, be distributed in a viable state in the PRA area and subsequently be transferred to a host.

For the purpose of considering the likelihood of entry, the department divides this step into 2 components:

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

Factors to be considered in the likelihood of importation may include:

- likelihood of the pest being associated with the pathway at origin
  - prevalence of the pest in the source area
  - occurrence of the pest in a life-stage that would be associated with the commodity
  - mode of trade (for example, bulk, packed)
  - volume and frequency of movement along each pathway

- seasonal timing of imports
- pest management, cultural and commercial procedures applied at the place of origin (for example, application of plant protection products, handling, culling, and grading)
- likelihood of survival of the pest during transport or storage
  - speed and conditions of transport and duration 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
  - prevalence of the pest likely to be associated with a consignment
  - commercial procedures (for example, refrigeration) applied to consignments during transport and storage in the country of origin, and during transport to Australia
- likelihood of pest surviving existing pest management procedures.

Factors to be considered in the likelihood of distribution may include:

- commercial procedures (for example, refrigeration) applied to consignments during distribution in Australia
- dispersal mechanisms of the pest, including vectors, to allow movement from the pathway to a suitable 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 suitable hosts
- time of year at which import takes place
- intended use of the commodity (for example, for planting, processing or consumption)
- risks from by-products and waste.

A2.2.2 Likelihood of establishment

Establishment is defined as the ‘perpetuation for the foreseeable future, of a pest within an area after entry’ (FAO 2023a). In order to estimate the likelihood of establishment of a pest, reliable biological information (for example, lifecycle, host range, epidemiology, survival) is obtained from the areas where the pest currently occurs. The situation in the PRA area can then be compared with that in the areas where it currently occurs and expert judgement used to assess the likelihood of establishment.

Factors to be considered in the likelihood of establishment in the PRA area may include:

- availability of suitable hosts, alternate hosts and vectors in the PRA areas
  - prevalence of hosts and alternate hosts in the PRA area
  - whether hosts and alternate hosts occur within sufficient geographic proximity to allow the pest to complete its life cycle
  - whether there are other plant species, which could prove to be suitable hosts in the absence of usual host species
  - whether a vector, if needed for dispersal of the pest, is already present in the PRA area or likely to be introduced
- suitability of environment in the PRA area

- factors in the environment in the PRA area (for example, suitability of climate, soil, pest and host competition) that are critical to the development of the pest, its host and if applicable its vector, and to their ability to survive periods of climatic stress and complete their life cycles
- cultural practices and control measures in the PRA area that may influence the ability of the pest to establish
- other characteristics of the pest
  - reproductive strategy of the pest and method of pest survival
  - potential for adaptation of the pest
  - minimum population needed for establishment.

A2.2.3 Likelihood of spread

Spread is defined as 'the expansion of the geographical distribution of a pest within an area' (FAO 2023a). The likelihood of spread considers the factors relevant to the movement of the pest, after establishment on a host plant or plants, to other susceptible host plants of the same or different species in other areas. In order to estimate the likelihood of spread of the pest, reliable biological information is obtained from areas where the pest currently occurs. The situation in the PRA area is then carefully compared with that in the areas where the pest currently occurs and expert judgement used to assess the likelihood of spread.

Factors to be considered in the likelihood of spread may include:

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

A2.2.4 Assigning likelihoods for entry, establishment and spread

Likelihoods are assigned to each step of entry, establishment and spread. Six qualitative likelihood descriptors are used: High; Moderate; Low; Very Low; Extremely Low; and Negligible. Definitions for these descriptors and their indicative ranges are given in Table A.1. 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 A.1 Nomenclature of likelihoods

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

A2.2.5 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 A.2). This matrix is then used to combine the likelihood of entry and the likelihood of establishment, and the likelihood of entry and establishment is then combined with the likelihood of spread to determine the overall likelihood of entry, establishment and spread.

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

importation x distribution = entry [E]	**Low x Moderate = Low**
entry x establishment = [EE]	**Low x High = Low**
[EE] x spread = [EES]	**Low x Very Low = Very Low**

Table A.2 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

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

The 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. If there are substantial changes in the volume and nature of the trade in specific commodities then the department will review the risk analysis and, if necessary, provide updated policy advice.

In assessing the volume of trade in this risk analysis, the department assumed that a substantial volume of trade will occur.

A2.3 Assessment of potential consequences

In estimating the potential consequences of a pest if the pest were to enter, establish and spread in Australia, the department uses a 2-step process. In the first step, a qualitative descriptor of the impact is assigned to each of the direct and indirect criteria in terms of the *level of impact* and the *magnitude of impact*. The second step involves combining the impacts for each of the criteria to obtain an 'overall consequences' estimation.

Step 1: Assessing direct and indirect impacts

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

- the life or health of plants and plant products

  This may include pest impacts on the life or health of the plants and production effects (yield or quality) either at harvest or during storage.

  - Where applicable, pest impacts on the life or health of humans or of animals and animal products may also be considered.
- other aspects of the environment.

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

- eradication and control

  This may include pest impacts on new or modified eradication, control, surveillance or monitoring and compensation strategies or programs.
- domestic trade

  This may include pest impacts on domestic trade or industry, including changes in domestic consumer demand for a product resulting from quality changes and effects on other industries supplying inputs to, or using outputs from, directly affected industries.
- international trade

  This may include pest impacts on international trade, including loss of markets, meeting new technical requirements to enter or maintain markets and changes in international consumer demand for a product resulting from quality changes.
- non-commercial and environment

This may include pest impacts on the community and environment, including reduced tourism, reduced rural and regional economic viability, loss of social amenity, and any 'side effects' of control measures.

For each of these direct and indirect criteria, the level of impact is estimated over 4 geographic levels, defined as:

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

For each criterion, the magnitude of impact at each of these geographic levels is described using 4 categories, defined as:

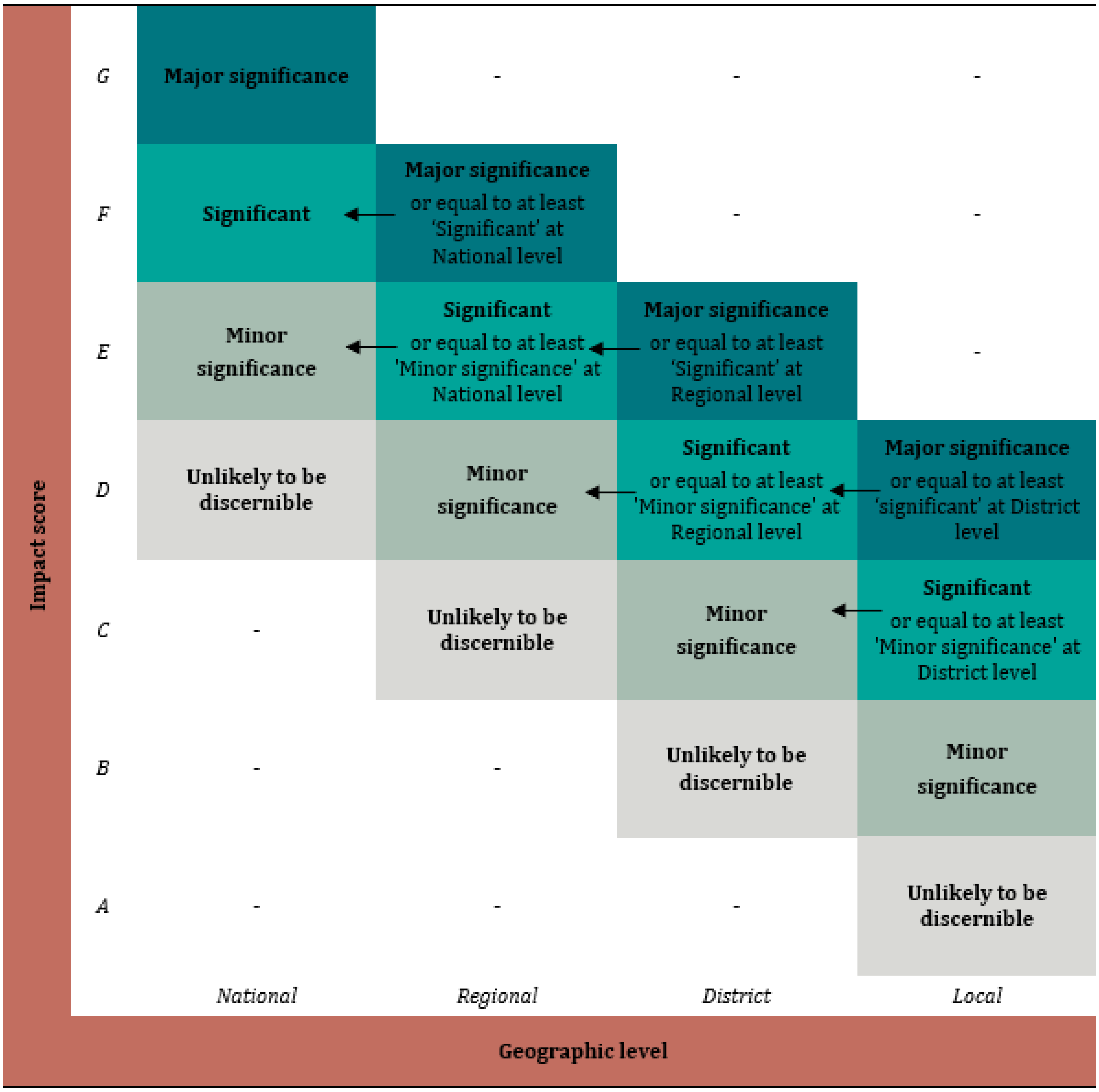
- **Unlikely to be discernible**–pest impact is not usually distinguishable from normal day-to-day variation in the criterion
- **Minor significance**–expected to lead to a minor increase in mortality/morbidity of hosts or a minor decrease in production but not expected to threaten the economic viability 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.

Each individual direct or indirect impact is given an impact score (A–G) using the decision rules in Figure A.1. This is done by determining which of the shaded cells with bold font in Figure A.1 correspond to the level and magnitude of the particular impact.

The following are considered during this process:

- At each geographic level below 'National', an impact more serious than 'Minor significance' is considered at least 'Minor significance' at the level above. For example, a 'Significant' impact at the state or territory level is considered equivalent to at least a 'Minor significance' impact at the national level.
- If the impact of a pest at a given level is in multiple states or territories, districts or regions or local areas, it is considered to represent at least the same magnitude of impact at the next highest geographic level. For example, a 'Minor significance' impact in multiple states or territories represents a 'Minor significance' impact at the national level.
- The geographic distribution of an impact does not necessarily determine the impact. For example, an outbreak could occur on one orchard/farm, but the impact could potentially still be considered at a state or national level.

Figure A.1 Decision rules for determining the impact score for each direct and indirect criterion, based on the *level of impact* and the *magnitude of impact*



For each criterion:

- the *level of impact is estimated over 4 geographic levels: local, district, regional and national*
- the *magnitude of impact* at each of the 4 geographic levels is described using 4 categories: unlikely to be discernible, minor significance, significant and major significance
- an impact score (A–G) is assigned by determining which of the shaded cells with bold font correspond to the level and magnitude of impact.

Step 2: Combining direct and indirect impacts

The overall consequence for each pest or each group of pests is achieved by combining the impact scores (A–G) for each direct and indirect criterion using the decision rules in Table A.3. These rules are mutually exclusive, and are assessed in numerical order until one applies. For example, if the first rule does not apply, the second rule is considered, and so on.

Table A.3 Decision rules for determining the overall consequence rating for each pest

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

A2.4 Estimation of the unrestricted risk

Once the assessment of the likelihood of entry, establishment and spread and for potential consequences are completed, the unrestricted risk can be determined for each pest or each group of pests. This is determined by using a risk estimation matrix (Table A.4) to combine the estimates of the likelihood of entry, establishment and spread and the overall consequences of pest establishment and spread.

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 give a Low rating.

Table A.4 Risk estimation matrix

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

A2.5 The 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, which reflects community expectations through government policy, is currently expressed as providing a high level of sanitary or phytosanitary protection aimed at reducing risk to a very low level, but not to zero. The band of cells in Table A.4 marked 'Very Low risk' represents the ALOP for Australia.

A2.6 Adoption of outcomes from previous assessments

Outcomes of previous risk assessments have been adopted in this assessment for pests for which the risk profile is assessed as comparable to previously assessed situations.

The prospective adoption of previous risk assessment ratings for the likelihood of importation and the likelihood of distribution is considered on a case-by-case basis by comparing factors relevant to the pathway being assessed with those assessed previously. For assessment of the likelihood of importation, factors considered/compared include the commodity type, the prevalence of the pest and commercial production practices in the exporting country/region. For assessment of the likelihood of distribution of a pest the factors considered/compared include the commodity type, the ways the imported produce will be distributed within Australia as a result of the processing, sale or disposal of the imported produce, and the time of year when importation occurs and the availability and susceptibility of hosts at that time. After comparing these factors and reviewing the latest literature, previously determined ratings may be adopted if the department considers the likelihoods for the pathway being assessed to be comparable to those assigned in the previous assessment(s), and there is no new information to suggest that the ratings assigned in the previous assessment(s) have changed.

The likelihoods of establishment and of spread of a pest species in the PRA area will be comparable between risk assessments, regardless of the import pathway through which the pest has entered the PRA area. This is because these likelihoods relate specifically to conditions and events that occur in the PRA area, and are independent of the import pathway. Similarly, the estimate of potential consequences associated with a pest species is also independent of the import pathway. Therefore, the likelihoods of establishment and of spread of a pest, and the estimate of potential consequences, are directly comparable between assessments. If there is no new information available that would significantly change the ratings for establishment or spread or the consequences the pests may cause, the ratings assigned in the previous assessments for these components may be adopted with confidence.

A2.7 Application of Group PRAs to this risk analysis

The Group PRAs that were applied to this risk analysis are:

- the *Final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports* (thrips Group PRA) (DAWR 2017a).
- the *Final group pest risk analysis for mealybugs and the viruses they transmit on fresh fruit, vegetable, cut-flower and foliage imports* (mealybugs Group PRA) (DAWR 2019a).

- the *Final group pest risk analysis for soft and hard scale insects on fresh fruit, vegetable, cut-flower and foliage imports* (scales Group PRA) (DAWE 2021).

The Group PRA approach is consistent with relevant international standards and requirements– including ISPM 2: *Framework for Pest Risk Analysis* (FAO 2019a), ISPM 11: Pest Risk Analysis for Quarantine Pests (FAO 2019b) and the SPS Agreement (WTO 1995). ISPM 2 states that 'Specific organisms may be analysed individually, or in groups where individual species share common biological characteristics.'

Risk estimates derived from a Group PRA are 'indicative' in character. This is because the likelihood of entry (the combined likelihoods of importation and distribution) can be influenced by a range of pathway-specific factors, as explained in section A2.6. Therefore, the indicative likelihood of entry from a Group PRA needs to be verified on a case-by-case basis.

In contrast, and as noted in section A2.6, the risk factors considered in the likelihoods of establishment and spread, and the potential consequences associated with a pest species are not pathway-specific, and are therefore comparable across all import pathways within the scope of the Group PRA. This is because at these latter stages of the risk analysis the pest is assumed to have already found a host within Australia at or beyond its point of entry. Therefore, unless there is specific evidence to suggest otherwise, a Group PRA assessment can be applied as the default outcome for any pest species on a plant import pathway once the previously assigned likelihood of entry has been verified.

In a scenario where the likelihood of entry for a pest species on a commodity is assessed as different to the indicative estimate, the Group PRA-derived likelihoods of establishment and spread and the estimate of consequences can still be used, but the overall risk rating (the URE) may change.

Application of Group policy involves identification of up to 3 species of each relevant group associated with the import pathway. However, if any other quarantine pests or regulated articles not included in this risk analysis and/or in the relevant group policies are detected at pre-export or on arrival in Australia, the relevant Group policy will also apply.

A3 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 assessment 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 the ALOP for Australia. The effectiveness of any proposed/recommended phytosanitary measures (or combination of measures) is evaluated, using the same approach as used to evaluate the unrestricted risk. This ensures the restricted risk for the relevant pest or pests achieves the ALOP for Australia.

ISPM 11 (FAO 2019b) provides details on the identification and selection of appropriate risk management options and notes that the choice of measures should be based on their effectiveness in reducing the likelihood of entry of the pest.

Examples given of measures commonly applied to traded commodities include:

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

Appendix B: Initiation and categorisation for pests of passionfruit from Vietnam

The pest categorisation table does not represent a comprehensive list of all the pests associated with the entire passionfruit plant, grown in Vietnam. Reference to soil-borne nematodes, soil-borne pathogens, wood-borer pests, root pests or pathogens, and secondary pests has not been made, as they are not directly related to the export pathway passionfruit and would be addressed by Australia's current approach to contaminating pests.

The steps in the initiation and categorisation processes are considered sequentially, with the assessment terminating at 'Yes' for column 3 (except for pests that are present, but under official control and/or pests of regional concern), or at the first 'No' for columns 4, 5, 6 or 7. In the final column of the table (column 8) the acronyms 'EP', 'GP' and 'RA' are used. The acronym 'EP' (existing policy) is used for pests that have been assessed by Australia and for which a policy exists. The acronym 'GP' (Group policy) is used for pests that have been assessed by Australia in a Group policy. The acronym 'RA' (regulated article) is used for pests that are known to vector pathogens of biosecurity concern and are therefore regulated articles. The acronym for the state or territory for which regional pest status is considered, such as 'WA' (Western Australia) or 'SA' (South Australia), is used to identify organisms that have been recorded in some regions of Australia, and due to interstate quarantine regulations are considered regional quarantine pests.

The *Final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports* (DAWR 2017a), the *Final group pest risk analysis for mealybugs and the viruses they transmit on fresh fruit, vegetable, cut-flower and foliage imports* (DAWR 2019a) and the *Final group pest risk analysis for soft and hard scale insects on fresh fruit, vegetable, cut-flower and foliage imports* (DAWE 2021) have been applied in this risk analysis. Application of Group policy involves identification of up to 3 species of each relevant group associated with the commodity pathway. However, if any other quarantine pests or regulated articles not included in this risk analysis and/or in the relevant Group policies are detected at pre-export or on-arrival in Australia, the relevant Group policy will also apply.

The department is aware of the changes in fungal nomenclature which ended the separate naming of different states of fungi with a pleomorphic life cycle. However, as the nomenclature for these fungi is in a phase of transition and many priorities of names are still to be resolved, this report uses the generally accepted names and provides alternatively used names as synonyms, where required. The department is also aware of the changes in nomenclature of arthropod species based on the latest morphological and molecular reviews. As official lists of accepted fungus and arthropod names become available, these accepted names will be adopted.

A detailed description of the method used for a pest risk analysis is provided in Appendix A.

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	**Potential for distribution**			
ARTHROPODS							
Coleoptera							
Araecerus fasciculatus (De Geer, 1775) Synonyms: *Araecerus coffeae* (Fabricius, 1801) *Anthribus coffeae* (Fabricius, 1801) [Anthribidae] Coffee bean weevil	Yes (Alba-Alejandre, Alba-Tercedor & Vega 2018)	Yes. NSW, NT, Qld, Vic. (recorded as *Araecerus coffeae*) (APPD 2022), WA (Government of Western Australia 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Aulacophora flavomarginata Duvivier, 1884 [Anthribidae] Pumpkin beetle	Yes (MARD 2016)	No records found	No. *Aulacophora flavomarginata* has been reported in Vietnam on the leaves of passionfruit plants (MARD 2016). Adults lay eggs in the soil and the hatching larvae burrow into the soil and feed primarily on plant roots. The adults feed on leaves, but may also cause damage to flowers and small fruits (Tsatsia & Jackson 2017). Adults are strong fliers and quickly disperse when disturbed (Tsatsia & Jackson 2017) and therefore are unlikely to	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			remain on the fruit during harvesting and packing house practices.				
Cassida obtusata Boheman, 1854 [Chrysomelidae] Leaf beetle	Yes (Borowiec & Świętojańska 2023)	No records found	No. *Cassida obtusata* has been reported to feed on the leaves of *Passiflora edulis* (Okinawa Prefectural Plant Protection Center 2016; Shigetoh & Souma 2019). Eggs of this genus are laid on leaves (Chaboo 2007; Tsatsia & Jackson 2020).	Assessment not required	Assessment not required	Assessment not required	No
Hypomeces squamosus (Fabricius, 1792) [Curculionidae]	Yes (PPD 2009)	No records found	No. *Hypomeces squamosus* is associated with passionfruit (Zhang et al. 2022), however, adults feed on the leaves and larvae feed on the roots of host plants (Ong & Farid 2017; Thu et al. 2010).	Assessment not required	Assessment not required	Assessment not required	No
Phyllotreta striolata (Fabricius, 1803) [Chrysomelidae] Cabbage flea beetle	Yes (MARD 2016)	No records found	No. *Phyllotreta striolata* has been reported in Vietnam on the leaves of passionfruit (MARD 2016). Adults feed on the leaves and larvae feed on the roots of host plants, primarily	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			crucifers (Mason, Alford & Kuhar 2020).				
Xylosandrus compactus (Eichhoff, 1875) [Bostrichidae] Shot-hole borer	Yes (Waterhouse 1993)	No records found	No. Eggs, larvae and adults are reported only on twigs and branches of hosts, including passionfruit (Dixon & Woodruff 2021)	Assessment not required	Assessment not required	Assessment not required	No
Diptera							
Bactrocera dorsalis (Hendel, 1912) Synonyms: *Bactrocera invadens* (Drew, Tsuruta & White, 2005), *B. papayae* Drew & Hancock, 1994 and *B. philippinensis* Drew & Hancock, 1994 have been synonymised with *B. dorsalis* (Schutze et al. 2014; Schutze et al. 2015). [Tephritidae] Oriental fruit fly	Yes (Drew & Hancock 1994; Drew & Romig 2013; Thuy 1998; Thuy, Duc & Vu 2000)	Absent: pest eradicated (Hancock et al. 2000)	Yes. *Passiflora edulis* is described as either a field host (Steiner 1955; Vargas et al. 2007; Vargas et al. 2012) or a conditional host (Moquet & Delatte 2021) for *B. dorsalis*. In a small field survey, no flies emerged from 105 ripe field-collected passionfruit; however, 10% of mature, intact fruit were infested by *B. dorsalis* under laboratory conditions (Moquet & Delatte 2021). Mature, infested fruits were visually indistinguishable from non-infested (control) samples over a test period of 14 days	Yes. *Bactrocera dorsalis* is highly polyphagous (McQuate & Liquido 2017) and suitable hosts are available in Australia. Passionfruit will be distributed across Australia for sale and could potentially carry fruit fly eggs and larvae. At temperatures between 20-25°C, *B. dorsalis* is able to complete development from egg to pupa in less than 10 days (Michel et al. 2021), which is within the expected shelf life of whole	Yes. This highly polyphagous species can infest more than 470 individual plant taxa across 78 plant families (McQuate & Liquido 2017). Since 1990, *B. dorsalis* has spread to a further 70 countries (Zeng et al. 2018). It is distributed across sub-Saharan Africa, Asia and several islands in Oceania including Papua New Guinea and Hawaii (CABI	Yes. *Bactrocera dorsalis* is highly polyphagous and a major pest of avocado, citrus, and mango (CABI 2022; Follett, Haynes & Dominiak 2021), all of which are grown commercially in Australia, and are of economic importance. A detection of Oriental fruit fly (then known as papaya fruit fly) near Cairns in	Yes (EP)

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
			(Moquet & Delatte 2021), indicating potential for import of passionfruit infested by *B. dorsalis*.	passionfruit (10-23 days) (Yumbya et al. 2014). Viable immature stages that could potentially be present in imported passionfruit could pupate, develop into adults, and disperse to new hosts available in Australia.	2023b; Vargas, Piñero & Leblanc 2015; White & Elson-Harris 1992), which have similar climates to parts of Australia. Its host range and geographic distribution suggest that *B. dorsalis* could establish and spread in Australia.	1995 cost $33.5 million and took nearly 4 years to eradicate. The estimated cost to industry at that time was $100 million (Cantrell, Chadwick & Cahill 2002).	
Bactrocera latifrons (Hendel, 1915) Synonyms: *Chaetodacus antennalis* Shiraki, 1933; *Chaetodacus latifrons* Hendel, 1915; *Dacus parvulus* Hendel, 1912 [Tephritidae] Solanum fruit fly	Yes (Drew & Romig 2013; Thuy 1998)	No records found	No. *Bactrocera latifrons* is a polyphagous species that predominantly infests fruits of the families Solanaceae and Cucurbitaceae (McQuate & Liquido 2013). The family Passifloraceae is reported as a host for *B. latifrons* (McQuate & Liquido 2013, 2017; PHA 2018). However, only 2 records of infestation have been found: *B. latifrons* is reported in 2 samples of *Passiflora foetida* in a survey of fruit flies in	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			southeast Asia (Allwood et al. 1999), and an interception of viable larvae in *Passiflora* sp. occurred at Hawaii airport (McQuate & Liquido 2013). No record was found in the literature of *B. latifrons* infesting *Passiflora edulis*.				
Liriomyza huidobrensis (Blanchard, 1926) [Agromyzidae] Serpentine leaf miner	Yes (Andersen, Tran & Nordhus 2008; Weintraub et al. 2017)	Yes. Under official control (Regional) for WA (IPPC 2021a). Present in NSW, Qld (IPPC 2021a), Vic (Agriculture Victoria 2022).	No. Although *L. huidobrensis* is associated with passionfruit (Kahinga, Gichuki & Waiganjo 2017), it is a leaf miner; larvae feed and develop in the leaves of the host plant (Weintraub et al. 2017). Fruit is not considered a pathway for spread of leafminers; harvesting and packing house practices will remove any adults on fruit and remove leaf material that could be infested (Plant Health Australia 2022).	Assessment not required	Assessment not required	Assessment not required	No
Liriomyza sativae Blanchard, 1938	Yes (Andersen, Tran & Nordhus 2008;	Yes. Under official control (National). Present with	No. Although *L. sativae* is associated with passionfruit (Mujica et	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
[Agromyzidae] Vegetable leaf miner	Hofsvang et al. 2005; Mujica et al. 2016)	restricted distribution in Qld (IPPC 2017).	al. 2016), it is a leaf miner; larvae feed and develop in the leaves of the host plant (Mujica et al. 2016). Fruit is not considered a pathway for spread of leafminers; harvesting and packing house practices will remove adults and remove leaf material that could be infested (Burgess, Ridland & Pirtle 2020).				
Zeugodacus cucurbitae (Coquillett, 1899) Synonym: *Bactrocera cucurbitae* (Coquillett, 1899) [Tephritidae] Melon fly	Yes (Drew & Romig 2013; Thuy 1998; Thuy, Duc & Vu 2000)	No records found	Yes. *Passiflora edulis* is a host for *Z. cucurbitae* (Aye & Thaung 2002; Steiner 1955; Tsuruta et al. 1997). *Zeugodacus cucurbitae* generally oviposits into immature fruit with a tender rind, but may also oviposit into more developed fruit (Akamine et al. 1974). Small, undeveloped infested fruit tend to shrivel and drop from the vine whereas more developed fruit may continue to maturity, with scarring developing	Yes. *Zeugodacus cucurbitae* is polyphagous (Dhillon et al. 2005) and suitable hosts are available in Australia. Passionfruit will be distributed across Australia for sale and could potentially carry fruit fly eggs and larvae. Viable immature stages that could potentially be present in imported passionfruit could pupate, develop into adults, and disperse	Yes. *Zeugodacus cucurbitae* has spread from its native range of India through southeastern and east Asia (Weems, Heppner & Fasulo 2018) to many Pacific Islands, including Hawaii, and to Africa (De Meyer et al. 2015). Some of these areas have similar climates to parts of Australia. In some regions there have been	Yes. *Zeugodacus cucurbitae* damages over 81 plant species (Dhillon et al. 2005). It is a major pest of cucurbitaceous crops, which are commercial crops of economic importance for Australia. *Zeugodacus cucurbitae* may cause up to 100% damage depending upon	Yes (EP)

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			at oviposition sites (Akamine et al. 1974).	to new hosts available in Australia.	multiple introductions, eradications and subsequent re-introductions (Kakinohana et al. 1997; Mitchell 1980; Wong et al. 1989). Its wide host range (predominantly cucurbits) (Allwood et al. 1999) and geographic distribution suggest that *Z. cucurbitae* could establish and spread in Australia.	the cucurbit species and the season (Dhillon et al. 2005).	
Zeugodacus tau (Walker, 1849) Synonym: *Dacus hageni* Meijere, 1911 [Tephritidae] Pumpkin fruit fly	Yes (Drew & Romig 2013; Shi, Kerdelhué & Ye 2014; Thuy 1998; Thuy, Duc & Vu 2000)	No records found	Yes. The fruit of *Passiflora edulis* is a host for *Z. tau* (Hasyim, Muryati & de Kogel 2008). Adult females lay eggs under the skin of fruit; emerging larvae feed on the flesh, causing fruit to rot and drop (Li et al. 2020).	Yes. *Zeugodacus tau* is polyphagous (Ahmad & Vasudha 2019) and suitable hosts are available in Australia. Passionfruit will be distributed across Australia for sale and could potentially carry fruit fly eggs and larvae. Viable	Yes. *Zeugodacus tau* was first described from southeastern China. and has since spread throughout tropical and subtropical Asia and the South Pacific region (Shi, Kerdelhué & Ye	Yes. *Zeugodacus tau* has been reported to infest 62 plant species across more than 20 families (Ahmad & Vasudha 2019), including several crop species	Yes (EP)

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
				immature stages that could potentially be present in imported passionfruit could pupate and develop into adults and disperse to new hosts available in Australia.	2014). Some of these regions have similar climates to parts of Australia. Its wide host range (predominantly cucurbits) (Allwood et al. 1999) and geographic distribution suggest that *Z. tau* could establish and spread in Australia.	(predominantly cucurbits), which are commercial crops of economic importance for Australia. Fruit loss caused by *Z. tau* in agricultural crops is estimated to be as high as 40% of production (Hasyim, Muryati & de Kogel 2008; Jaleel, Lu & He 2018). Like *Z. cucurbitae, Z. tau* is considered an economically important pest, based on similarities in host range and population growth capacity (Yang, Carey & Dowell 1994).	
Hemiptera							

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Aonidiella aurantii (Maskell, 1879) [Diaspididae] California red scale	Yes (García Morales et al. 2022)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Aleurocanthus woglumi Ashby, 1915 [Aleyrodidae]	Yes (CABI 2022; MARD 2016)	No records found	No. *Aleurocanthus woglumi* is associated with *Passiflora edulis* (Dietz & Zetek 1920) and has been reported in Vietnam on the leaves and stems (MARD 2016). Adults lay eggs on the undersides of leaves (Nguyen, Hamon & Fasulo 2010) and nymphs feed on leaves throughout their development (Enkerlin 1976). Adult whiteflies are very active and easily disturbed, and therefore are unlikely to remain on the fruit during harvesting and packing house practices. However, if any life stages are present on harvested fruit, they would likely be removed during packing house processes such as brushing and washing.	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	**Potential for distribution**			
Aphis craccivora Koch, 1854 [Aphididae] Cowpea aphid	Yes (Waterhouse 1993)	Yes. NSW, Qld, SA, Vic., WA (ALA 2022; APPD 2022). As a potential vector of the potyviruses *East Asian Passiflora virus, Passiflora mottle virus* and *Telosma mosaic virus* (which are not known to occur in Australia but are present in Vietnam) (Do et al. 2021; Gadhave et al. 2020c; Ha et al. 2008a), the potential for *A. craccivora* to enter on the pathway needs to be assessed.	No. *Aphis craccivora* is associated with passionfruit (Garcêz et al. 2015; Nantale et al. 2014). Aphids feed on phloem of leaves, stems (Capinera 2018; Nalam et al. 2021), buds or roots (Mahr 2022) of plants. *Aphis craccivora* is unlikely to feed on mature fruit. However, if any life stages are present on harvested fruit, they would likely be removed during packing house processes such as brushing and washing.	Assessment not required	Assessment not required	Assessment not required	No
Aphis fabae Scopoli, 1763 Synonyms: *Anuraphis cynariella*; *Aphis abietaria*; *Aphis acanthi* [Aphididae] Black bean aphid; Bean aphid	Yes (PPD 2021)	No records found	No. *Aphis fabae* has been reported as a pest of *Passiflora edulis* (PPD 2021). Aphids feed on phloem of leaves, stems (Capinera 2018; Nalam et al. 2021), buds or roots (Mahr 2022) of plants. They are unlikely to feed on mature fruit. However, if any life stages are present on harvested fruit, they would likely be removed	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
			during packing house processes such as brushing and washing.				
Aphis gossypii Glover, 1877 [Aphididae] Cotton aphid	Yes (MARD 2016)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022). As a potential vector of the potyviruses *East Asian Passiflora virus, Passiflora mottle virus* and *Telosma mosaic virus (*which are not known to occur in Australia but are present in Vietnam) (Do et al. 2021; Gadhave et al. 2020c; Ha et al. 2008a), the potential for *A. gossypii* to enter on the pathway needs to be assessed.	No. *Aphis gossypii* has been reported in Vietnam on the leaves of passionfruit (MARD 2016). Aphids feed on phloem of leaves, stems (Capinera 2018; Nalam et al. 2021), buds or roots (Mahr 2022) of plants. They are unlikely to feed on mature fruit. However, if any life stages are present on harvested fruit, they would likely be removed during packing house processes such as brushing and washing.	Assessment not required	Assessment not required	Assessment not required	No
Aphis spiraecola Patch*,* 1914 [Aphididae] Spirea aphid	Yes (MARD 2016)	Yes. NSW, Qld, SA, Tas., Vic., WA (APPD 2022). As a potential vector of the potyviruses *East Asian Passiflora virus, Passiflora mottle virus* and *Telosma mosaic virus* (which are not known to occur in Australia but are present in Vietnam) (Do et al. 2021; Gadhave et al.	No. *Aphis spiraecola* has been reported in Vietnam on the young leaves of passionfruit (MARD 2016). Aphids feed on phloem of leaves, stems (Capinera 2018; Nalam et al. 2021), buds or roots (Mahr 2022) of plants. They are unlikely to feed on mature fruit.	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
		2020c; Ha et al. 2008a), the potential for *A. spiraecola* to enter on the pathway needs to be assessed.	However, if any life stages are present on harvested fruit, they would likely be removed during packing house processes such as brushing and washing.				
Aspidiotus destructor Signoret, 1869 [Diaspididae] Coconut scale	Yes (García Morales et al. 2022)	Yes. NSW, NT, Qld, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Aspidiotus nerii Bouche, 1833 [Diaspididae] Oleander scale	Yes (García Morales et al. 2022)	Yes. NSW, NT, Qld, SA, Vic., WA (ABRS 2022; APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Bemisia tabaci species complex Gennadius, 1889 Synonym: *Bemisia argentifolii* Bellows, Perring, Gill & Hendrick, 1994 [Aleyrodidae] Silverleaf whitefly Tobacco whitefly	Yes (Götz & Winter 2016)	Yes, but only some members of the complex. At least three species (AUS1, AUS II and MEAM 1) are known to be present in Australia. Most species in the complex remain absent from Australia. The *B. tabaci* complex is a known vector for begomoviruses, several of which are quarantine pests of concern for Australia (Fiallo-Olivé et al. 2020). Therefore, the *B. tabaci*	No. *Passiflora edulis* is a host for *B. tabaci* (Li et al. 2011). *Bemisia tabaci* feeds on leaves and stems (Gangwar & Gangwar 2018) of host plants. The species is unlikely to feed on mature fruit. However, if present on harvested fruit, it would likely be removed during packing house processes such as brushing and washing. In addition, adult whiteflies are very	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
		complex, including those known to be present in Australia, are regulated articles for Australia.	active and easily disturbed, and therefore are unlikely to remain on harvested fruit.				
Chrysomphalus dictyospermi (Morgan, 1889) [Diaspididae] Dictyospermum scale	Yes (García Morales et al. 2022)	Yes. Under official control (Regional) for WA (Government of Western Australia 2022). Present in NSW, NT, Qld (APPD 2022).	*Yes. Chrysomphalus dictyospermi* is polyphagous and has been reported as a pest of *Passiflora* spp. (Miller & Davidson 2005; Watson 2022). *Chrysomphalus dictyospermi* feeds on the upper surface of leaves and can also infest the underside of leaves, branches and fruit (Miller & Davidson 2005; Watson 2022).	*Yes. Chrysomphalus dictyospermi* is polyphagous (Miller & Davidson 2005; Watson 2022) and suitable hosts are available in Australia. Imported passionfruit will be distributed across Western Australia for sale and could potentially carry *C. dictyospermi*. *Chrysomphalus dictyospermi* present on discarded passionfruit fruit waste could potentially disperse to a new host within close proximity.	Yes. Assessed in the scale group PRA (DAWE 2021)	Yes. Assessed in the scale group PRA (DAWE 2021)	Yes (GP)
Coccus hesperidum Linnaeus, 1758 Synonym: *Coccus patellaeformi* Curtis, 1843 [Coccidae]	Yes (García Morales et al. 2022; PPD 2010a)	Yes. ACT, NSW, NT, Qld, SA, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Brown soft scale							
Hyperomyzus lactucae (Linnaeus, 1758) [Aphididae] Currant-lettuce aphid; Sowthistle aphid; Currant-sowthistle aphid	Yes (PPD 2021)	Yes. ACT, NSW, Qld, SA, Tas., Vic., WA (Brumley 2020). As a potential vector of the potyvirus *East Asian Passiflora virus*, (which is not known to be present in Australia but is present in Vietnam) (Iwai et al. 2006; Omatsu et al. 2004; PPD 2021), the potential for *H. lactucae* to enter on the pathway needs to be assessed.	No. *Hyperomyzus lactucae* has been associated with passionfruit (Omatsu et al. 2004). Aphids feed on phloem of leaves, stems (Capinera 2018; Nalam et al. 2021), buds or roots (Mahr 2022) of plants. *Hyperomyzus lactucae* is unlikely to feed on mature fruit. However, if any life stages are present on harvested fruit, they would likely be removed during packing house processes such as brushing and washing.	Assessment not required	Assessment not required	Assessment not required	No
Icerya purchasi Maskell,1879 [Monophlebidae] Cottony cushion scale	Yes (García Morales et al. 2022)	Yes. NSW, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Leptoglossus gonagra (Fabricius, 1775) Synonym: *Leptoglossus australis* Fabricius, 1775 [Coreidae]	Yes (PPD 2010b)	Yes. NSW, NT, Qld, WA (ABRS 2022; Government of Western Australia 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Passionvine bug							
Maconellicoccus hirsutus (Green, 1908) Synonyms: *Phenacoccus hirsutus* Green, 1908; *Phenacoccus glomeratus* Green, 1922 [Pseudococcidae] Grape mealybug	Yes (García Morales et al. 2022)	Yes. NT, Qld, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Macrosiphum euphorbiae (Thomas, 1878) [Aphididae] Potato aphid	Yes (Kim et al. 2016)	Yes. NSW, NT, Qld, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Megymenum brevicorne (Fabricius, 1787) Synonym: *Cimex brevicornis* Fabricius, 1787 [Dinidoridae] Shield bug	Yes (Waterhouse 1993)	No records found	No. *Megymenum brevicorne* has been reported to feed on *Passiflora quadrangularis* (Miller 1929). This pest feeds on stems and fruit of host plants. Eggs are laid in chains on leaves and stems of host plants (Miller 1929). Shield bug nymphs and adults are easily disturbed and are highly unlikely to be	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			found on commercially produced and processed passionfruit as they will not remain on fruit during the harvest, sorting and packing processes.				
Myzus persicae (Sulzer, 1776) Synonym: *Myzus* (*Nectarosiphon*) *persicae* (Sulzer, 1776) [Aphididae] Green peach aphid	Yes (Waterhouse 1993)	Yes. NSW, NT, Qld, Tas., Vic., WA (APPD 2022). As a potential vector of the potyviruses, *East Asian Passiflora virus, Passiflora mottle virus* and *Telosma mosaic virus* (which are not known to occur in Australia but are present in Vietnam) (Do et al. 2021; Gadhave et al. 2020c; Ha et al. 2008a), the potential for *M. persicae* to enter on the pathway needs to be assessed.	No. *Passiflora edulis* is a host for *Myzus persicae* (Joy & Sherin 2016). Aphids feed on phloem of leaves, stems (Capinera 2018; Nalam et al. 2021), buds or roots (Mahr 2022) of plants. They are unlikely to feed on mature fruit. However, if any life stages are present on harvested fruit, they would likely be removed during packing house processes such as brushing and washing.	Assessment not required	Assessment not required	Assessment not required	No
Nezara viridula (Linnaeus, 1758) [Pentatomidae] Green vegetable bug	Yes (Lam, Lam & Lan 2015; Waterhouse 1993)	Yes. ACT, NSW, Qld, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Parasaissetia nigra (Nietner, 1861)	Yes (García Morales et al. 2022)	Yes. NSW, NT, Qld, SA, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Synonym: *Lecanium nigrum* Nietner, 1861 [Coccidae] Pomegranate scale							
Parlatoria proteus (Curtis, 1843) Synonym: *Parlatoria selenipedii* Signoret, 1869 [Diaspididae] Orchid parlatoria scale	Yes (García Morales et al. 2022)	Yes. NSW, NT, Qld, SA, WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Phenacoccus solenopsis (Tinsley, 1898) [Pseudococcidae] Solenopsis mealybug	Yes (García Morales et al. 2022)	Yes. Qld, NT, WA (APPD 2023; Government of Western Australia 2023)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Pinnaspis strachani (Cooley, 1899) Synonym: *Pinnaspis temporaria* Ferris, 1942 [Diaspididae] Cotton white scale	Yes (García Morales et al. 2022)	Yes. NSW, NT, Qld, WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Planococcus citri (Risso, 1813) [Pseudococcidae] Citrus mealybug	Yes (García Morales et al. 2022)	Yes. ACT, NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Planococcus minor Maskell, 1897 Synonym: *Planococcus pacificus* Cox, 1981 [Pseudococcidae] Pacific mealybug	Yes (García Morales et al. 2022)	Yes. Under official control (Regional) for WA (Government of Western Australia 2022). Present in NSW, NT, Qld, SA, Vic. (APPD 2022).	Yes. *Planococcus minor* has been reported on *Passiflora* spp. (Roda et al. 2013; Williams & Watson 1988). This species has been intercepted via trade of many commodities (Venette & Davis 2004) and could be present on imported fresh passionfruit.	Yes. *Planococcus minor* is polyphagous (DAWR 2019a) and suitable hosts are available in Australia. Imported passionfruit will be distributed across Western Australia for sale and could potentially carry *P. minor. Planococcus minor* present on discarded passionfruit fruit waste could potentially disperse to a new host within close proximity.	Yes. Assessed in the mealybug Group PRA (DAWR 2019a)	Yes. Assessed in the mealybug Group PRA (DAWR 2019a)	Yes (GP)
Plautia affinis (Dallas, 1851) [Pentatomidae] Green Stink Bug	Yes (MARD 2016)	Yes. NSW, NT, Qld, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Pseudococcus longispinus (Targioni Tozzetti, 1867) Synonym: *Dactylopius longispinus* (Targioni Tozzetti, 1867) [Pseudococcidae] Longtailed mealybug	Yes (García Morales et al. 2022)	Yes. ACT, NSW, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Pseudaulacaspis pentagona (Targioni Tozzetti, 1886) [Diaspididae] Mulberry scale	Yes (García Morales et al. 2022; Suh 2015)	Yes. Under official control (Regional) for WA (Government of Western Australia 2022). Present in NSW, Qld (APPD 2022).	Yes. *Pseudaulacaspis pentagona* is a pest of *Passiflora edulis* (Crause 1990). This pest is found mainly on stems and fruits, and occasionally on leaves and roots, affecting host plants during the seedling, vegetative, flowering and fruiting stages (Watson 2022).	Yes. *Pseudaulacaspis pentagona* is polyphagous (DAWE 2021) and suitable hosts are available in Australia. Imported passionfruit will be distributed across Western Australia for sale and could potentially carry *P. pentagona. Pseudaulacaspis pentagona* present on discarded passionfruit fruit waste could potentially disperse to a new host within close proximity.	Yes. Assessed in the scale Group PRA (DAWE 2021)	Yes. Assessed in the scale Group PRA (DAWE 2021)	Yes (GP)
Rastrococcus invadens Williams, 1986 [Pseudococcidae] Mango mealybug	Yes (García Morales et al. 2022; PPD 2009; Williams 2004)	No records found	No. Although the genus *Passiflora* has been reported as a host for *R. invadens* (García Morales et al. 2022; Nébié et al. 2018), no records were found for *Passiflora edulis* as a host for the species. *Rastrococcus invadens* remains a quarantine pest for Australia. Should *R. invadens* be	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			detected on the passionfruit from Vietnam, it would require remedial action and may trigger a re-assessment for this species on this pathway. Similarly, a re-assessment would also be required for *R. invadens* if evidence becomes available that *Passiflora edulis* is a host.				
Saissetia coffeae (Walker, 1852) Synonym: *Chermes anthurii* Boisduval, 1867 [Coccidae] Hemispherical scale	Yes (García Morales et al. 2022)	Yes. ACT, NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Selenaspidus articulatus (Morgan, 1889) [Diaspididae] West Indian red scale	Yes (Suh 2016)	Absent: pest records (Mamet 1958) are considered invalid.	*Yes. Selenaspidus articulatus* is polyphagous (Martins et al. 2022) and has been reported as a pest of *Passiflora edulis* (Carlos & Bartra 1974). It can be found on both sides of leaves, with a preference for upper leaf surfaces, and occasionally on	*Yes. Selenaspidus articulatus* is polyphagous (Martins et al. 2022) and suitable hosts are available in Australia. Imported passionfruit will be distributed across Australia for sale and could potentially	Yes. Assessed in the scale group PRA (DAWE 2021).	Yes. Assessed in the scale group PRA (DAWE 2021).	Yes (GP)

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	**Potential for distribution**			
			fruits and pods of host plants (Watson 2022).	carry *S. articulatus. Selenaspidus articulatus* present on discarded passionfruit fruit waste could potentially disperse to a new host within close proximity.			
Toxoptera aurantii (Boyer de Fonscolombe, 1841) [Aphididae] Black citrus aphid	Yes (Nguyen et al. 2019)	Yes. NSW, NT, Qld, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Toxoptera citricida (Kirkaldy, 1907) Synonym: *Toxoptera citricidus* (Kirkaldy, 1907) [Aphididae] Black citrus aphid	Yes (EPPO 1994)	Yes. NSW, Qld, SA, Tas., Vic., WA (ABRS 2022; APPD 2022; Hollis & Eastop 2005)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Lepidoptera							
Acraea terpsicore (Linnaeus, 1758) [Nymphalidae]	Yes (Inayoshi 2023; Pierre & Bernaud 1997)	Yes. NT, Qld, WA (Chowdhury et al. 2021)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Chrysodeixis eriosoma (Doubleday, 1843)	Yes (Waterhouse 1993)	Yes. NSW, NT, Qld, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
[Noctuidae] Green looper							
Eudocima fullonia Clerck, 1874 [Noctuidae] Fruit-piercing moth	Yes (MARD 2016)	Yes. NSW, NT Qld, Vic., WA (ALA 2023; APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Euproctis scintillans Walker, 1856 Synonyms: *Somena scintillans* Walker 1856; *Porthesia scintillans* Walker 1856 [Lymantriidae]	Yes (Waterhouse 1993)	No records found	No. Larvae feed on the leaves of *P. edulis* (Hill 2008).	Assessment not required	Assessment not required	Assessment not required	No
Spodoptera frugiperda (Smith and Abbot, 1797) Synonym: *Phalaena frugiperda* (Smith, 1797) [Noctuidae] Fall armyworm	Yes (Dao et al. 2020)	Yes. NSW, NT, Qld, Tas., Vic., WA (IPPC 2021b)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Tiracola plagiata (Walker, 1870) [Noctuidae]	Yes (Hong & Sen 2018)	Yes. NSW, Qld, WA (ALA 2023; APPD 2023)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Zeuzera coffeae Nietner, 1861	Yes (Thu et al. 2010)	No records found	No. *Zeuzera coffeae* is a polyphagous pest that has been reported on	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Synonym: *Zeuzera roricyanea* Walker, 1862 [Cossidae] Coffee carpenter			*Passiflora edulis* in Asia (Waterhouse 1993). *Zeuzera coffeae* damages the plant stem. Adults lay eggs on the stem; larvae burrow inside the stem and excavate tunnels, before pupating in tunnels (Mannakkara 2006; Thu et al. 2010).				
Thysanoptera							
Frankliniella schultzei species complex (Trybom, 1910) [Thripidae] Cotton thrips Tomato thrips	Yes (Poushkova & Kasatkin 2020). There are at least 8 species in the complex globally (De Oliveira, Bitencourt & Silva Junior 2023), but it is not clear which of these species are present in Vietnam.	Yes. ACT, NSW, NT, Qld, SA, Vic., WA (ALA 2023; Mound & Tree 2012), but only 3 species of the *F. schultzei* complex are present in Australia (De Oliveira, Bitencourt & Silva Junior 2023; Hereward et al. 2017). The *F. schultzei* complex is a known vector for orthotospoviruses, of which some are quarantine pests of concern for Australia (PHA & NGIA 2011). Therefore, the *F. schultzei* species complex, including those species in the complex known to be present in Australia, are	Yes. *Frankliniella schultzei* species complex is a polyphagous pest, causing damage to flowers (Milne & Walter 2000), leaves and young fruit (PHA & NGIA 2011). The species has been reported to feed on *P. edulis*, and eggs have been reported to be laid under the skin of the fruit in Australia (DAF 2023, *pers. comm.*). *Frankliniella schultzei* species complex is routinely intercepted on horticultural products at the Australian border (DAWR 2017a).	Yes. Passionfruit will be distributed throughout Australia for sale and could potentially carry thrips adults, eggs and larvae. *Frankliniella schultzei* species complex is polyphagous (CABI 2023a) and suitable hosts are available in Australia. Adults, as well as viable immature stages, could potentially be present on imported passionfruit, and could disperse to	Yes. Given the *F. schultzei* species complex is considered a quarantine pest, results of the thrips Group PRA, which are applicable to all quarantine pest thrips, are applied to this species complex. (DAWR 2017a).	Yes. Given the *F. schultzei* species complex is considered a quarantine pest, results of the thrips Group PRA, which are applicable to all quarantine pest thrips, are applied to this species complex (DAWR 2017a).	Yes (GP)

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
		regulated articles for Australia.		new hosts available in Australia.			
Haplothrips gowdeyi (Franklin, 1908) Synonym*:* *Anthothrips gowdeyi* (Franklin, 1908) [Phlaeothripidae] Gold-tipped tubular thrips	Yes (MARD 2016)	Yes. NSW, NT, Qld, WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Heliothrips haemorrhoidalis (Bouché, 1833) [Thripidae] Greenhouse thrips	Yes (Waterhouse 1993)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Scirtothrips dorsalis Hood, 1919 [Thripidae] Synonym: *Scirtothrips padmae* Ramakrishna 1942 Oriental tea thrips Chilli thrips	Yes (PPD 2017)	Yes. NSW, NT, Qld, WA (APPD 2022). *Scirtothrips dorsalis* was previously assessed in the thrips Group PRA as a vector of quarantine orthotospoviruses. Therefore, it is a regulated article for Australia (DAWR 2017a).	Yes. *Scirtothrips dorsalis* has been reported as a pest of *Passiflora edulis* (Greenlife Industry Australia 2021; NPDN 2022). It usually feeds externally on leaves and flowers of host plants. However, fruit may also be damaged with scars and deformities due to feeding injury (CABI 2022). *Scirtothrips* spp. are routinely intercepted on	Yes. *Scirtothrips dorsalis* has a wide host range including crop plants and ornamentals (CABI 2022), and many hosts are available in Australia. Imported passionfruit will be distributed across Australia for sale and could potentially carry *S. dorsalis. Scirtothrips dorsalis* present on discarded	Not applicable to vector. However, the emerging quarantine ortho-tospoviruses vectored by this thrips have potential for establishment and spread (DAWR 2017a).	Not applicable to vector. However, the emerging quarantine ortho-tospoviruses vectored by this thrips have potential for consequences (DAWR 2017a).	Yes (GP, RA)

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	**Potential for distribution**			
			horticultural products at the Australian border (DAWR 2017a).	passionfruit fruit waste could potentially disperse to a new host within close proximity.			
Thrips hawaiiensis (Morgan, 1913) Hawaiian flower thrips Synonym: *Euthrips hawaiiensis* (Morgan, 1913) [Thripidae] Hawaiian flower thrips	Yes (MARD 2016)	Yes. NSW, NT, Qld, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Thrips palmi (Karny, 1925) Synonyms: *Thrips clarus* (Moulton, 1928); *Thrips gossypicola* (Priesner, 1939) [Thripidae] Melon thrips	Yes (Hung 2009)	Yes. Under official control (Regional) for SA (PIRSA 2022) and WA (Government of Western Australia 2022). Present in NSW, NT and Qld (APPD 2022).	Yes. Bermudez (2014) listed *P. edulis* as a host of *T. palmi*. It usually feeds externally on leaves and flowers of host plants. However, *T. palmi* is routinely intercepted on horticultural products at the Australian border (DAWR 2017a).	Yes. *Thrips palmi* is a polyphagous species that attacks many hosts in the Cucurbitaceae, Solanaceae and Fabaceae families (CABI 2022; Young & Zhang 1998), and many hosts are available in Australia. Imported passionfruit will be distributed across South Australia and Western Australia	Yes. Assessed in the thrips Group PRA (DAWR 2017a)	Yes. Assessed in the thrips Group PRA (DAWR 2017a)	Yes (GP)

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
				for sale and could potentially carry *T. palmi. Thrips palmi* present on discarded passionfruit fruit waste could potentially disperse to a new host within close proximity.			
Trombidiformes							
Brevipalpus phoenicis species complex (Geijskes, 1939) [Tenuipalpidae] False spider mite	Yes (PPD 2010; Zhang 2021). There are at least 8 species in the complex (Beard et al. 2015), but it is not clear which of these species are present in Vietnam.	Yes. NSW, NT, SA, Qld, Vic., WA (APPD 2023; Womersley 1940), but only 2 species (*B. papayensis* and *B. yothersi*) are considered present (Beard et al. 2015).	Yes. *Brevipalpus phoenicis* is a polyphagous pest causing damage to leaves (Gupta 1985; Hill 2008) and fruit (Haramoto 1966; Vacante 2010). *Passiflora edulis* is a host (Childers, Rodrigues & Webourn 2003; Haramoto 1966; Kitajima, Rezende & Rodrigues 2003; Womersley 1940). *Brevipalpus* species are routinely intercepted on horticultural products at the Australian border.	Yes. Passionfruit will be distributed throughout Australia for sale and could potentially carry mite adults, eggs, larvae and nymphs. *Brevipalpus phoenicis* is polyphagous (Childers, Rodrigues & Webourn 2003; UH-CTAHR Department of Entomology & Hawaii Department of Agriculture 2023) and suitable hosts are available in Australia. Adults, as well as viable immature stages, could potentially be present on imported	Yes. *Brevipalpus phoenicis* reproduces asexually via parthenogenesis and so individuals may reproduce readily on reaching a suitable host and establish if conditions are favourable. The species is polyphagous, which would facilitate natural spread, although the rate of spread would be slow due to its limited mobility. The pest	Yes. *Brevipalpus phoenicis* has been reported as a pest of a range of economically important crops, including citrus, passionfruit, stone fruit and grapes (Childers, Rodrigues & Webourn 2003; Hill 2008), which are grown commercially in Australia. Infestations can lead to reduced fruit	Yes

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
				passionfruit, and could disperse to new hosts available in Australia for feeding and oviposition (UH-CTAHR Department of Entomology & Hawaii Department of Agriculture 2023), although their capacity for dispersal is limited.	could more rapidly spread to new regions via movement of infested plants or plant material.	production, damage to fruit and, in extreme cases, death of the host plant. This species can also vector viruses, including citrus leprosis viruses and passionfruit green spot virus, which can cause significant crop losses (Rodrigues & Childers 2013). Although these viruses are not present in Vietnam or Australia, the presence of additional vectors may increase the potential for such viruses to become established if they were introduced.	

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Oligonychus coffeae (Nietner, 1861) [Tetranychidae] Tea red spider mite	Yes (Vacante 2016)	Yes. NSW, NT, Qld, WA (APPD 2022; Botha, Bennington & Poole 2014)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Panonychus citri (McGregor, 1916) [Tetranychidae] Citrus red mite	Yes (CABI 2022; Huyen et al. 2017)	Yes. Under official control (Regional) for WA (Government of Western Australia 2022). Present in NSW (NSW DPI 2017).	No. *Panonychus citri* has a wide host range of about 90 different species across 30 plant families (NSW DPI 2017). Although passionfruit is listed as a host for *P. citri* in some publications (NSW DPI 2017; Practical Action 2003), no evidence could be found indicating that *P. citri* is a pest of passionfruit in Vietnam or other countries.	Assessment not required	Assessment not required	Assessment not required	No
Polyphagotarsonemus latus (Banks, 1904) [Tarsonemidae] Broad mite	Yes (PPD 2010b)	Yes. NSW, NT, Qld, SA, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Tetranychus marianae McGregor, 1950 [Tetranychidae] Mariana mite	Yes (Migeon & Dorkeld 2022)	Yes. NT, Qld, WA (APPD 2022; Government of Western Australia 2022; Seeman & Beard 2011)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	**Potential for distribution**			
Tetranychus piercei McGregor, 1950 Synonym: *Tetranychus manihotis* Flechmann, 1981 [Tetranychidae]	Yes (Bolland, Gutierrez & Flechtmann 1998)	No records found	Yes. *Tetranychus piercei* has been reported as a pest of *Passiflora edulis* (Bolland, Gutierrez & Flechtmann 1998; Walter 2006). *Tetranychus* spp. are generally found on the leaves. However, at levels of high infestation they can also be found on fruit of hosts (Meck, Walgenbach & Kennedy 2012).	Yes. *Tetranychus piercei* is polyphagous (Bolland, Gutierrez & Flechtmann 1998) and suitable hosts of this mite are available in Australia. Imported passionfruit will be distributed across Australia for sale and could potentially carry *T. piercei. Tetranychus piercei* present on discarded passionfruit fruit waste could potentially disperse to a new host within close proximity (Kennedy & Smitley 1985).	Yes. This pest has the potential to establish and spread in Australia as suitable hosts and environments are available. *Tetranychus piercei* is polyphagous. Hosts include passionfruit, banana, peach, papaya, eggplant cassia and pandanus (Bolland, Gutierrez & Flechtmann 1998; Masaki 2001). Hosts of *T. piercei* are grown across Australia. This mite occurs in tropical and warm subtropical regions, and similar climates are found in some parts of Australia (Bolland, Gutierrez &	Yes. *Tetranychus piercei* is polyphagous with horticultural crop hosts including passionfruit, banana, peach, papaya and eggplant (Bolland, Gutierrez & Flechtmann 1998). *Tetranychus piercei* is reported as causing severe damage to bananas in southern China (Fu et al. 2002).	Yes

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
					Flechtmann 1998).		
Tetranychus urticae Koch, 1836 Synonym: *Tetranychus telarius* Linnaeus, 1758 [Tetranychidae] Two-spotted spider mite	Yes (Hinomoto et al. 2007; Migeon & Dorkeld 2022)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
BACTERIA							
Pseudomonas syringae pv. *passiflorae* (Reid 1938) Young et al. 1978 Synonym: *Pseudomonas passiflorae* (Reid 1938) Burkholder 1948 [Pseudomonadales: Pseudomonadaceae] Grease spot	Yes (Red Pine International 2019)	Yes. WA (Doepel 1965; Government of Western Australia 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Pseudomonas syringae pv. *syringae* van Hall 1902	Yes (Red Pine International 2019)	Yes. ACT, NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022; Government of Western Australia 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
[Pseudomonadales: Pseudomonadaceae]							
Ralstonia solanacearum (Smith 1896) Yabuuchi et al., 1995 [Burkholderiales: Burkholderiaceae] Bacterial wilt	Yes (Burgess et al. 2008)	Yes. NSW, NT, Qld, SA, Vic. (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
CHROMALVEOLATA							
Phytophthora cinnamomi Rands [Peronosporales: Peronosporaceae]	Yes (PPD 2010b)	Yes. ACT, NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Phytophthora drechsleri Tucker [Peronosporales: Peronosporaceae]	Yes (Jung et al. 2020)	Yes. NSW, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Phytophthora nicotianae Breda de Haan [Peronosporales: Peronosporaceae] Fruit Rot	Yes (MARD 2016)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Phytopythium vexans (de Bary) Abad, de Cock, Bala, Robideau, Lodhi & Lévesque	Yes (Thao et al. 2020)	Yes. NSW, Qld, Vic., WA (APPD 2022; Government of Western Australia 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Synonym: *Pythium vexans* de Bary [Peronosporales: Pythiaceae]							
Pythium aphanidermatum (Edson) Fitzp [Peronosporales: Pythiaceae] Damping-off	Yes (Luong et al. 2010)	Yes. NSW, NT, Qld, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Pythium irregulare Buisman [Peronosporales: Pythiaceae]	Yes. (EPPO 2022)	Yes. NSW, Qld, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
FUNGI							
Aspergillus flavus Link:Fr, [Eurotiales: Aspergillaceae]	Yes (Burgess & Burgess 2009)	Yes. NSW, Qld, Vic. (APPD 2023)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Aspergillus niger Tiegh. [Eurotiales: Trichocomaceae]	Yes (Burgess & Burgess 2009)	Yes. NSW, NT, Qld, SA, Vic., WA (APPD 2022; Government of Western Australia 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Alternaria alternata (Fr.) Keissl. [Pleosporales: Pleosporaceae]	Yes (Le et al. 2000; PPD 2010a)	Yes. ACT, NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Alternaria leaf spot							
Alternaria passiflorae J.H. Simmonds [Pleosporales: Pleosporaceae] Brown spot	Yes (National Agricultural Extension Center 2021)	Yes. NSW, Qld, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Athelia rolfsii (Curzi) C. C. Tu & Kimbr. Synonym: *Sclerotium rolfsii* Sacc. [Atheliales: Atheliaceae]	Yes (Le et al. 2012)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Botrytis cinerea Pers [Helotiales: Screotiniaceae] Grey mould	Yes (Danse et al. 2007)	Yes. NSW, Qld, SA, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Ceratocystis fimbriata (Ellis & Halst.) Sacc. [Microscales: Ceratocystidaceae]	Yes (Tran et al. 2019)	No. *Ceratocystis fimbriata* has several apparently host specialised strains known as 'types', 'races', or forms (Baker et al. 2003; Harrington 2000; Vogelzang & Scott 1990). *Ceratocystis fimbriata* isolates reported in Australia are all from *Syngonium* (APPD 2022).	No. There is only one report from Brazil of *C. fimbriata* causing fruit rot in passionfruit (Firmino et al. 2013). There are no other reports of *C. fimbriata* on *Passiflora edulis* or causing fruit rot in passionfruit in Vietnam. In a laboratory pathogenicity test, a	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
			fungal spore isolate of *C. fimbriata* from passionflower, injected into passionfruit, produced visible degradation of the outer fruit shell after 96 hours at 25°C (Firmino et al. 2016). Due to the visible symptoms and rapid degradation, diseased fruits are unlikely to be harvested, or are likely to be removed during the sorting and packing processes.				
Cladosporium cladosporioides (Fresen.) De Vries [Capnodiales: Cladosporiaceae] Black mould	Yes (Alexandrova et al. 2018)	Yes. ACT, NSW, NT Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Cladosporium herbarum (Pers.) Link [Capnodiales: Cladosporiaceae]	Yes (PPD 2010a)	Yes. NSW, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Cladosporium oxysporum Berk. & M.A. Curtis [Capnodiales: Cladosporiaceae]	Yes (Le et al. 2000)	Yes. NSW, NT, Qld, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Colletotrichum acutatum J.H. Simmonds [Glomerellales: Glomerellaceae] Anthracnose	Yes (Nguyen et al. 2010)	Yes. NSW, Qld, SA, Tas., Vic., WA (APPD 2023)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Colletotrichum boninense Moriwaki, Toy, Sato & Tsukib. [Glomerellales: Glomerellaceae]	Yes (Nguyen et al. 2010)	Yes. NSW, Qld (Plant Health Australia 2023; Shivas et al. 2016)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Colletotrichum gloeosporioides (Penz.) Penz. & Sacc. Synonym: *Glomerella cingulata* (Stoneman) Spauld & H Schrenk [Glomerellales: Glomerellaceae] Anthracnose	Yes (Nguyen et al. 2009)	Yes. NSW, NT, Qld, SA, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Colletotrichum karsti You L. Yang, Zuo Y. Liu, K.D. Hyde & L. Cai. [Glomerellales: Glomerellaceae] Anthracnose	Yes (Damm et al. 2012)	Yes. NSW, Qld, Vic. (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	**Potential for distribution**			
Colletotrichum plurivorum Damm, Alizadeh & Toy. Sato *Colletotrichum plurivorum* is part of the *C. orchidearum* species complex. [Glomerellales: Glomerellaceae]	Yes (Damm et al. 2019)	No records found	No. Only two published records were found of *C. plurivorum* on *Passiflora edulis*, one in Japan (Damm et al. 2019) and one in Brazil (Silva et al. 2022). In the Brazilian study, *C. plurivorum* isolated from leaves of *P. edulis* in the field and inoculated into perforated yellow passionfruit in the laboratory produced visible lesions within 7 days (Silva et al. 2022). The depressed, soggy, brown necrotic lesions and potential degradation of infected fruit are likely to be detected during commercial production and packing processes, resulting in infected fruit being discarded.	Assessment not required	Assessment not required	Assessment not required	No
Colletotrichum truncatum (Schwein.) Andrus & WD Moore Synonym: *Colletotrichum capsici*	Yes (PPD 2010a)	Yes. NSW, NT, Qld, WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
(Syd.) EJ Butler & Bisby [Glomerellales: Glomerellaceae] Anthracnose							
Corynespora cassiicola (Berk. & M. A. Curtis) Synonym: *Cercospora melonis* (Cooke) [Pleosporales: Corynesporascaceae]	Yes (CABI 2023a; Farr & Rossman 2022; Madriz-Ordeñana et al. 2019)	Yes. NSW, NT, Qld, Vic., WA (APPD 2023)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Curvularia australiensis (Bugnic. ex M. B. Ellis) Manamgoda, L. Cai & K. D. Hyde Synonyms: *Drechslera australiensis* Bugnic. ex M. B. Ellis *Bipolaris australiensis* (Bunic. ex Ellis) Tsuda & Ueyama [Pleosporales; Pleosporaceae]	Yes (Madrid et al. 2014)	Yes. NSW, Qld, Vic., WA (APPD 2023)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Curvularia lunata (Wakk.) Boedijin	Yes (Le et al. 2000)	Yes. ACT, NSW, NT, Qld, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
[Pleosporales: Pleosporaceae]							
Fusarium avenaceum (Fr.) Sacc. Synonym: *Gibberella avenacea* R.J. Cook [Hypocreales: Nectriaceae]	Yes (Red Pine International 2019)	Yes. NSW, NT, Qld, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Fusarium fujikuroi Nirenberg *F. fujikuroi* is part of a species complex Synonyms: *Gibberella fujikuroi* (Sawada) Wollenw. [Hypocreales: Nectriaceae]	Yes. As part of the *Gibberella fujikuroi* species complex on rice (Wulff et al. 2010)	Yes. Qld (Liew et al. 2016)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Fusarium graminearum Schwabe Synonyms: *Gibberella zeae* (Schwein.) Petch *Gibberella saubinetii* (Durieu & Mont.) Sacc. [Hypocreales: Nectriaceae]	Yes (Red Pine International 2019)	Yes. NSW, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Fusarium incarnatum (Desm.) Sacc. Synonyms: *Fusarium semitectum* Berk. & Ravenel; *Fusarium pallidoroseum* Cooke [Hypocreales: Nectriaceae]	Yes (Le et al. 2000)	Yes. NSW, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Fusarium lateritium Nees Synonym: *Gibberella baccata* (Wallr.) Sacc. [Hypocreales: Nectriaceae]	Yes (Le et al. 2000)	Yes. NSW, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Fusarium oxysporum Schltdl. [Hypocreales: Nectriaceae]	Yes (MARD 2016)	Yes. ACT, NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Fusarium proliferatum (Matsush.) Nirenberg [Hypocreales: Nectriaceae]	Yes (Phan et al. 2021)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Fusarium solani (Mart.) Sacc. [Hypocreales: Nectriaceae]	Yes (Thuy et al. 2013).	Yes. ACT, NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Lasiodiplodia theobromae (Pat) Griffon & Maubl. Synonym: *Botryosphaeria rhodina* (Berk. & M.A. Curtis) Arx [Botryosphaeriales: Botryosphaeriaceae]	Yes (MARD 2016)	Yes. NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Penicillium digitatum Sacc. Synonym: *Monilia digitata* Pers. [Eurotiales: Trichocomaceae]	Yes (Whittle 1992)	Yes. NSW, Qld, SA, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Penicillium italicum Wehmer [Eurotiales: Trichocomaceae] Blue mould	Yes (Whittle 1992)	Yes. NSW, Qld, SA, Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Rhizoctonia solani J.G. Kühn Synonym: *Thanatephorus cucumeris* (A.B. Frank) Donk [Cantharellales: Ceratobasidiaceae]	Yes (PPD 2010b)	Yes. ACT, NSW, NT, Qld, SA, Tas., Vic., WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Rhizopus stolonifer (Ehrenb.) Vuill. Synonym: *Mucor stolonifer* Ehrenb. [Mucorales: Mucoraceae]	Yes (Ngoc et al. 2018)	Yes. NSW, NT, Qld, Tas., Vic., WA (APPD 2022; Yuan et al. 2009)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Sclerotinia sclerotiorum (Lib.) de Bary Synonyms: *Hymenoscyphus sclerotiorum* (Lib.) W. Phillips; *Whetzelinia sclerotiorum* (Lib.) Korf & Dumont [Helotiales: Sclerotiniaceae]	Yes (Trinh et al. 2012)	Yes. NSW, Qld, SA, Tas., Vic., WA (Plant Health Australia 2021)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Septoria passifloricola Punith. Synonym: *Septoria passiflorae* Louw [Capnodiales: Mycosphaerellaceae]	Yes (Red Pine International 2019)	Yes. NSW, QLD, WA (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
PHYTOPLASMAS							
‘*Candidatus* Phytoplasma asteris’ Lee et al. 2004 [16SrI]	Yes (Hoat et al. 2015)	Absent: pest records invalid (EPPO 2022)	Yes. While no records have been found of ‘*Candidatus* Phytoplasma asteris’ on passionfruit in Vietnam,	No. As the end use is human consumption, most fruit, other than the skin, will be consumed. Most fruit	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
			passionfruit has been reported as a host for '*Candidatus* Phytoplasma asteris' (CABI Invasive Species Compendium 2021). Infected fruit may not show obvious symptoms and therefore may be packed and exported.	waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be discarded in the environment. Phytoplasmas may be transmitted by phloem-feeding leafhoppers, planthoppers and psyllids (Weintraub & Beanland 2006). Phloem-feeding leafhoppers, planthoppers and psyllids are unlikely to feed on discarded passionfruit waste. While there is evidence for seed transmission of *Candidatus* Phytoplasma asteris' in sandalwood (Kirdat et al. 2022), no records have been found for seed transmission of '*Candidatus* Phytoplasma asteris' in passionfruit.			

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
'*Candidatus* Phytoplasma aurantifolia' Zreik et al. 1995 [16SrII]	Yes (Hoat et al. 2015)	No. Specimens previously recorded as '*Candidatus* Phytoplasma aurantifolia' (Lee, Wylie & Jones 2010; Saqib et al. 2005a; Streten & Gibb 2006; Tairo, Jones & Valkonen 2006) were later considered to be misidentifications (Bertaccini et al. 2022; Rodrigues Jardim et al. 2023).	Yes. While no records have been found of '*Candidatus* Phytoplasma aurantifolia' on passionfruit in Vietnam, passionfruit has been reported as a host for '*Candidatus* Phytoplasma aurantifolia' in Uganda (Arocha et al. 2009). Infected fruit may not show obvious symptoms and therefore may be packed and exported.	No. As the end use is human consumption, most fruit, other than the skin, will be consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be discarded in the environment. Phytoplasmas may be transmitted by phloem-feeding leafhoppers, planthoppers and psyllids (Weintraub & Beanland 2006). Phloem-feeding leafhoppers, planthoppers and psyllids are unlikely to feed on discarded passionfruit waste. While there is evidence for seed transmission of 16SrII group phytoplasmas (Satta 2017), no records have been found for seed transmission of	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
				'*Candidatus* Phytoplasma aurantifolia' in passionfruit.			
VIRUSES							
Bean common mosaic virus (BCMV) [Potyviridae: Potyvirus]	Yes (Gadhave et al. 2020b; Ha et al. 2008b)	Yes. NSW, NT, Qld, SA, Tas., Vic., (APPD 2022); WA (Saqib et al. 2005b)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Cotton leaf curl Multan virus (CLCUMV) [Geminiviridae: Begomovirus]	Yes (Tang, He & Zhou 2020)	No records found	Yes. *Cotton leaf curl Multan virus* is part of a complex that causes cotton leaf curl disease (Briddon 2003; Rahman et al. 2017). While no records have been found of CLCUMV on passionfruit in Vietnam, CLCUMV is associated with passionfruit in Yunnan province, China (Tang, He & Zhou 2020), a region adjoining Vietnam. Infection, with symptoms of leaf curling and dark green, swollen veins (Tang, He & Zhou 2020), is systemic (Geering 2006). In cotton, symptoms may	No. As the end use is human consumption, most fruit, other than the skin, will be consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be discarded in the environment. CLCUMV is not known to be seedborne or seed transmitted (Rahman et al. 2017; Varma 1963). CLCUMV is transmitted by	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	**Potential for distribution**			
			take 3-4 weeks to appear following inoculation (Singh, Sohi & Mann 1997) and may become mild or absent in cooler weather (PHA 2015). Standard commercial production and packing practices would reduce the likelihood of passionfruit infected with CLCUMV being exported to Australia. However, there is a possibility that infected fruit may not show obvious symptoms and therefore may be packed and exported.	*Bemisia tabaci* (Chen et al. 2019; Tang, He & Zhou 2020) in a persistent and circulative manner (Chen et al. 2019). *Bemisia tabaci* is a phloem feeder that infests leaves, stems (Li et al. 2021) and buds (Alegbejo & Banwo 2005) of host plants. It is unlikely to feed on discarded passionfruit waste.			
Cowpea aphid-borne mosaic virus (CABMV) [Potyviridae: Potyvirus]	Yes (Manyangarirwa, Sibiya & Mortensen 2010)	Yes. Qld, WA, NT (APPD 2022; Behncken & Maleevsky 1977; Coutts et al. 2011)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Cucumber mosaic virus (CMV) [Bromoviridae: Cucumovirus]	Yes (Kiritani & Su 1999)	Yes. NSW, Qld, SA, Tas., Vic., WA (Büchen-Osmond et al. 1988)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
East Asian Passiflora virus (EAPV) [Potyviridae: Potyvirus]	Yes (Do et al. 2021)	No records found	Yes. *East Asian Passiflora virus* is a causal pathogen of passionfruit woodiness disease (Do et al. 2021). This virus infects passionfruit plants systemically (Chong et al. 2018; Iwai et al. 2006). In experimental studies, foliar symptoms on passionfruit plants were evident 1 month after inoculation (Do et al. 2021). Affected fruit exhibit size reduction, malformation and woodiness (Do et al. 2021) or may be dappled or faded (Iwai et al. 2006). Standard commercial production and packing practices would reduce the likelihood of passionfruit infected with EAPV being exported to Australia. However, there is a possibility that infected fruit may not show obvious symptoms and	No. As the end use is human consumption, most fruit, other than the skin, will be consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be discarded in the environment. EAPV is not seedborne (Iwai et al. 1996) or seed transmitted (Omatsu et al. 2004). While it can be mechanically transmitted (Iwai et al. 2006), mechanical transmission from fruit for human consumption is unlikely. EAPV has been shown experimentally to be transmitted by aphids (*Aphis gossypii, Hyperomyzus lactucae* and *Myzus*	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
			therefore may be packed and exported.	*persicae*) to healthy passionfruit plants (Iwai et al. 1996; Omatsu et al. 2004). Aphids feed on phloem of leaves, stems (Capinera 2018; Nalam et al. 2021), buds or roots (Mahr 2022) of plants – they are not reported to commonly feed on fruit waste. As virus transmission in aphids occurs in a non-persistent manner (Gadhave et al. 2020a), an aphid vector would need to locate infected passionfruit waste, collect virus particles (while they are still viable) on their mouthparts, and travel to a nearby host within a timeframe of minutes to hours (Gadhave et al. 2020a; Hogenhout et al. 2008; Ng & Perry 2004) and			

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
				commence probing or feeding for transmission to occur. *East Asian Passiflora virus* has a limited host range (Iwai et al. 1996; Iwai et al. 2006), further limiting the likelihood of transmission.			
Euphorbia leaf curl virus (EuLCV) [Geminiviridae: Begomovirus]	Yes (Hoa et al. 2014)	No records found	Yes. *Euphorbia leaf curl virus* is associated with passionfruit in Vietnam (Hoa et al. 2014). This virus infects plants systemically (Wu, Zulfiqar & Huang 2010). Striped concaves have been observed on the surface of immature passionfruit produced from diseased plants; diseased plants may become symptomless in warmer weather (Cheng et al. 2014). Standard commercial production and packing practices would reduce the likelihood of passionfruit infected with EuLCV being	No. As the end use is human consumption, most fruit, other than the skin, will be consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be discarded in the environment. There are no records found of this virus being seedborne or seed-transmitted in passionfruit. EuLCV is transmitted by *Bemisia tabaci* (Wu, Zulfiqar & Huang 2010) and	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
			exported to Australia. However, there is a possibility that infected fruit may not show obvious symptoms and therefore may be packed and exported.	transmission of begomoviruses occurs in a persistent, circulative manner (Inoue-Nagata, Lima & Gilbertson 2016). *Bemisia tabaci* is a phloem feeder that infests leaves, stems (Li et al. 2021) and buds (Alegbejo & Banwo 2005) of host plants. It is unlikely to feed on discarded passionfruit waste.			
Papaya leaf curl China virus (PaLCuCNV) [Geminiviridae: Begomovirus]	Yes (Ha 2007)	No records found	Yes. While no records have been found of PaLCuCNV on passionfruit in Vietnam, PaLCuCNV is associated with passionfruit in Jiangxi province, China (Huang et al. 2020a) a region adjoining Vietnam. An efficient vector of PaLCuCNV in China, the Middle East-Asia Minor 1 species of *B. tabaci*, is abundant in northern Vietnam (Götz & Winter 2016) where passionfruit are grown	No. As the end use is human consumption, most fruit, other than the skin, will be consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be discarded in the environment. There are no records found of this virus being seedborne or	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			(Guo et al. 2015; Hang 2018). This virus infects plants systemically (Zhang et al. 2010). Standard commercial production and packing practices would reduce the likelihood of passionfruit infected with PaLCuCNV being exported to Australia. However, there is a possibility that infected fruit may not show obvious symptoms (Huang et al. 2020a) and therefore may be packed and exported.	seed-transmitted in passionfruit. PaLCuCNV is transmitted by *Bemisia tabaci* (Guo et al. 2015) and transmission of begomoviruses occurs in a persistent, circulative manner (Inoue-Nagata, Lima & Gilbertson 2016). *Bemisia tabaci* is a phloem feeder that infests leaves, stems (Li et al. 2021) and buds (Alegbejo & Banwo 2005) of host plants. It is unlikely to feed on discarded passionfruit waste.			
Papaya leaf curl Guandong virus (PaLCuGDV) [Geminiviridae: Begomovirus]	Yes. However, uncertainty exists on the virus name as Hoa et al. (2014) refer to the virus in Vietnam as *Papaya leaf curl virus* with an ambiguous citation to Cheng et al. (2011), which is considered to be the reference to	No records found	Yes. *Papaya leaf curl Guandong virus* is associated with passionfruit in Vietnam (Hoa et al. 2014). Evidence of visible symptoms of PaLCuGDV on the fruit of passionfruit is ambiguous (Cheng et al. 2014).	No. As the end use is human consumption, most fruit, other than the skin, will be consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
	Cheng et al. (2014) indicating the name of the virus as *Papaya leaf curl Guangdong virus,* since renamed to *Papaya leaf curl Guandong virus* (ICTV 2022).		Standard commercial production and packing practices would reduce the likelihood of passionfruit infected with PaLCuGDV being exported to Australia. However, there is a possibility that infected fruit may not show obvious symptoms and therefore may be packed and exported.	discarded in the environment. There are no records found of this virus being seedborne or seed-transmitted in passionfruit. Yang et al. (2013) reported transmission of PaLCuGDV in *Nicotiana tabacum* by *Bemisia tabaci*. Transmission of begomoviruses by *B. tabaci* occurs in a persistent, circulative manner (Inoue-Nagata, Lima & Gilbertson 2016). *Bemisia tabaci* is a phloem feeder that infests leaves, stems (Li et al. 2021) and buds (Alegbejo & Banwo 2005) of host plants. It is unlikely to feed on discarded passionfruit waste.			
Passiflora mottle virus (PaMoV)	Yes (Do et al. 2021)	No records found	Yes. *Passiflora mottle virus* is the main cause of passionfruit woodiness disease in Vietnam (Do	No. As the end use is human consumption, most fruit, other than the skin, will be	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
Passionfruit Vietnam virus (PVNV) [Potyviridae: Potyvirus]			et al. 2021). This virus infects plants systemically (Do et al. 2021). Infection of *Passiflora edulis* f. *flavicarpa* (yellow passionfruit) by *Passiflora mottle virus* produces small, distorted woody fruits with pale green skin (Do et al. 2021). Standard commercial production and packing practices would reduce the likelihood of passionfruit infected with PaMoV being exported to Australia. However, there is a possibility that infected fruit may not show obvious symptoms (Chang 1992) and therefore may be packed and exported.	consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be discarded in the environment. PaMoV is not seedborne or seed-transmitted in passionfruit (Chang 1992). PaMoV has been shown experimentally to be transmitted by aphids (Chang 1992). Aphids feed on phloem of leaves, stems (Capinera 2018; Nalam et al. 2021), buds or roots (Mahr 2022) of plants – they are not reported to commonly feed on fruit waste. As virus transmission in aphids occurs in a non-persistent manner (Gadhave et			

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway: Potential for importation	Potential to enter on pathway: Potential for distribution	Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
				al. 2020a), an aphid vector would need to locate infected passionfruit waste, collect virus particles (while they are still viable) on their mouthparts, and travel to a nearby host within a timeframe of minutes to hours (Gadhave et al. 2020a; Hogenhout et al. 2008; Ng & Perry 2004) and commence probing or feeding for transmission to occur. *Passiflora mottle virus* has a limited host range (Do et al. 2021), further limiting the likelihood of transmission.			
Soybean mosaic virus (SMV) [Potyviridae: Potyvirus]	Yes (Thu et al. 2014)	Yes (APPD 2022)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Telosma mosaic virus (TelMV) [Potyviridae: Potyvirus]	Yes (Do et al. 2021; Gadhave et al. 2020b; Ha et al. 2008a)	No records found	Yes. *Telosma mosaic virus* is associated with passionfruit in Vietnam (Do et al. 2021). Infection by TelMV presents as mosaic skin on green fruit (Chiemsombat, Prammanee & Pipattanawong 2014); fruit development is adversely affected, with reduced fruit length, thickness and weight (Chen et al. 2018). Viral infection on leaves is evident 21 days after infection (Chiemsombat, Prammanee & Pipattanawong 2014). Standard commercial production and packing practices would reduce the likelihood of passionfruit infected with TelMV being exported to Australia. However, there is a possibility that infected fruit may not show obvious symptoms and therefore may be packed and exported.	No. As the end use is human consumption, most fruit, other than the skin, will be consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be discarded in the environment. There are no records found of this virus being seedborne or seed-transmitted in passionfruit. Potyviruses are transmitted by aphids, but aphid transmission from infected passionfruit waste to a new host is unlikely to occur. Aphids primarily feed on phloem of leaves, stems (Capinera 2018; Nalam et al. 2021), buds or roots (Mahr 2022) of plants – they are not reported	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
				to commonly feed on fruit waste. As virus transmission in aphids occurs in a non-persistent manner (Gadhave et al. 2020a), an aphid vector would need to locate infected passionfruit waste, collect virus particles (while they are still viable) on their mouthparts, and travel to a nearby host within a timeframe of minutes to hours (Gadhave et al. 2020a; Hogenhout et al. 2008; Ng & Perry 2004) and commence probing or feeding for transmission to occur. *Telosma mosaic virus* has a limited host range (Zhang et al. 2024), further limiting the likelihood of transmission.			

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
Tobacco mosaic virus (TMV) [Virgaviridae: Tobamovirus]	Yes (MARD 2010)	Yes. NSW, Qld, SA, Tas., Vic., WA (Büchen-Osmond et al. 1988)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Tomato ringspot virus (ToRSV) [Secoviridae: Nepovirus]	Yes (MARD 2010)	Absent: pest eradicated (IPPC 2013)	Yes. While no records have been found of *Tomato ringspot virus* associated with *Passiflora edulis* in Vietnam (Koenig & Fribourg 1986), there is a single, historic report of ToRSV on passionfruit in Peru (Koenig & Fribourg 1986). Infected fruit may not show obvious symptoms and therefore may be packed and exported.	No. As the end use is human consumption, most fruit, other than the skin, will be consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), however, some may be discarded in the environment. Seed transmission has been reported in some hosts (Stace-Smith 1984). However, no records have been found for seed transmission of ToRSV in passionfruit. *Tomato ringspot virus* is transmitted by nematodes (*Xiphinema* spp.) (Stace-Smith 1984). Transmission via	Assessment not required	Assessment not required	No

Pest	Present in Vietnam	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Pest risk assessment required
			Potential for importation	Potential for distribution			
				nematodes from fruit waste is unlikely.			
Turnip mosaic virus (TuMV) [Potyviridae: Potyvirus]	Yes (Gadhave et al. 2020b; Ha et al. 2008a)	Yes. ACT, NSW, Qld, SA, Tas., Vic., WA (Büchen-Osmond et al. 1988)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Zucchini yellow mosaic virus (ZYMV) [Potyviridae: Potyvirus]	Yes (Gadhave et al. 2020b)	Yes. NSW, NT, Qld, WA (Maina et al. 2019)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

Appendix C: Stakeholder comments

This section outlines key technical issues raised by stakeholders during consultation on the draft report, and the department responses. Additional information on other issues raised by stakeholders, which are outside the scope of this technical report, is available on the department website.

Issue 1: Concerns with variation in different passionfruit cultivars, especially skin hardness, and any impacts on pest risk and management

As outlined in the report (Section 1.2.2), this risk analysis covers all cultivars of commercially produced passionfruit (*Passiflora edulis*) from all production regions in Vietnam. Passionfruit varieties grown commercially in Vietnam generally have a hardened or thickened skin, but this characteristic of the fruit has not been relied upon in the risk analysis. Fruit flies were the only pest group in the report where passionfruit skin thickness was discussed in the likelihood of importation. The report notes evidence from several studies indicating that the thick skin of passionfruit may provide some resistance to fruit fly oviposition and development, but this was not considered sufficient to alter the likelihood of importation, which was assessed as High. While there may be differences between passionfruit cultivars in their susceptibility to pests and pathogens, the department is not aware of any information that would change the risk ratings and management measures for the quarantine pests and regulated articles identified in the report.

Issue 2: Concerns with the thrips species complex *Frankliniella schultzei* on imported passionfruit, given there are Australian reports of it infesting passionfruit, including through laying eggs in the fruit surface

The department has reviewed information on *F. schultzei* provided by stakeholders, as well as other available information on the species. Observations by entomologists in northern Queensland confirm that *F. schultzei* can be a pest of passionfruit, including through laying eggs in the fruit surface (DAF 2023, *pers. comm.*). Recent studies have confirmed *F. schultzei* is a species complex, with at least 8 species globally and only 3 out of these species are present in Australia (De Oliveira, Bitencourt & Silva Junior 2023; Hereward et al. 2017). *Frankliniella schultzei* is reported from Vietnam but it is not clear which species of the complex are present there. Based on the above information and uncertainty, the department considers species of the *F. schultzei* complex present in Vietnam to be of quarantine concern to Australia and has added the *F. schultzei* species complex in the pest risk assessment for thrips in this report (section 3.9).

Because the *F. schultzei* species complex can transmit quarantine orthotospoviruses, it has also been assessed as a regulated article. However, eggs of thrips do not pose a virus risk as virus transmission from adult females to eggs has not been shown to occur (Wijkamp, Goldbach & Peters 1996). Only thrips larvae can acquire viruses through feeding on infected plants, and once the larvae acquire a virus, they remain viruliferous as adults (Wijkamp, Goldbach & Peters 1996).

Inspection is a commonly employed measure to manage the risk of thrips and other small arthropod pests on imported fruit pathways. The department recognises that some thrips such as *F. schultzei* can lay eggs in the fruit surface, including close to harvest, resulting in small galls of less than 1mm that may not be easy to detect through visual inspection. In addition to the

600-unit pre-export phytosanitary inspection undertaken by Vietnam's Plant Protection Department, a further 600-unit phytosanitary inspection is undertaken by the department on-arrival in Australia. If imported passionfruit are infested with thrips eggs, it is expected that some eggs would have hatched into larvae when passionfruit arrive in Australia, which would assist detection at the on-arrival inspection, and remedial action would be applied to the consignment. In addition, as discussed in the thrips Group PRA (DAWR 2017a), it is highly unlikely that any eggs of thrips on imported fruit could result in successful distribution to a new host. Due to the reasons outlined, visual inspection and remedial action, if found, is considered an appropriate measure to reduce the risk associated with thrips, including *F. schultzei* species complex, to achieve the ALOP for Australia.

Issue 3: Concerns with the risk of viruses being on imported passionfruit and being subsequently transmitted to suitable hosts in Australia via aphid vectors

Three viruses, *East Asian Passiflora virus*, *Passiflora mottle virus* and *Telosma mosaic virus*, were assessed in the report as being associated with passionfruit in Vietnam and able to be transmitted by aphid vectors. However, they were assessed in the pest categorisation as not having the potential to distribute to a suitable host in Australia in a viable state via the passionfruit for human consumption pathway.

The viruses were not considered to have potential for distribution from an infected passionfruit to a new host in Australia because:

- The end use for imported fresh passionfruit from Vietnam is human consumption, and most fruit, other than the skin, will be consumed. Most fruit waste will be disposed of via municipal waste facilities (Pickin et al. 2022), but some may be discarded in the environment.
- These viruses can be vectored by aphids. However, aphids feed on the phloem of actively growing leaves, stems, buds or roots of plants, and are highly unlikely to feed on discarded passionfruit waste. As virus transmission in aphids occurs in a non-persistent manner, an aphid vector would need to locate infected passionfruit waste, collect virus particles (while they are still viable) on their mouthparts, and travel to a nearby host within a timeframe of minutes to hours and commence probing or feeding for transmission to occur. These viruses have a limited host range, further limiting the likelihood of transmission.

As a result, these three viruses were not considered further, consistent with the methods outlined in Section A2.1 in Appendix A of the report.

Issue 4: Assurance that imported passionfruit will meet Australia's food safety requirements and maximum residue limits

The scope of this report is to assess and, if required, recommend the management of, the biosecurity risk associated with the importation of passionfruit from Vietnam for human consumption in Australia. However, as outlined in the report (Section 4.5), in addition to meeting Australia's biosecurity laws, imported food for human consumption must comply with the requirements of the *Imported Food Control Act 1992*, as well as Australian state and territory food laws. The same food safety laws that apply to domestic food also apply to imported food. Among other things, these laws require all food, including imported food, to meet the standards set out in the Australia New Zealand Food Standards Code (the Code). Standard 1.4.2 and Schedules 20, 21 and 22 of the Code set out the maximum residue limits and extraneous residue limits for agricultural or veterinary chemicals that are permitted in foods for sale, including imported food.

The department checks imported food at the border for safety and compliance with Australia's food standards, through the risk-based inspection program, the Imported Food Inspection Scheme. Post-border checks are made by state and territory food safety regulatory agencies.

Glossary, acronyms and abbreviations

Term or abbreviation	Definition
ACT	Australian Capital Territory
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 2023a).
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 *Biosecurity Act 2015* 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.
Area	An officially defined country, part of a country or all or parts of several countries (FAO 2023a).
Area of low pest prevalence	An area, whether all of a country, part of a country, or all or parts of several countries, as identified by the competent authorities, in which a specific pest is present at low levels and which is subject to effective surveillance or control (FAO 2023a).
Aril	A fleshy and usually brightly coloured and edible covering that surrounds the seed
Arthropod	The largest phylum of animals, including the insects, arachnids and crustaceans.
Australian territory	Australian territory as referenced in the *Biosecurity Act 2015* refers to Australia, Christmas Island and Cocos (Keeling) Islands and any external Territory to which that provision extends.
BA	Biosecurity Advice
BICON	Australia's Biosecurity Import Conditions system bicon.agriculture.gov.au/BiconWeb4.0
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 import risk analysis (BIRA)	The *Biosecurity Act 2015* 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 measures	The *Biosecurity Act 2015* 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 risk	The *Biosecurity Act 2015* 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.
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 2023a).
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO 2023a).

Term or abbreviation	Definition
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 2023a).
Endemic	Belonging to, native to, or prevalent in a particular geography, area or environment.
Endocarp	The inside layer of the fruit, which directly surrounds the seeds
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 2023a).
EP	Existing policy. This denotes that a pest species has previously been assessed in another policy published by the department.
Epicarp	The outermost layer of the fruit
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO 2023a).
FAO	Food and Agriculture Organization of the United Nations
Fresh	Living; not dried, deep-frozen or otherwise conserved (FAO 2023a).
FSANZ	Food Standards Australia New Zealand (foodstandards.gov.au/Pages/default.aspx) and the Australia New Zealand Food Standards Code (foodstandards.gov.au/code/Pages/default.aspx)
Fumigation	A method of pest control that completely fills an area with gaseous pesticides to suffocate or poison the pests within.
Genus	A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature the genus name is used, either alone or followed by a Latin adjective or epithet, to form the name of a species.
Goods	The *Biosecurity Act 2015* 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).
GP	Group policy. This refers to the *Final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports* (thrips Group PRA) (DAWR 2017a), the *Final group pest risk analysis for mealybugs and the viruses they transmit on fresh fruit, vegetable, cut-flower and foliage imports* (mealybugs Group PRA) (DAWR 2019a) and the *Final group pest risk analysis for soft and hard scale insects on fresh fruit, vegetable, cut-flower and foliage imports* (scales Group PRA) (DAWE 2021).
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 2023a).
Import permit	Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2023a).
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 2023a).
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 2023a).
Intended use	Declared purpose for which plants, plant products or other articles are imported, produced or used (FAO 2023a).

Term or abbreviation	Definition
Interception (of a pest)	The detection of a pest during inspection or testing of an imported consignment (FAO 2023a).
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 2023a).
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO 2023a).
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 2023a). Within this report a 'lot' refers to a quantity of fruit of a single variety, harvested from a single production site during a single pick and packed at one time.
MARD	Ministry of Agriculture and Rural Development
Mature fruit	Commercial maturity is the start of the ripening process. The ripening process will then continue and provide a product that is acceptable to consumers. Maturity assessments include colour, starch, index, soluble solids content, flesh firmness, acidity, and ethylene production rate.
Mesocarp	The fleshy layer of a fruit between the epicarp and endocarp
National Plant Protection Organization (NPPO)	Official service established by a government to discharge the functions specified by the IPPC (FAO 2023a).
NSW	The state of New South Wales in Australia.
NT	The Northern Territory of Australia.
Nymph	The immature form of some insect species that undergoes incomplete metamorphosis. It is not to be confused with larva, as its overall form is already that of the adult.
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 2023a).
Pathogen	A biological agent that can cause disease to its host.
Pathway	Any means that allows the entry or spread of a pest (FAO 2023a).
PPD	Plant Protection Department
Peduncle	A flower stalk bearing either a cluster or a solitary flower, which develops into fruit
Pest	Any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products (FAO 2023a).
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 2023a).
Pest free area (PFA)	An area in which a specific pest is absent as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained (FAO 2023a).

Term or abbreviation	Definition
Pest free place of production (PFPP)	Place of production 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 2023a).
Pest free production site (PFPS)	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 2023a).
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 2023a).
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 2023a).
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 2023a).
Pest risk management (for quarantine pests)	Evaluation and selection of options to reduce the risk of introduction and spread of a pest (FAO 2023a).
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 2023a).
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 2023a).
Phytosanitary certificate	An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (FAO 2023a).
Phytosanitary certification	Use of phytosanitary procedures leading to the issue of a phytosanitary certificate (FAO 2023a).
Phytosanitary measure	Phytosanitary relates to the health of plants. Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO 2023a). 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 pests (FAO 2023a).
Phytosanitary regulation	Official rule to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests, including establishment of procedures for phytosanitary certification (FAO 2023a).
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 2023a).
Production site	In this report, a production site is a continuous planting of passionfruit plants treated as a single unit for pest management purposes. If a property is subdivided into one or more units for pest management purposes, then each unit is a production site.
Qld	The state of Queensland in Australia.
Quarantine	Official confinement of regulated articles, pests or beneficial organisms for inspection, testing, treatment, observation or research (FAO 2023a).

Term or abbreviation	Definition
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 2023a).
Regulated article (RA)	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 2023a).
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 2023a).
Regulated pest	A quarantine pest or a regulated non-quarantine pest (FAO 2023a).
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.
Risk management measure	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.
SA	The state of South Australia.
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO 2023a).
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures.
Stakeholders	Government agencies, individuals, community or industry groups or organizations, whether in Australia or overseas, including the proponent/applicant for a specific proposal, who have an interest in the policy issues.
Surveillance	An official process which collects and records data on pest presence or absence by survey, monitoring or other procedures (FAO 2023a).
Systems approach(es)	The integration of different risk management measures, at least 2 of which act independently, and which cumulatively achieve the appropriate level of protection against regulated pests.
Tas.	The state of Tasmania in Australia.
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 (as a phytosanitary measure)	Official procedure for killing, inactivating, removing, rendering infertile or devitalising regulated pests (FAO 2023a).
Unrestricted risk	Unrestricted risk estimates apply in the absence of risk management measures.
Vector	In this report, a vector is an organism that is capable of harbouring and spreading a pest from one host to another.
Viable	Alive, able to germinate or capable of growth and/or development.
Vic.	The state of Victoria in Australia.
WA	The state of Western Australia.
WTO	World Trade Organization

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