



Australian Government
Department of Agriculture,
Fisheries and Forestry

Mangosteen fruit from Malaysia: biosecurity import requirements draft report

June 2026



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Acknowledgement of Country

We acknowledge the continuous connection of First Nations Traditional Owners and Custodians to the lands, seas and waters of Australia. We recognise their care for and cultivation of Country. We pay respect to Elders past and present, and recognise their knowledge and contribution to the productivity, innovation and sustainability of Australia's agriculture, fisheries and forestry industries.

Stakeholder submissions on draft reports

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

Submissions should be sent to the Department of Agriculture, Fisheries and Forestry following the conditions specified within the related Biosecurity Advice, which is available at: agriculture.gov.au/biosecurity-trade/policy/risk-analysis/memos.

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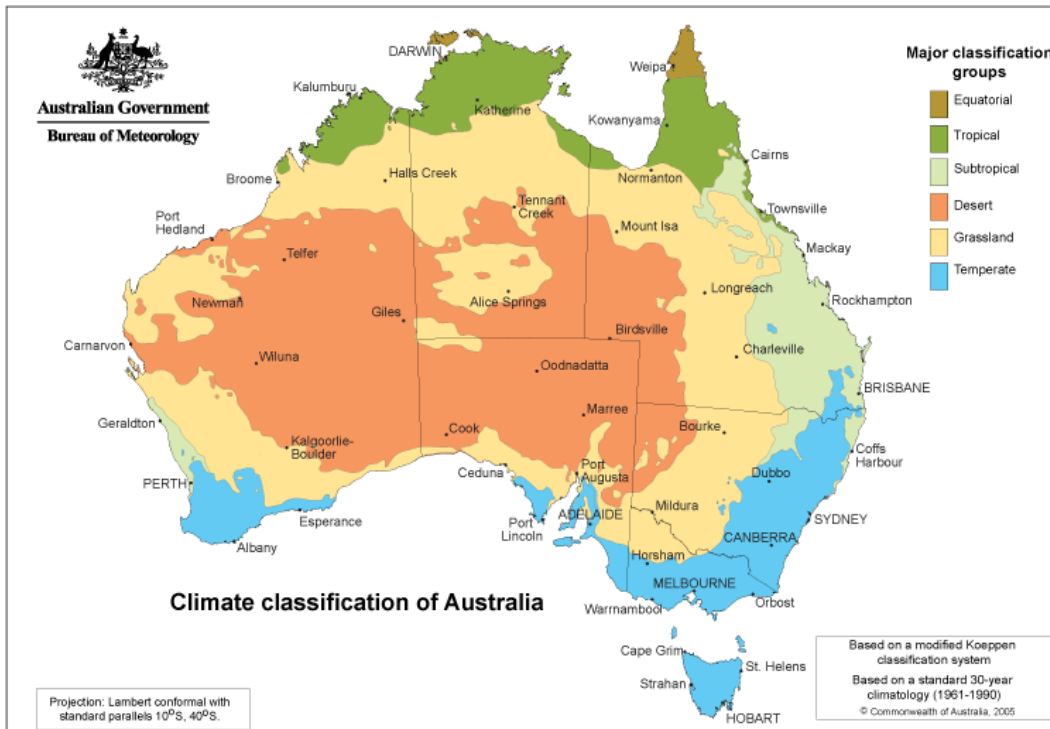
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Map 1 Map of Australia



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



Summary

The Australian Government Department of Agriculture, Fisheries and Forestry (the department) has prepared this draft report to assess the proposal by Malaysia for market access to Australia for mangosteen fruit for human consumption.

Australia currently permits the importation of mangosteen fruit from Thailand and Indonesia for human consumption, provided Australian biosecurity import conditions are met.

This draft report determines that the importation of commercially produced mangosteen fruit to Australia from all commercial production areas of Malaysia can be permitted, subject to a range of biosecurity requirements.

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

Twenty-one 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:

- fruit flies: carambola fruit fly (*Bactrocera carambolae*) and oriental fruit fly (*Bactrocera dorsalis*)
- hard scales: cyanotis scale (*Aspidiotus excisus*), rigid coconut scale (*Aspidiotus rigidus*), dictyospermum scale (*Chrysomphalus dictyospermi*), black thread scale (*Ischnaspis longirostris*) and trilobite scale (*Pseudaonidia trilobitiformis*)
- mealybugs: Annona mealybug (*Dysmicoccus lepelleyi*), grey pineapple mealybug (*Dysmicoccus neobrevipes*), cocoa mealybug (*Exallomochlus hispidus*), citrus mealybug (*Hordeolicoccus heterotrichus*), intercepted mealybug (*Paracoccus interceptus*), mealybug (*Paraputo odontomachi*), coffee mealybug (*Planococcus lilacinus*), Pacific mealybug (*Planococcus minor*), orange-coloured mealybug (*Pseudococcus aurantiacus*), cryptic mealybug (*Pseudococcus cryptus*) and mango mealybug (*Rastrococcus spinosus*)
- dolichoderine ants: cocoa black ant (*Dolichoderus thoracicus*) and black ant (*Technomyrmex butteli*)
- thrips: *Scirtothrips hitam*.

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 proposed risk management measures take account of regional differences in pest distribution within Australia. Five of the pests requiring risk management measures, *Chrysomphalus dictyospermi*, *Ischnaspis longirostris*, *Pseudaonidia trilobitiformis*, *Planococcus minor* and *Pseudococcus cryptus*, have been identified as regional quarantine pests for Western Australia. These pests are considered regional quarantine pests, as interstate quarantine regulations and enforcements are in place to prevent the introduction and distribution of these pests into Western Australia.

In this draft report the department proposes a range of risk management measures, combined with an operational system, to reduce the risks posed by the 21 identified species to achieve the ALOP for Australia. The proposed measures are:

- for fruit flies:
 - pest free areas, pest free places of production, or pest free production sites; or
 - non-host status, ensured by fruit quality and maturity requirements; or
 - fruit treatment considered to be effective against fruit flies such as irradiation.
- for hard scales, mealybugs, dolichoderine ants and thrips:
 - fruit treatment considered to be effective against all life stages of hard scales, mealybugs, dolichoderine ants and thrips, such as methyl bromide fumigation or irradiation; or
 - a systems approach considered to be effective in mitigating the risk of hard scales, mealybugs, dolichoderine ants and thrips on mangosteen fruit, and approved by the department.

This draft report has been published on the department website to allow interested parties to provide comments and submissions within the specified consultation period.

1 Introduction

1.1 Australia's biosecurity policy framework

Australia's biosecurity policies aim to protect Australia against the risks that may arise from exotic pests entering, establishing and spreading in Australia, thereby threatening Australia's unique flora and fauna, as well as 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 proposed to reduce the risks to an acceptable level. If the risks cannot be reduced to an acceptable level, the goods will not be imported into Australia until suitable measures are identified 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's website at agriculture.gov.au/biosecurity-trade/policy/risk-analysis/guidelines.

1.2 This risk analysis

1.2.1 Background

Malaysia's Department of Agriculture (DOA) formally requested market access to Australia for mangosteen fruit for human consumption in a submission received in May 2004. This submission provided information on the pests associated with mangosteen fruit in Malaysia, including the plant parts affected. Information was also provided on the production practices for producing commercial quality mangosteen fruit in Malaysia.

On 31 October 2024, the department notified stakeholders of the decision to progress a request for market access for mangosteen fruit from Malaysia as a review of biosecurity import requirements. This analysis is conducted in accordance with the *Biosecurity Act 2015*.

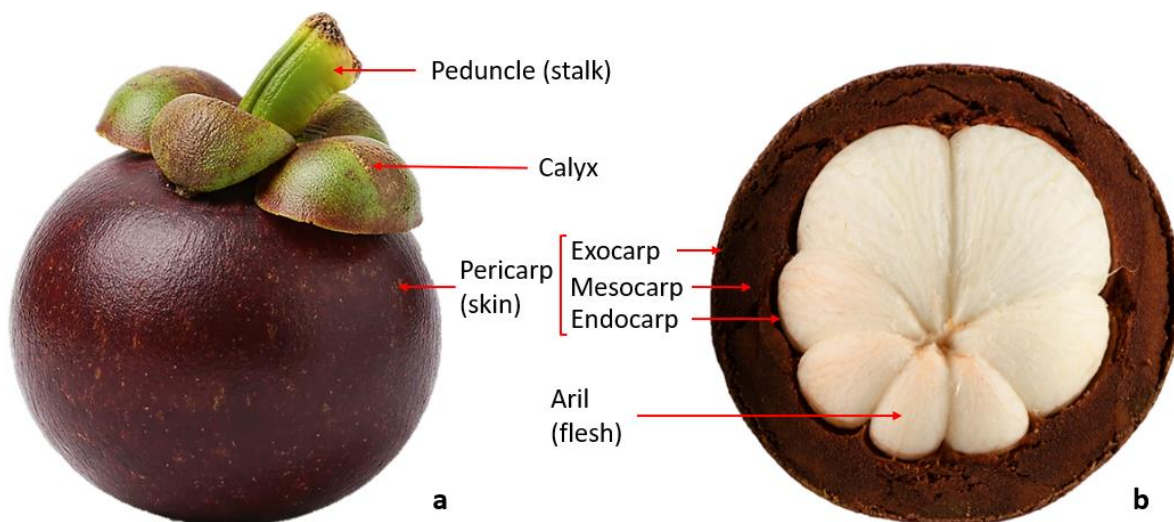
In August 2024, officers from the department visited production areas for mangosteen fruit from Malaysia. The objective of this visit was to observe commercial production, pest management and other export practices.

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 mangosteen fruit (*Garcinia mangostana*) from Malaysia, produced using commonly applied commercial production practices, for human consumption in Australia. Commercial production practices observed in Malaysia to produce mangosteen fruit for export are described in Chapter 2.

In this risk analysis, mangosteen fruit are defined as the entire fruit with the calyx, skin, flesh, seeds and a small portion of stalk (Figure 1.1). This risk analysis covers all varieties of commercially produced mangosteen fruit from all production regions in Malaysia.

Figure 1.1 Diagram of mangosteen fruit morphology



a: Whole mangosteen fruit. b: Cross-section of a mangosteen fruit. Source: Wikipedia, original image by Ivar Leidus, modified, licenced under CC BY-SA 4.0.

1.2.3 Existing policy

International policy

Australia currently permits fresh mangosteen fruit imports from Thailand (DAFF 2004) and Indonesia (DAFF 2012b). Australia also has import policy for decrowned pineapple from Malaysia (DAFF 2012a) and import conditions for fresh jackfruit segments and chilled durian segments from Malaysia.

The biosecurity import conditions for these commodity pathways, except for decrowned pineapple for which import conditions are yet to be finalised, can be found at the Biosecurity Import Conditions (BICON) system on the department website at bicon.agriculture.gov.au/BiconWeb4.0.

A preliminary assessment has identified that the potential pests of biosecurity concern for mangosteen fruit from Malaysia are the same, or of the same pest groups, as those identified for mangosteen fruit and other commodities 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 2017).

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 2019).

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).

The biosecurity risk posed by spider mites has been re-assessed by the department in the *Final report for a review of pest risk assessments for spider mites (Acari: Trombidiformes: Tetranychidae)* (spider mites review) (DAFF 2024).

The Group policies (GPs) for thrips, mealybugs, scale insects and spider mites are applicable for the mangosteen fruit from Malaysia pathway. The department has determined that the information in those GPs can be adopted for the species under consideration in this risk analysis. These GPs and their adoption are further explained in Chapter 3.

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 plant 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 mangosteen fruit from Malaysia 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 31 October 2024, the department notified stakeholders, in Biosecurity Advice 2024-P05, of the commencement of a review of biosecurity import requirements to assess a proposal by Malaysia for market access to Australia for mangosteen fruit for human consumption.

Prior to, and following the announcement of this decision, the department engaged with the Queensland Fruit and Vegetable Growers and Far North Queensland Growers.

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

1.2.6 Overview of this pest risk analysis

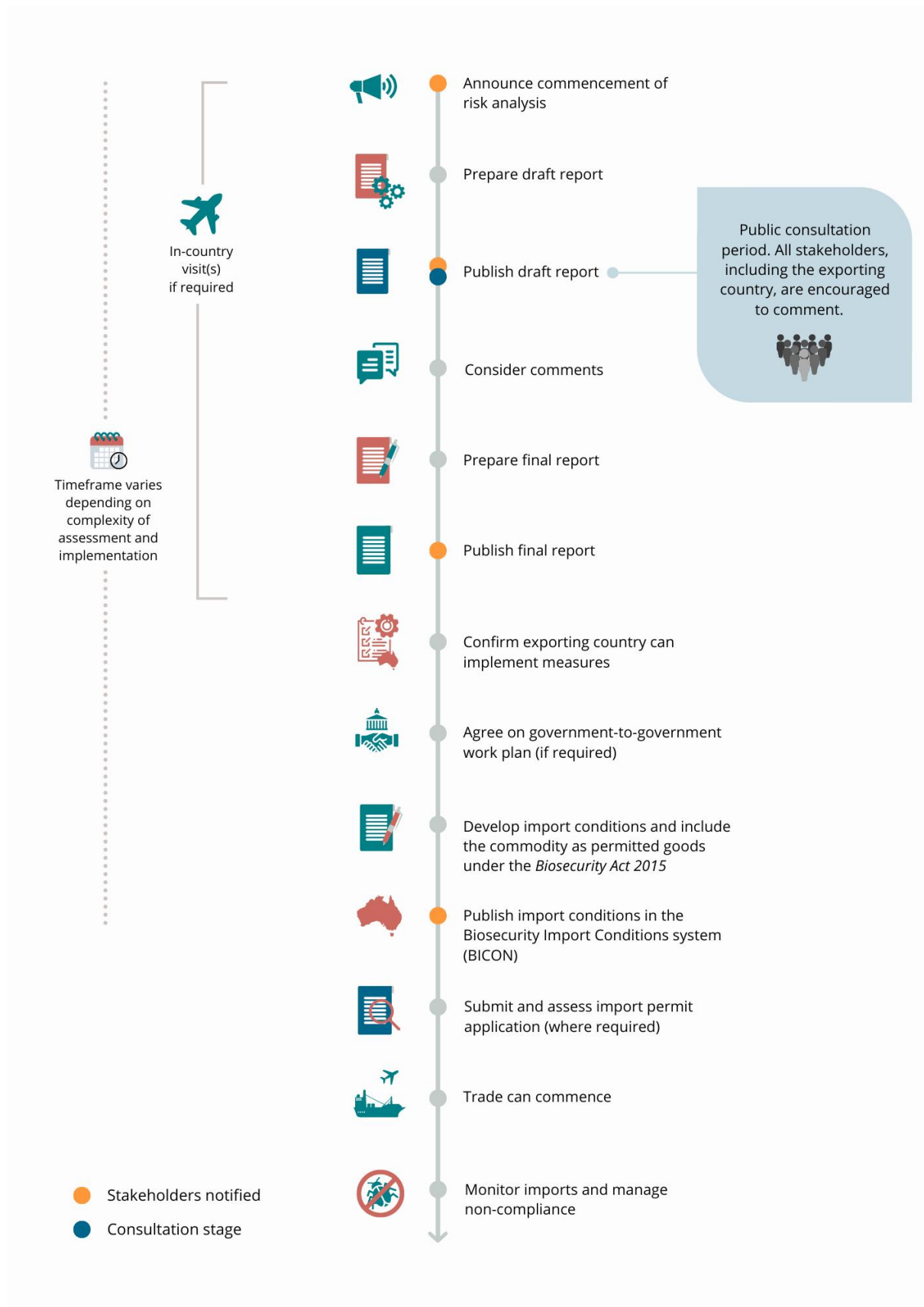
A pest risk analysis (PRA) is 'the process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it'. A pest is 'any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products' (FAO 2026b). 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.

Introduction

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 2026b).

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 mangosteen fruit in Malaysia and its export capacity 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 department has notified the proposer, the registered stakeholders and the WTO-Secretariat about the release of this draft report.

This draft report gives stakeholders an opportunity to comment on the department’s review and proposed measures, and to draw attention to any scientific, technical or other gaps in the data, or misinterpretations or errors.

Introduction

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

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.

The biosecurity requirements recommended in the final report will form the basis of the conditions published on BICON, and for any import permits subsequently issued.

Should the final report recommend importation be permitted, Malaysia must be able to demonstrate to the department that processes and procedures are in place to implement the agreed risk management measures prior to publication of import conditions on BICON. This will ensure safe trade in mangosteen fruit from Malaysia.

2 Commercial production practices for mangosteen fruit in Malaysia

This chapter provides information on pre-harvest, harvest and post-harvest practices in Malaysia for the commercial production of mangosteen fruit for export. It also outlines the export capacity of Malaysia.

2.1 Considerations used in estimating unrestricted risk

Malaysia provided a technical market access submission to Australia that included information on commercial production practices of mangosteen fruit in Malaysia.

In August 2024, the department visited mangosteen production areas and packing houses in the Malaysian states of Johor, Melaka and Negeri Sembilan. The department observed production, harvest, processing and packing procedures for mangosteens produced for export. These observations, along with additional information provided by Malaysia, are described in this chapter. Where relevant, information and data from published literature and other sources on mangosteen production in Malaysia are also included.

The pre-harvest, harvest and post-harvest production practices described in this chapter may not be applied consistently or to the same standard by all exporters. Therefore, in estimating the likelihood of pest introduction, the minimal practices applied to produce export quality fruit of sorting, cleaning, grading, packing and phytosanitary inspection are considered standard. The requirements for certification by Malaysia's Department of Agriculture (DOA) as part of the registration of farms and packing houses for export are also considered to be standard. These include on-farm Integrated Pest Management (IPM) and pest survey practices mandated under the Malaysian Good Agricultural Practices (myGAP) program.

These commonly applied practices were taken into consideration in the pest initiation and categorisation processes (Appendix B), and when estimating the unrestricted risk of pests that may be associated with the import of fresh mangosteen fruit from Malaysia (Chapter 3).

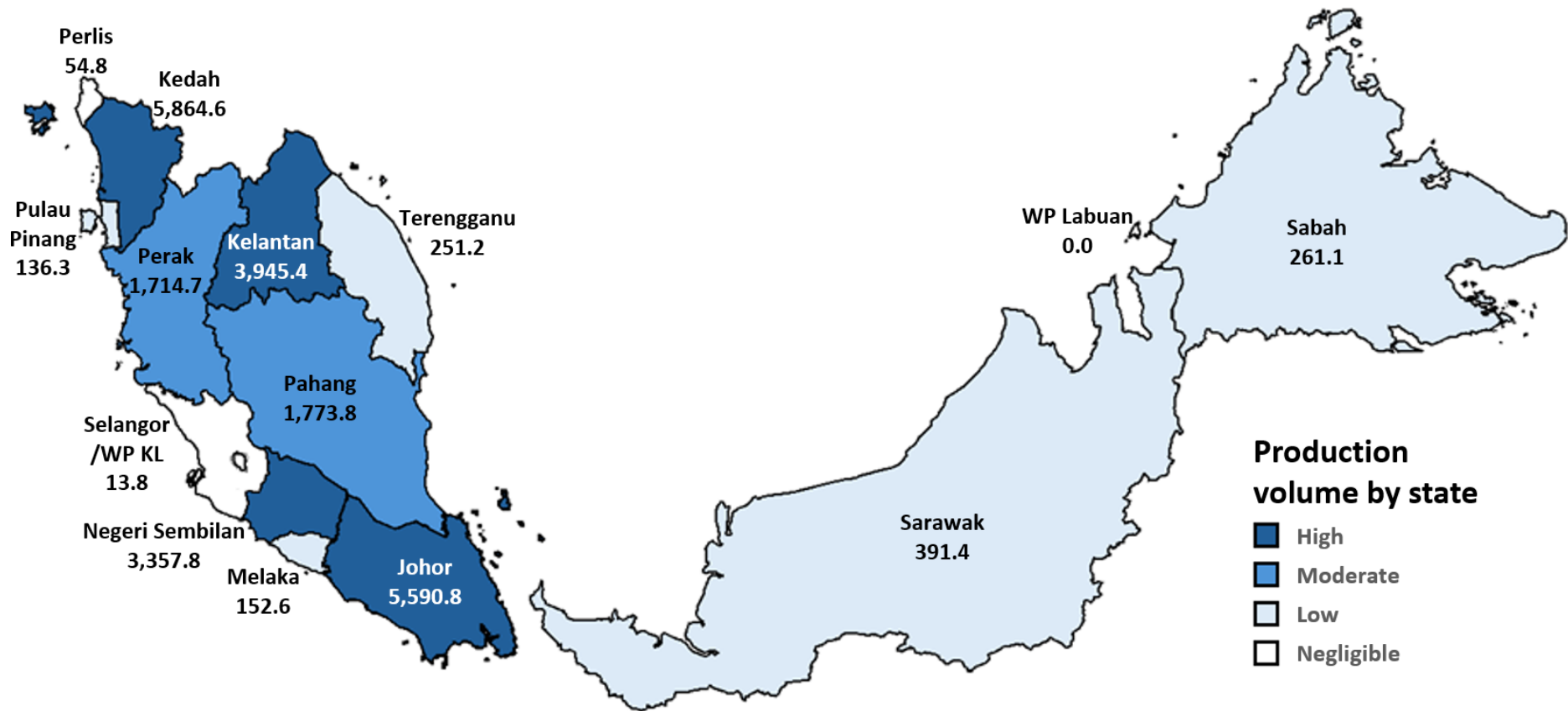
2.2 Production areas of mangosteen fruit

Mangosteens are cultivated throughout Malaysia, with commercial production occurring in every state, with the exception of the Federal Territory of Labuan (Wilayah Persekutuan Labuan) (DOA Malaysia 2024b).

The largest production of mangosteen fruit in 2022 occurred in Kedah (5,864.6 tonnes), Johor (5,590.8 tonnes), Kelantan (3,945.4 tonnes), Negeri Sembilan (3,357.8 tonnes), Pahang (1,773.8 tonnes) and Perak (1,714.7 tonnes) (DOA Malaysia 2024b). These six states have consistently been the largest producers of mangosteen in Malaysia for several years (DOA Malaysia 2024b).

These production values are identified in Map 3.

Map 3 Production of mangosteen fruit by state in Malaysia



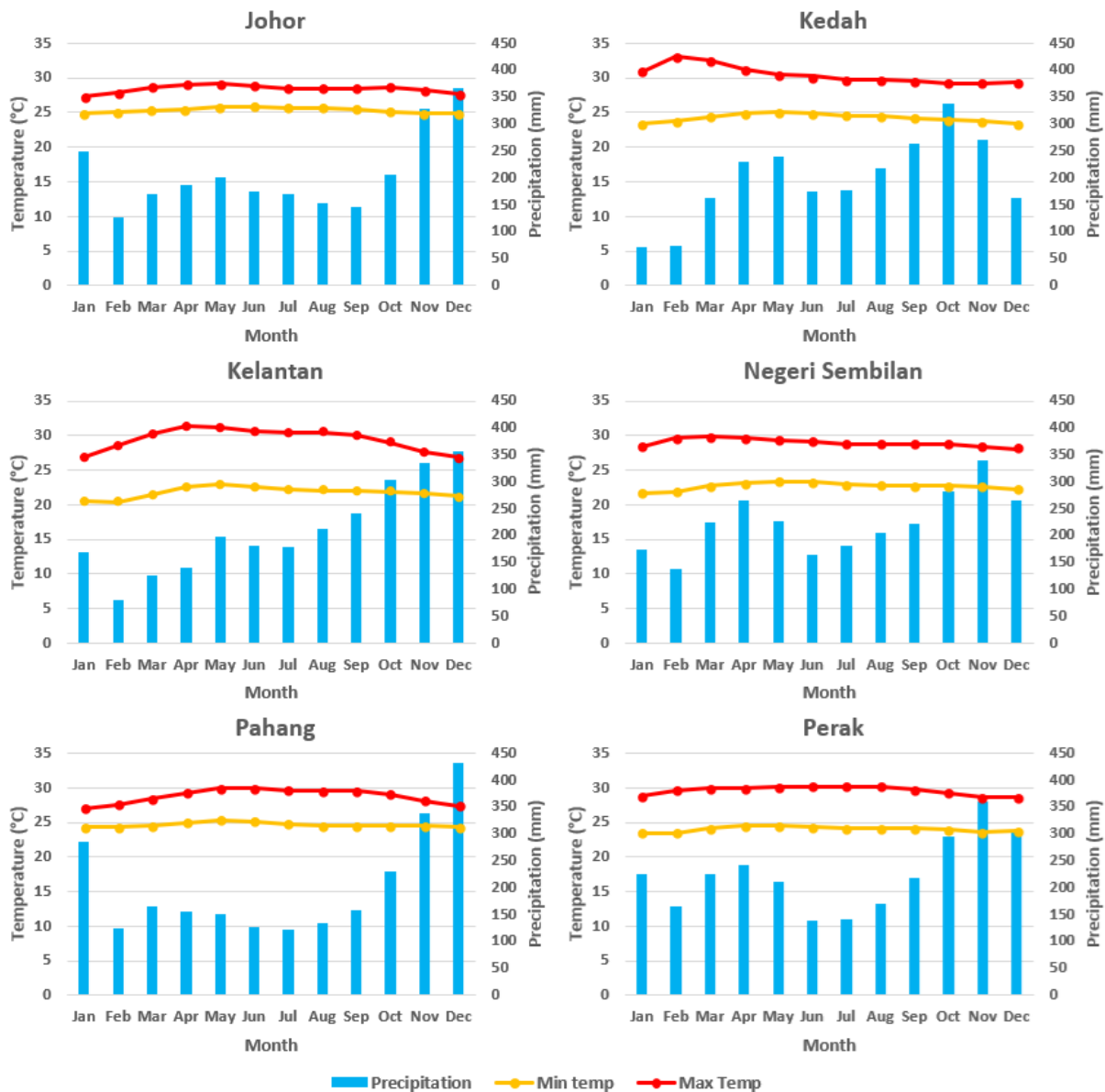
Production of mangosteen fruit (in tonnes) for each state in Malaysia in 2022. Source: Image modified using data from DOA Malaysia (2024b).

2.3 Climate in production areas

Malaysia is located near the equator and has a tropical climate characterised by high temperatures, high humidity and generally high rainfall year-round. Annual average rainfall exceeds 2000 mm, and the average temperature is 27°C (Climate-data.org 2026). Malaysia experiences two monsoon seasons: the south-west monsoon from April to September and the north-east monsoon from October to March (CCKP 2026).

Figure 2.1 shows mean monthly minimum and maximum temperatures, as well as mean monthly rainfall in the six states that produce the highest volumes of mangosteen.

Figure 2.1 Mean monthly minimum and maximum temperatures and mean monthly rainfall in the main production areas of mangosteen fruit in Malaysia



Source: Climate-data.org (2026)

2.4 Registration

All farms intending to export mangosteen fruit must be registered with DOA. Eligibility for registration requires the implementation of Integrated Pest Management (IPM) practices, compliance with Good Agricultural Practices (GAP) and certification under the myGAP program with DOA. The myGAP program provides a national standard for sustainable, safe and environmentally responsible agricultural production. The objective is to ensure that farms implement practices that support product quality, traceability and biosecurity, while meeting the requirements of the importing country.

In addition, farms intending to export mangosteen fruit must also be registered with the Ministry of Investment, Trade and Industry's Export Registration Approval Main Committee. Export registration requires farms to hold a myGAP certification and undergo inspection to verify compliance with the export production requirements.

Packing houses intending to export mangosteen fruit must be registered with DOA to ensure compliance with national standards for the safe and hygienic processing of export-grade fruit. Registration requires packing houses to be certified by DOA as meeting the requirements for processing mangosteen fruit for export. Registered packing houses must implement a one-way process flow with segregation of processing and packing areas, maintain documented fruit cleaning procedures, apply Good Manufacturing Practices (GMP) and provide a designated phytosanitary inspection area. In addition, packing houses must be certified by the Ministry of Health's Food Safety and Quality Division as meeting Hazard Analysis and Critical Control Point (HACCP) requirements. Certification under HACCP confirms that packing houses maintain documented systems for identifying, assessing and controlling food safety hazards in accordance with national and international food safety standards.

2.5 Pre-harvest

2.5.1 Varieties

Mangosteen trees are evergreen and can grow up to 10–25 metres tall, forming a dense, pyramidal crown (DOA Malaysia 2004). Commercial mangosteen trees are believed to have originated as a hybrid between various *Garcinia* species native to Malaysia (Makhonpas, Phongsamran & Silasai 2015).

Mangosteen fruit have 6–10 mm thick skin (Paull & Ketsa 2014), which starts out pale green and gradually turns light pink, then dark purple as the fruit matures (DOA Malaysia 2004; Joanna et al. 2016). The fruit also has 4 large, thick, leaf-like sepals that form a persistent calyx which remains attached to the fruit throughout maturation (Choehom, Ketsa & van Doorn 2003).

Mangosteen is an apomictic plant, which reproduces without sexual fertilisation, meaning its seeds are genetically identical to the mother plant (Mansyah et al. 2010). However, there are still recognised varieties of mangosteen, with different tree and fruit physiology (Joanna et al. 2016; Mansyah et al. 2010). The two main varieties of mangosteen grown commercially in Malaysia are known locally as "Manggis" and "Mesta" (Joanna et al. 2016).

Manggis

Fruit of the Manggis variety are roughly spherical and typically measure 4–7 cm in diameter (Paull & Ketsa 2014; Specialty Produce 2026). The edible aril within is divided into 4–8 segments, with only one or two enlarged segments that contain seeds (Joanna et al. 2016; Paull & Ketsa 2014).

Mesta

Fruit of the Mesta variety are smaller than the Manggis variety, ovoid in shape and slightly pointed at the end opposite the calyx (Joanna et al. 2016). Most aril segments in Mesta fruit are seedless or contain only undeveloped seed (Joanna et al. 2016).

2.5.2 Cultivation practices

Seedling production

Mangosteen seedlings for commercial planting are produced in nurseries registered with DOA's Plant Quality Control Division. These seedlings are grown from seeds sourced from registered mangosteen farms, and farms may supply their own seeds to nurseries specifically for propagation into seedlings for use back on the same farm.

Mangosteen trees begin fruiting at 10–15 years of age, reach peak production around 30–45 years of age and can continue producing fruit even at 100 years of age (Orwa et al. 2009; Yaacob & Tindall 1995). Therefore, some export farms may include trees that were already present on site and not produced in registered nurseries.

Planting and farm design

Mangosteen trees grow best in medium texture soil of alluvial origin that is reasonably deep, fertile, well drained and has a pH of 5.0–6.5. Planting usually involves digging holes of approximately 0.6 m³ in size, laid out in a square pattern with a spacing of at least 6 metres. The holes are typically left unfilled to weather through exposure to air for 2–4 weeks before each is filled with 5–10 kg of organic matter or compost. Seedlings are then planted in the prepared holes and supported with stakes in the early stages of growth.

Young seedlings require indirect sunlight and are therefore often intercropped with other plants to create shade. These shade plants are typically removed when the mangosteen trees begin fruiting, which occurs after around 5–7 years.

Irrigation

Mangosteen trees have high water requirements and thrive in areas with high rainfall. They require the greatest amount of water during fruit maturation and development, shoot growth and flowering. Farmers typically plant seedlings between September and October, prior to the monsoon season, to ensure adequate water for establishment.

Most of the water requirements for mangosteen trees are met by natural rainfall in Malaysia. However, supplementary irrigation may be required at some times, such as during the dry season. In these cases, water can be applied by workers, for example with hoses connected to a tank carried on a utility vehicle (Diamond International 2024).

Application of fertiliser

On farms where mangosteen trees are less than three years old, fertiliser is typically applied up to 3 times per year at a rate of 0.5 kg per tree per year at a ratio of 15:15:15 of Nitrogen, Phosphorous and Potassium respectively. Once trees are older than 3 years, fertiliser is typically applied annually at a ratio of 12:12:17:2 of Nitrogen, Phosphorous, Potassium and Magnesium, respectively. The amount of fertiliser applied increases as the trees age, with up to 6.0 kg applied per year in trees older than 8 years (DOA Malaysia 2004). Farms producing mangosteen fruit for export must maintain records of all fertiliser use, as per the requirements of myGAP.

Pruning and weeding

Mangosteen trees are usually pruned outside of the harvest season, when trees are not fruiting. Pruning creates spaces between branches, improving airflow and light penetration in the tree canopy, which creates a less favourable environment for pests and diseases and makes it easier to apply pesticides and pest traps. Removing injured and infested branches further reduces pest pressure. Trees are typically pruned to a maximum height of 6 metres, and this height, combined with the opened canopy, provides easier access to fruit during harvesting.

Weed control helps reduce pest pressure, as weeds can provide favourable habitats for pest insects and shelter for ant nests in the soil. Managing weeds also reduces competition, allowing trees better access to nutrients and water. During the fruiting season, underbrush and ground cover are usually removed from beneath the trees (Figure 2.2). Weeds may be controlled through slashing, physical removal or spraying with approved herbicides, with any herbicide use recorded in accordance with myGAP.

Removed weeds and pruned material are typically transported off-farm to a designated waste area for composting.

Figure 2.2 Pruned mangosteen trees with weeds cleared



2.5.3 Pest management

Growers manage pests and diseases throughout the commercial production season using various practices, such as integrated pest management (IPM), surveillance and monitoring programs and use of insecticides and fungicides. Pest and disease management typically focuses on trapping and farm sanitation, with chemical pesticides used if required. The main pests observed during commercial mangosteen production in Malaysia include thrips, mealybugs, scale insects, ants and fruit flies.

Sticky traps are typically placed in trees at different points throughout the farm to monitor and control flying insects. An example of a trapping program observed during the visit consisted of a minimum of 10 traps per hectare hung from trees within the farm, with yellow traps to trap and monitor for fruit flies (Figure 2.3a) and blue traps to trap and monitor for thrips (Figure 2.3b). Sticky traps are checked and replaced by farm workers, typically every 4 days during the fruiting and harvest stages of production.

Figure 2.3 Sticky traps deployed in mangosteen trees



a: Yellow sticky trap with trapped fruit flies. **b:** Blue sticky trap for thrips.

Ants are primarily managed through the control of mealybugs and scale insects, as the black ants commonly associated with mangosteen fruit are attracted to and feed on the honeydew produced by these insects. Pruning and farm hygiene practices that limit the presence of mealybugs and scale insects also help reduce ant activity on the fruit.

Chemical controls may be used when trees are not fruiting, and are applied in response to pest detections that exceed trigger levels, or if an ant nest is found. If insecticidal sprays are used, products with different active ingredients and modes of action to recently used applications should be selected, to prevent pests developing resistance.

Some farms individually number each tree by affixing a card to its trunk (Figure 2.4). This unique identification system allows farm workers to accurately report issues such as pest infestations, disease symptoms or growth anomalies affecting specific trees. As a result, corrective measures can be applied directly to the affected trees and workers can conduct follow-up monitoring to confirm the effectiveness of the treatment.

Figure 2.4 Labelled mangosteen tree



A summary of common management practices for pest groups in mangosteen farms registered for export is presented in Table 2.1.

Table 2.1 Examples of pest management options for mangosteen fruit in Malaysia

Pest/pest group	Management methods
Thrips	Pruning to allow airflow through canopy. Blue sticky traps to monitor and record pest numbers. Use of chemical sprays (e.g., diafenthiuron, imidacloprid) only if large numbers are detected in field.
Mealybugs	Pruning to allow airflow through canopy. Use of chemical sprays (e.g., white oil, malathion, alpha-cypermethrin) only if large numbers are detected in field.
Scale insects	Pruning to allow airflow through canopy. Use of chemical sprays (e.g., white oil, malathion, alpha-cypermethrin) only if large numbers are detected in field.
Ants	Pruning to allow airflow through canopy. Removal of ground cover to limit presence of ant nests. Use of chemical sprays (e.g., malathion, alpha-cypermethrin) only if nests or large populations are detected in field.
Fruit flies	Yellow sticky traps to monitor and record pest numbers.

Source: Diamond International (2024); DOA Malaysia (2004)

Surveillance and the application of IPM practices are required under myGAP certification, and are therefore considered standard production practices for all farms producing mangosteen fruit for export. However, application of these practices (e.g., surveillance methods, pest level tolerances or triggers) may vary between producers.

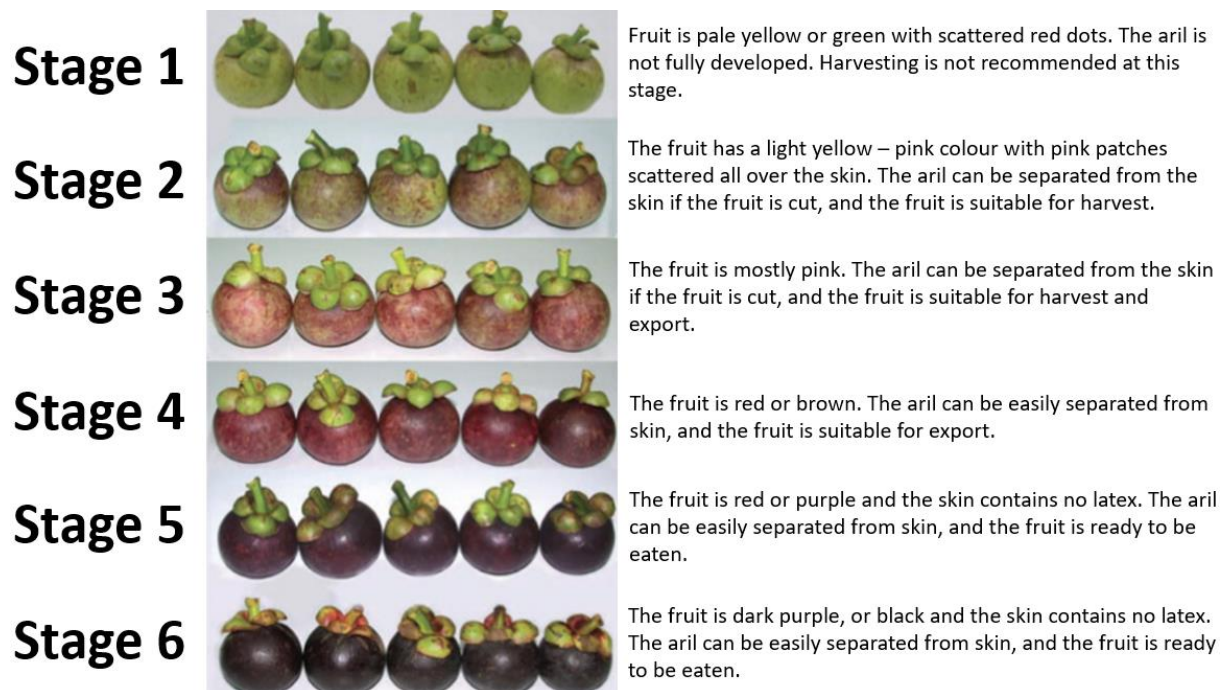
Additionally, all mangosteen farms registered for export are required to undergo regular surveys by DOA staff. These surveys of the trees for pests and diseases ensure that farms comply with monitoring and management practices, record keeping requirements and farm hygiene programs.

2.6 Harvesting and handling procedures

In Malaysia, mangosteen fruiting is influenced more by temperature than by the time of the year (DOA Malaysia 2004). When temperatures remain high for extended periods, two harvests may be possible: a main harvest in June to August and a smaller one in November to December. In years where temperatures are high enough to allow for a second season, additional fertiliser may be applied to encourage a second round of fruiting.

Harvesting can begin 13–14 weeks after initial fruit set (DOA Malaysia 2004). Mangosteen fruit are climacteric, and continue to ripen after being picked, provided they reach a minimum maturity beforehand. The colour index stages that are used to indicate the maturity of mangosteen fruit are shown in Figure 2.5. Fruit intended for export are often harvested at colour index stages 2–4. The specific maturity stage harvested depends on the requirements of the export market.

Figure 2.5 Chart of mangosteen fruit colour index stages



Source: Image from Ketsa & Paull (2011), text modified from DOA Malaysia (2004).

Mangosteen fruit are usually picked by hand while workers are standing on the ground. For fruit higher in the canopy, a picking pole may be used. The pole has a bent wire frame to detach the fruit, which is then collected in a net at the end of the pole (Figure 2.6a). Picked fruit are usually placed into baskets to prevent them from touching the ground.

For fruit that cannot be easily reached by hand or picking pole, workers climb into the canopy to pick the fruit directly (Figure 2.6b). Fruit are then placed into baskets that have been raised into the tree and can be lowered using a rope.

Figure 2.6 Mangosteen fruit being harvested from trees



a: Mangosteen fruit being harvested with a picking pole. b: Worker climbing tree to pick mangosteen fruit.

Fruit are transferred from the harvest basket into a plastic crate located in the field (Figure 2.7a). Each crate holds approximately 70 fruit and is labelled to allow traceback to individual blocks within the farm (Figure 2.7b). Once full, crates are carried to a shaded collection area near the farm entrance (Figure 2.8a) before being loaded onto a vehicle for transport to a packing house (Figure 2.8b).

Figure 2.7 Picked mangosteen fruit being transferred to labelled crates



a: Worker transferring picked fruit from basket to plastic crate. b: Labelled crates of picked mangosteen fruit.

Figure 2.8 Field collection area and transport to packing house



a: Field collection area with crates of picked mangosteen fruit. **b:** Vehicle for transporting picked fruit to packing house.
Source: Diamond International (2024)

2.7 Post-harvest

2.7.1 Packing house processes

Packing houses registered for export must implement a one-way process flow, with different sections of the facility segregated and labelled. Examples of the types of steps involved in processing and packing export quality mangosteen fruit in Malaysia are described in this section.

Receival and initial sorting

Upon arrival at the packing house, fruit are unloaded and stacked in the receival area. Each crate is weighed, and the labels are checked and recorded.

Fruit are initially sorted into groups: accepted for export, fruit for sale on the local domestic market or waste fruit for disposal or alternative use. The sorting criteria depend on the requirements of the destination market, and may include factors such as the specified colour index stage. Fruit sorted for export proceed to further processing.

Cleaning

Fruit may be cleaned to remove dust, plant debris, and external pests. The cleaning techniques may vary between packing houses, but mangosteen fruit processed for export are typically cleaned using high-pressure air. Cleaning with high-pressure air usually occurs over plastic-lined bins to catch any dislodged insects, plant material or other debris and prevent reinfestation of the fruit (Figure 2.9). Cleaned fruit are placed into new, clean containers.

Figure 2.9 Mangosteen fruit being cleaned with high-pressure air over plastic-lined bins



Quality check

Fruit may be quality checked by staff trained in diagnostics by DOA, following high-pressure air cleaning, to ensure the fruit are clean and free of pests. Fruit may be visually inspected, either by the naked eye or using magnifying lenses (Figure 2.10). A brush may be used to dislodge any remaining pests or contaminants, such as dirt or debris, if found. If required, fruit may be returned for recleaning or redirected to the local market.

Figure 2.10 Quality checking of mangosteen fruit under magnification



Grading and packing

Fruit quality is manually checked to ensure it meets export grade (Figure 2.11). Fruit that are damaged, scarred, have gummosis spots on the skin or do not meet the required maturity colour index stage for the destination market are removed.

Figure 2.11 Manual grading of fruit for quality



Fruit are then graded either manually or mechanically according to size and weight (Figure 2.12).

Figure 2.12 Mangosteen fruit being mechanically graded by size and weight



Graded fruit are packed into boxes by size and any other market requirement. The boxes are typically lined with paper and an internal plastic bag, and contain around 70 pieces of fruit, stacked 2 layers high (Figure 2.13a), with each loaded box weighing around 7 kg. Each box is labelled with the fruit grade and approximate weight.

The packed fruit may be sprayed with water, and a wet sponge placed on top to help maintain quality and appearance during storage and transport. This keeps the fruit shiny, the sepals green for several days longer and slows further skin colouring. The boxes are sealed and palletised (Figure 2.13b) and placed in cool storage, if required, before undergoing phytosanitary inspection and transport.

Figure 2.13 Boxes of graded and packed mangosteen fruit



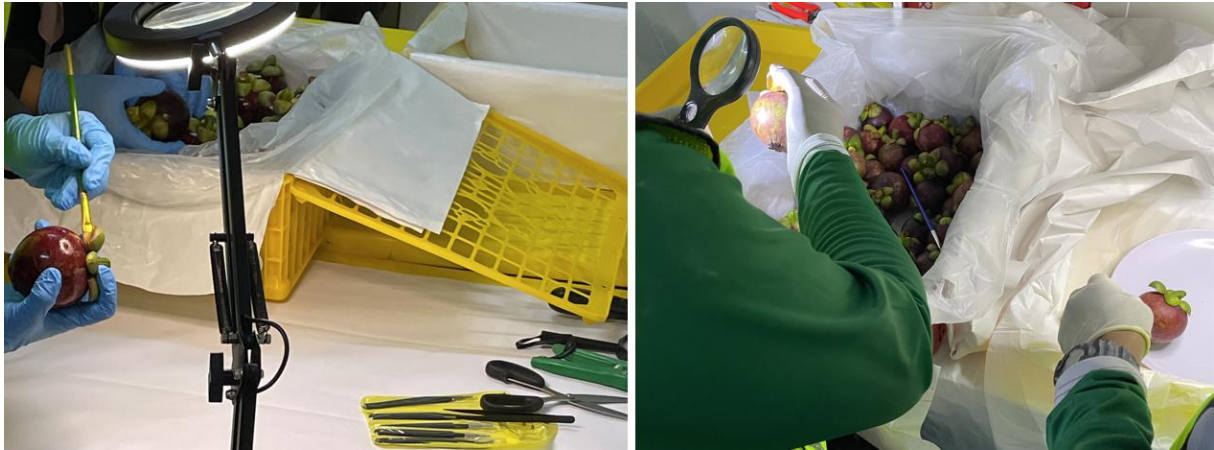
a: Cleaned and graded mangosteen fruit packed in export boxes. b: Sealed export boxes awaiting phytosanitary inspection.

2.7.2 Phytosanitary inspection

Phytosanitary inspection is performed by DOA officers at specially equipped tables in a dedicated area or laboratory at the packing house, or at the port of departure, depending on the requirements of the importer. DOA inspection officers randomly inspect a sample of fruit in accordance with the importing country's phytosanitary inspection requirements (e.g., a 600-unit inspection). Inspections are conducted using magnifying lenses to detect small contaminants, along with brushes and metal probes to examine underneath the calyx (Figure 2.14).

If the consignment is found free of quarantine pests and meets the requirements of the importing country, it is issued with a phytosanitary certificate, in accordance with ISPM 12: *Phytosanitary certificates* (FAO 2022).

Figure 2.14 Phytosanitary inspection of mangosteen fruit for export

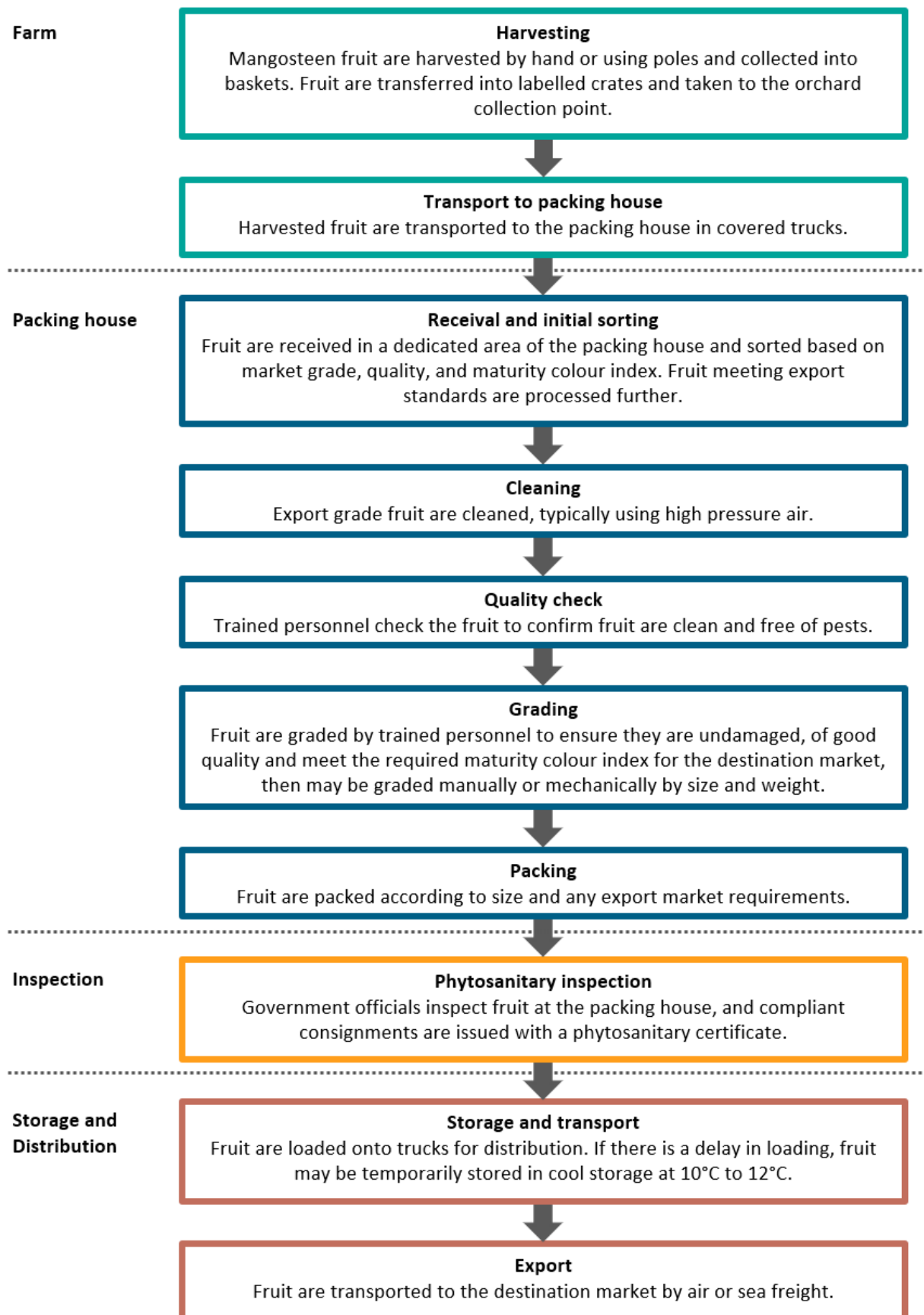


2.7.3 Transport

Mangosteen fruit may be transported from Malaysia to Australia by air or sea and are typically exported as soon as they are packed and inspected. However, boxes may be temporarily stored in a cool room at 10°C to 12°C before being loaded onto a truck for transport to the airport or seaport. The temperature during transport is recommended to be kept at 10°C to 12°C for maintaining fruit quality, but this is not a requirement for export.

A summary of the operational steps for mangosteen fruit grown in Malaysia for export is provided in Figure 2.15.

Figure 2.15 Summary of operational steps for mangosteen fruit grown in Malaysia for export



2.8 Export capacity

2.8.1 Commercial production statistics

Total commercial production of mangosteen fruit in Malaysia has remained relatively steady in recent years, with 23,296.6 tonnes being harvested in 2020, 26,831.4 tonnes in 2021 and 23,508.4 tonnes in 2022 (DOA Malaysia 2024b). Malaysia's most productive mangosteen-growing states are presented in Table 2.2 with their respective yields and crop areas.

Table 2.2 Mangosteen commercial production in Malaysia's top producing states in 2022

State	Yield (tonnes)	Harvested Area (hectares)
Kedah	5,864.6	473.1
Johor	5,590.8	562.1
Kelantan	3,945.4	308.0
Negeri Sembilan	3,357.8	205.5
Pahang	1,773.8	106.6
Perak	1,714.7	110.8

Source: DOA Malaysia (2024b)

2.8.2 Export statistics

Malaysia exports mangosteen fruit to multiple countries, including China, Indonesia, Singapore and Thailand (Table 2.3). Export volumes have remained relatively stable from year to year, with a total of approximately 2,186.05 tonnes exported in 2022.

Table 2.3 Export volumes of mangosteen fruit from Malaysia by destination market

Export market	Export volume per year (tonnes)		
	2020	2021	2022
Brunei Darussalam	7.9	0.6	4.7
China	1,173.3	259.7	–
Hong Kong	2.1	26.0	1.4
Indonesia	1.8	–	4.0
Saudi Arabia	774.5	–	–
Singapore	0.6	1,918.1	2,125.2
Thailand	348.0	–	50.6
Other	1.55	1.02	0.15
Total	2,309.75	2,205.42	2,186.05

Source: DOA Malaysia (2024b)

2.8.3 Export season

The peak mangosteen harvest season typically runs from June to August, with a smaller secondary season running from November to December if temperatures remain high after the main harvest. Mangosteen fruit are generally exported within a day of harvest, and can develop chilling injury if stored at low temperatures. However, they can be stored successfully for up to 20 days if kept at 12°C (Choehom, Ketsa & van Doorn 2003). This suggests that mangosteen fruit imports into Australia from Malaysia will likely cease within a month of the harvest season ending.

3 Pest risk assessments for quarantine pests

3.1 Summary of outcomes of pest initiation and categorisation

The initiation process (Appendix B) identified 119 pests as being potentially associated with aerial parts of mangosteen trees in Malaysia.

Of these 119 pests, the pest categorisation process (Appendix B) identified:

- 60 pests as already present in Australia and not under official control, and therefore not requiring further assessment,
- 37 pests as not having potential to enter on the commercially produced mangosteen fruit from Malaysia pathway, and therefore not requiring further assessment,
- 1 pest as not having potential to establish and spread in Australia, and therefore not requiring further assessment.

The remaining 21 pests were assessed as having potential to enter, establish, spread and cause consequences in Australia, and therefore requiring further pest risk assessment.

In applying the Group PRAs, 7 thrips, 14 mealybugs and 11 hard scales were identified 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 21 pests, associated with commercially produced mangosteen fruit for export from Malaysia, identified as requiring further pest risk assessment are listed in Table 3.1.

Of these 21 pests:

- 16 are quarantine pests for Australia,
- 5 are regional quarantine pests for Western Australia. While they have been recorded in some regions of Australia, interstate quarantine regulations are in place and enforced for these pests.

Table 3.1 Quarantine pests potentially associated with mangosteen fruit from Malaysia, and requiring further pest risk assessment

Pest/pest group	Scientific name	Common name	Policy status/region
Fruit flies [Diptera: Tephritidae]	<i>Bactrocera carambolae</i>	carambola fruit fly	EP
	<i>Bactrocera dorsalis</i>	oriental fruit fly	EP
Hard scales [Hemiptera: Diaspididae]	<i>Aspidiotus excisus</i>	cyanotis scale	GP
	<i>Aspidiotus rigidus</i>	rigid coconut scale	GP
	<i>Chrysomphalus dictyospermi</i>	dictyospermum scale	GP, WA
	<i>Ischnaspis longirostris</i>	black thread scale	GP, WA
	<i>Pseudaonidia trilobitiformis</i>	trilobite scale	GP, WA
Mealybugs [Hemiptera: Pseudococcidae]	<i>Dysmicoccus lepelleyi</i>	Annona mealybug	GP
	<i>Dysmicoccus neobrevipes</i>	grey pineapple mealybug	GP
	<i>Exallomochlus hispidus</i>	cocoa mealybug	GP
	<i>Hordeolicoccus heterotrichus</i>	citrus mealybug	GP

Pest/pest group	Scientific name	Common name	Policy status/region
	<i>Paracoccus interceptus</i>	intercepted mealybug	GP
	<i>Paraputo odontomachi</i>	mealybug	GP
	<i>Planococcus lilacinus</i>	coffee mealybug	GP
	<i>Planococcus minor</i>	Pacific mealybug	GP, WA
	<i>Pseudococcus aurantiacus</i>	orange-coloured mealybug	GP
	<i>Pseudococcus cryptus</i>	cryptic mealybug	GP, WA
	<i>Rastrococcus spinosus</i>	mango mealybug	GP
Dolichoderine ants [Hymenoptera: Formicidae]	<i>Dolichoderus thoracicus</i>	cocoa black ant	EP
	<i>Technomyrmex butteli</i>	black ant	EP
Thrips [Thysanoptera: Thripidae]	<i>Scirtothrips hitam</i>	thrips	GP

EP: Species has been assessed previously and import policy already exists. **GP:** Species has been assessed previously in a Group PRA, and the Group policy has been applied. **WA:** Regional quarantine pest for Western 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 21 of the pests 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 2017), which has been applied to this assessment of mangosteen fruit from Malaysia.

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

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 mangosteen fruit from Malaysia.

The biosecurity risk posed by spider mites was re-assessed by the department in the spider mites review (DAFF 2024), which has been applied to this assessment of mangosteen fruit from Malaysia. The approach used in the spider mites review is consistent with that applied to the Group PRAs for thrips (DAWR 2017), mealybugs (DAWR 2019) and scale insects (DAWE 2021). Therefore, the spider mites review is regarded as a Group PRA for spider mites.

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 in this chapter for convenience.

A summary of the likelihood, consequence and URE ratings obtained in each pest risk assessment is provided in Table 3.8. 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 Fruit flies

***Bactrocera carambolae* (EP) and *Bactrocera dorsalis* (EP)**

The species of fruit fly identified as quarantine pests potentially associated with mangosteen in Malaysia are *Bactrocera carambolae* (carambola fruit fly) and *B. dorsalis* (oriental fruit fly). These species belong to the Tephritidae family, a group of fruit flies considered to be among the most damaging pests of horticultural crops.

Bactrocera carambolae and *B. dorsalis* are not known to be present in Australia and are therefore quarantine pests for all of Australia.

Bactrocera carambolae and *B. dorsalis* have been grouped together in this assessment as they have common biological characteristics and are considered to pose similar risks. In this assessment, the term “fruit flies” is used to refer to these two species as a group. The scientific name is used when the information relates to a specific species.

Since mangosteen imports were last assessed, *B. invadens*, *B. papayae* and *B. philippinensis* have been synonymised within the *B. dorsalis* species complex (Schutze et al. 2014). References to these previously accepted species are now considered to be references to *B. dorsalis*.

Both *B. carambolae* and *B. dorsalis* are reported to be present in Malaysia (Drew & Hancock 1994; PHA 2026; Waterhouse 1993).

Tephritid fruit flies have 4 life stages: egg, larva, pupa and adult. Over the course of an adult female’s lifetime, *B. carambolae* can lay around 1,100 eggs (Castilho et al. 2019) and *B. dorsalis* can lay between 1,200 and 1,500 eggs (Weems et al. 2019). Eggs are laid below the fruit skin and hatched larvae feed within the fruit (Fletcher 1989). Upon maturity, fruit fly larvae drop to the ground and pupate in the soil, forming a tan/dark brown puparium (Christenson & Foote 1960; Weems et al. 2019). Adult fruit flies can produce several generations annually, depending on diet and temperature (Christenson & Foote 1960; Simpson et al. 2020). Adults often fly only short distances and fruit flies are primarily dispersed over long distances by transfer of infested fruit (Papadopoulos et al. 2024). However, adult flies of some species have a strong capacity for independent flight (Fletcher 1989; Qureshi et al. 1975).

There are a small number of records of *B. carambolae*, or *B. dorsalis* or its synonyms infesting mangosteen fruit (Allwood et al. 1999). However, studies have been performed that demonstrate that intact mangosteen fruit with unbroken skin does not support the development of these fruit fly species (Iswari, Kustaryati & Murdita 2011; Unahawutti et al. 2014).

Bactrocera carambolae and *B. dorsalis* have been assessed previously in the existing policies for mangosteens from Thailand (DAFF 2004) and Indonesia (DAFF 2012b). However, the scope of those reports was different to that of the current assessment and included the now defunct species name *Bactrocera papayae*, instead of the overall *B. dorsalis* species complex. *Bactrocera carambolae* and *B. dorsalis* have been assessed more recently in the policies for mangoes from Indonesia, Thailand and Vietnam (DAWR 2015) and pomelos from Vietnam (DAFF 2025), and these policies are more applicable to this assessment. In those policies, the URE for these fruit flies does not achieve the

ALOP for Australia. Therefore, specific risk management measures are required for these fruit fly species on those pathways.

However, there may be differences in the fruit physiology, host susceptibility, pest prevalence and horticultural practices between the previously assessed commodity/country pathways, and mangosteen fruit from Malaysia. These potential differences make it necessary to re-assess the likelihood that fruit flies will arrive in Australia in a viable state on the mangosteen fruit from Malaysia pathway.

Previous assessments for *B. carambolae* and *B. dorsalis* in the existing policies rated the likelihood of distribution as High.

Mangosteen fruit from Malaysia are expected to be distributed in Australia in a similar way to the previously assessed commodity/country pathways. There is some possibility that imported fresh mangosteen fruit may contain fruit fly eggs or larvae (Allwood et al. 1999). It is expected that once mangosteen fruit arrive in Australia from Malaysia, they will be distributed to various destinations throughout Australia for sale. Most fruit waste would likely be disposed of via municipal waste facilities, reducing the risk of fruit flies distributing to a host. However, small quantities of fruit waste may be discarded in urban, rural and natural environments. Any fruit flies present in discarded mangosteen fruit may disperse to new hosts, as adult fruit flies are highly mobile and can fly to host plants. Fruit flies have wide host ranges and there are likely to be hosts present year-round in many parts of Australia. On this basis, the same rating of High for the likelihood of distribution for *B. carambolae* and *B. dorsalis* in previous assessments is adopted for the mangosteen fruit from Malaysia pathway.

The likelihoods of establishment and spread of *B. carambolae* and *B. dorsalis* in Australia from the mangosteen fruit from Malaysia pathway have also 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 these 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. carambolae* and *B. dorsalis* in previous assessments have been adopted for the mangosteen fruit from Malaysia pathway.

In addition, the department has reviewed the latest literature—for example, Castilho et al. (2019); Koswanudin et al. (2018); Louzeiro et al. (2021); Michel et al. (2021); Unahawutti et al. (2014) and Weems et al. (2019). No new information has been identified that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for fruit flies in the existing policies.

The risk scenario of biosecurity concern is that eggs and/or larvae of *B. carambolae* and *B. dorsalis* may be present within mangosteen fruit imported from Malaysia, which may result in the establishment and spread of these pests in Australia.

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 *B. carambolae* and *B. dorsalis* will arrive in Australia in a viable state with the importation of mangosteen fruit from Malaysia is assessed as: **Very Low**.

Although *B. carambolae* and *B. dorsalis* are present in Malaysia, and have been recorded in mangosteen fruit, successful infestation only occurs when fruit are severely damaged to the point that the inner aril is exposed. Intact fruit do not support oviposition or larval development, and latex released when immature fruit is damaged prevents larval survival. Commercial harvesting, sorting, grading and packing processes are likely to remove visibly damaged or blemished fruit. However, if such fruit are packed for export, any fruit flies present may survive typical storage and transport temperatures.

The following information provides supporting evidence for this assessment.

Bactrocera carambolae and *B. dorsalis* are present in Malaysia, and can be associated with mangosteen fruit.

- Both *B. carambolae* and *B. dorsalis* are recorded as occurring in Malaysia (Drew & Hancock 1994; Drew & Romig 2013; PHA 2026; Waterhouse 1993).
- Mangosteen fruit is a potential host for fruit flies, and both *B. carambolae* and *B. dorsalis* have been recorded infesting mangosteen fruit (Allwood et al. 1999; Unahawutti et al. 2014).
- However, infestation is only associated with mangosteen fruit that is sufficiently damaged for the aril to be exposed, indicating that the fruit are not typically infested (Unahawutti et al. 2014).

Mangosteen fruit are considered a conditional host, as fruit flies can only infest fruit when the skin is broken to the extent that the aril is exposed.

- Mangosteen fruit have only been recorded as being infested by *B. carambolae* or *B. dorsalis* when the pericarp is damaged to the extent that the aril is exposed (Iswari, Kustaryati & Murdita 2011; Unahawutti et al. 2014).
- While fruit flies may occasionally lay eggs on the surface of mangosteen fruit or into shallow wounds, the hatched larvae cannot penetrate further through the pericarp to enter the aril and quickly die from desiccation or starvation (Unahawutti et al. 2014; Unahawutti & Oonthonglang 2002).
- The skin of less mature mangosteen fruit also produces yellowish latex (Paull & Ketsa 2014), which leaks when the skin is damaged and can smother small pests or eggs (Unahawutti & Oonthonglang 2002).
- Studies show damaged mangosteen fruit can be infested by *B. carambolae* or *B. dorsalis*, but this has only been demonstrated at higher colour index stages, usually stage 6 and 7 of ripeness (Iswari, Kustaryati & Murdita 2011; Unahawutti et al. 2014).
- Fruit flies are unable to survive in damaged immature fruit (below colour stage 6). When the pericarp of less mature mangosteen fruit is damaged, yellowish latex is released (Paull & Ketsa 2014), which can smother eggs and larvae (Unahawutti & Oonthonglang 2002). Unahawutti &

Oonthonglang (2002) also showed that first instar larvae exited puncture sites in fruit, rather than boring through the pericarp to reach the aril, indicating that immature fruit do not support larval development.

Fruit damaged to the extent that it becomes susceptible to fruit fly infestation would be detected during harvest and post-harvest processes.

- Fruit flies can only infest mangosteen fruit that is significantly damaged to the point that the aril is exposed. Fruit in this condition is readily detectable, and is likely to be removed during harvest and post-harvest processes.
- Immature fruit that has minor damage secretes visible yellow latex (Paull & Ketsa 2014) leading to a condition known as gummosis (DOA Malaysia 2024a). Blemished and scarred fruit showing gummosis symptoms are likely to be detected and removed during processing.

However, if damaged fruit are not detected during harvest or post-harvest processes and infested fruit are packed for export, fruit fly eggs and larvae may remain viable during transport and storage.

- Mangosteen fruit are likely to be imported into Australia soon after harvest to maximise fruit quality and shelf life.
- Fruit may be exported via sea freight (12–25 days), or air freight (3–5 days) (TSL Australia 2026) and are likely to be cool-stored under climate-controlled conditions at 10°C to 12°C during transport.
- The developmental biology of *B. carambolae* and *B. dorsalis* suggest that both species have the capacity to survive mangosteen storage temperatures and export durations.
 - *Bactrocera carambolae* eggs hatched after an average of 5.5 days when kept at 15°C, and larvae pupate after a further 28.9 days, with a lower developmental threshold calculated at around 11°C to 12°C for each stage (Danjuma et al. 2014).
 - *Bactrocera dorsalis* eggs hatched after an average of 4.3 days when kept at 15°C, and larvae pupate after a further 25 days, with a lower developmental threshold calculated at less than 8°C for both stages (Michel et al. 2021).

For the reasons outlined, the likelihood of importation of *B. carambolae* and *B. dorsalis* on imported mangosteen fruit from Malaysia is assessed as **Very Low**.

Likelihood of distribution

The likelihood that *B. carambolae* and *B. dorsalis* will be distributed within Australia in a viable state as a result of the processing, sale or disposal of mangosteen fruit from Malaysia, and subsequently transfer to a susceptible part of a host is likely to be similar to these fruit flies on previously assessed pathways. The same rating of **High** for the likelihood of distribution for *B. carambolae* and *B. dorsalis* in previous assessments is adopted for mangosteen fruit from Malaysia.

Overall likelihood of entry

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

3.4.2 Likelihoods of establishment and spread

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

Based on the existing import policies for *B. carambolae* and *B. dorsalis*, the likelihoods of establishment and spread are assessed as **High** and **High**, respectively.

3.4.3 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. carambolae* and *B. dorsalis* will enter Australia as a result of trade in mangosteen fruit from Malaysia, be distributed in a viable state to a susceptible part of a host, establish in Australia and subsequently spread within Australia is assessed as **Very Low**.

3.4.4 Consequences

The potential consequences of the entry, establishment and spread of *B. carambolae* and *B. dorsalis* in Australia are similar to those in the previously assessed pathways. The overall consequences in the previous assessments were assessed as High. The overall consequences for *B. carambolae* and *B. dorsalis* on the mangosteen fruit from Malaysia pathway are also assessed as **High**.

3.4.5 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 shown in Table A.4.

Unrestricted risk estimate for <i>Bactrocera carambolae</i> and <i>Bactrocera dorsalis</i>	
Overall likelihood of entry, establishment and spread	Very Low
Consequences	High
Unrestricted risk	Low

The URE for *B. carambolae* and *B. dorsalis* on the mangosteen fruit from Malaysia pathway is assessed as **Low**, which does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for these 2 species of fruit flies on this pathway.

3.5 Hard scales

***Aspidiotus excisus* (GP), *Aspidiotus rigidus* (GP), *Chrysomphalus dictyospermi* (GP, WA), *Ischnaspis longirostris* (GP, WA) and *Pseudaonidia trilobitiformis* (GP, WA)**

Five hard scale insect species were identified on the mangosteen fruit from Malaysia pathway as quarantine pests for Australia: *Aspidiotus excisus*, *Aspidiotus rigidus*, *Chrysomphalus dictyospermi*, *Ischnaspis longirostris* and *Pseudaonidia trilobitiformis* (Table 3.2).

Aspidiotus excisus and *Aspidiotus rigidus* are not known to be present in Australia and are therefore quarantine pests for all of Australia. *Chrysomphalus dictyospermi*, *I. longirostris* and *P. trilobitiformis* are not present in Western Australia and are assessed as regional quarantine pests for that state.

The indicative likelihood of entry for all quarantine hard scale species is assessed in the scales Group PRA as Moderate (DAWE 2021), which is comprised of indicative likelihoods of importation and distribution of High and Moderate, respectively.

Aspidiotus excisus, *A. rigidus*, *C. dictyospermi*, *I. longirostris* and *P. trilobitiformis* are reported from Malaysia and have been associated with mangosteen fruit (Chen, Wong & Wu 2014; García Morales et al. 2026; USDA-APHIS 2006; Watson et al. 2015). Due to their small size and the protective structure of the mangosteen fruit calyx, some hard scales may not be detected and removed during packing house processes, such as sorting, cleaning and grading. Any hard scales present on the fruit are likely to survive storage and transport conditions and be distributed through retail sale to multiple destinations in the PRA area. Entry into the external environment may occur through the disposal of infested fruit. Given their moderate to wide host range, first instar crawlers present on discarded fruit could disperse to a new host.

After assessment of relevant pathway-specific factors (explained in sections A2.6 and A2.7) for mangosteen fruit from Malaysia, the likelihood of entry of Moderate was verified as appropriate for these scale species on this pathway (Table 3.2).

Table 3.2 Quarantine scale insect species for mangosteen fruit from Malaysia

Pest	In scales Group PRA	Quarantine pest	On mangosteen fruit pathway	Likelihood of entry
<i>Aspidiotus excisus</i>	Yes	Yes	Yes	Moderate
<i>Aspidiotus rigidus</i>	Yes	Yes	Yes	Moderate
<i>Chrysomphalus dictyospermi</i>	Yes	Yes (WA)	Yes	Moderate
<i>Ischnaspis longirostris</i>	Yes	Yes (WA)	Yes	Moderate
<i>Pseudaonidia trilobitiformis</i>	Yes	Yes (WA)	Yes	Moderate

WA: Regional quarantine pest for Western Australia.

As explained in sections A2.6 and A2.7, the risk factors considered in the likelihoods of establishment and spread, and the potential consequences associated with a pest species, are independent of the import pathway. Therefore, the assessments for the likelihood of establishment (High) and spread (High) and the potential consequences (Low) have been adopted from the scales Group PRA.

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

Table 3.3 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 scales Group PRA, the indicative URE for hard scales is **Low** (Table 3.3), which does not achieve the ALOP for Australia. This indicative URE is considered to be applicable for the quarantine hard scales species present on the mangosteen fruit from Malaysia pathway. Therefore, specific risk management measures are required for the quarantine hard scales on this pathway.

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

3.6 Mealybugs

***Dysmicoccus lepelleyi* (GP), *Dysmicoccus neobrevipes* (GP), *Exallomochlus hispidus* (GP), *Hordeolicoccus heterotrichus* (GP), *Paracoccus interceptus* (GP), *Paraputo odontomachi* (GP), *Planococcus lilacinus* (GP), *Planococcus minor* (GP, WA), *Pseudococcus aurantiacus* (GP), *Pseudococcus cryptus* (GP, WA) and *Rastrococcus spinosus* (GP)**

Eleven mealybug species were identified on the mangosteen fruit from Malaysia pathway as a quarantine pest for Australia: *Dysmicoccus lepelleyi*, *Dysmicoccus neobrevipes*, *Exallomochlus hispidus*, *Hordeolicoccus heterotrichus*, *Paracoccus interceptus*, *Paraputo odontomachi*, *Planococcus lilacinus*, *Planococcus minor*, *Pseudococcus aurantiacus*, *Pseudococcus cryptus* and *Rastrococcus spinosus* (Table 3.4).

Dysmicoccus lepelleyi, *D. neobrevipes*, *E. hispidus*, *H. heterotrichus*, *P. interceptus*, *P. odontomachi*, *P. lilacinus*, *P. aurantiacus* and *R. spinosus* are not known to be present in Australia and are therefore quarantine pests for all of Australia. *Planococcus minor* and *P. cryptus* are not present in Western Australia and are assessed as regional quarantine pests for that state.

The indicative likelihood of entry for all quarantine mealybugs is assessed in the mealybugs Group PRA as Moderate (DAWR 2019), which is comprised of indicative likelihoods of importation and distribution of High and Moderate, respectively.

Dysmicoccus lepelleyi, *Dysmicoccus neobrevipes*, *Exallomochlus hispidus*, *Hordeolicoccus heterotrichus*, *Paracoccus interceptus*, *Paraputo odontomachi*, *Planococcus lilacinus*, *Planococcus minor*, *Pseudococcus aurantiacus*, *Pseudococcus cryptus* and *Rastrococcus spinosus* are reported from Malaysia and are associated with mangosteen fruit (Ben-Dov 1994; García Morales et al. 2026; Williams 2004). Due to their small size and the protective structure of the mangosteen fruit calyx, some mealybugs may not be detected and removed during packing house processes, such as sorting, cleaning and grading. Any mealybugs present on the fruit are likely to survive storage and transport conditions and be distributed through retail sale to multiple destinations in the PRA area. Entry into the external environment may occur through the disposal of infected fruit. Given these mealybug species have a wide host range, first instar crawlers present on discarded fruit could disperse to a new host.

After assessment of relevant pathway-specific factors (explained in sections A2.6 and A2.7) for mangosteen fruit from Malaysia, the likelihood of entry of Moderate was verified as appropriate for these mealybug species on this pathway (Table 3.4).

Table 3.4 Quarantine mealybug species for mangosteen fruit from Malaysia

Pest	In mealybugs Group PRA	Quarantine pest	On mangosteen fruit pathway	Likelihood of entry
<i>Dysmicoccus lepelleyi</i>	Yes	Yes	Yes	Moderate
<i>Dysmicoccus neobrevipes</i>	Yes	Yes	Yes	Moderate
<i>Exallomochlus hispidus</i>	Yes	Yes	Yes	Moderate
<i>Hordeolicoccus heterotrichus</i>	Yes	Yes	Yes	Moderate
<i>Paracoccus interceptus</i>	Yes	Yes	Yes	Moderate
<i>Paraputo odontomachi</i>	Yes	Yes	Yes	Moderate

Pest risk assessments for quarantine pests

<i>Planococcus lilacinus</i>	Yes	Yes	Yes	Moderate
<i>Planococcus minor</i>	Yes	Yes (WA)	Yes	Moderate
<i>Pseudococcus aurantiacus</i>	Yes	Yes	Yes	Moderate
<i>Pseudococcus cryptus</i>	Yes	Yes (WA)	Yes	Moderate
<i>Rastrococcus spinosus</i>	Yes	Yes	Yes	Moderate

WA: Regional quarantine pest for Western Australia.

As explained in sections A2.6 and A2.7, the risk factors considered in the likelihoods of establishment and spread, and the potential consequences associated with a pest species, are independent of the import pathway. Therefore, the assessments for the likelihood of establishment (High) and spread (High) and the potential consequences (Low) have been adopted from the scales Group PRA.

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

Table 3.5 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 3.5), which does not achieve the ALOP for Australia. This indicative URE is considered to be applicable for the quarantine mealybugs species present on the mangosteen fruit from Malaysia pathway. Therefore, specific risk management measures are required for the quarantine mealybugs 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 mealybugs on this pathway.

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

3.7 Dolichoderine ants

***Dolichoderus thoracicus* (EP) and *Technomyrmex butteli* (EP)**

Dolichoderus thoracicus and *Technomyrmex butteli* belong to the subfamily Dolichoderinae in the family Formicidae. Dolichoderine ants belong to a large subfamily that includes over 850 described species (AntWiki 2026). They are noted for their chemical defences and behavioural dominance in ant communities and consist of some of the world's most successful invasive species (Ward et al. 2010), including multiple *Technomyrmex* species.

While *D. thoracicus* and *T. butteli* are not considered plant pests, they are associated with honeydew-producing Hemiptera present on mangosteen fruit and both species have been intercepted on mangosteen imported into Australia. Both species have also been found occasionally nesting underneath the calyx of mangosteen fruit (Biosecurity Australia 2003; Sugiarto 2019).

Dolichoderus thoracicus and *T. butteli* are not known to be present in Australia and are therefore quarantine pests for all of Australia.

These ants have been grouped together in this assessment as they have common biological characteristics and are considered to pose a similar risk. In this assessment, the term 'dolichoderine ants' is used to refer to both species. The scientific name is used when the information relates to specific species.

Dolichoderus thoracicus is widely distributed throughout East and Southeast Asia with a geographic range extending from China to Indonesia, including Malaysia (AntWeb 2026). *Technomyrmex butteli* has been reported from Indonesia, Thailand and Malaysia (AntWeb 2026).

Dolichoderine ants have 4 life stages: egg, larva, pupa and adult. Adult dolichoderine ants are general scavengers and are known to protect and collect food from honeydew-producing Hemiptera, such as mealybugs and soft scale insects (AntWiki 2026; Shattuck & Marsden 2013). While ants typically nest in the soil, dolichoderine ants can nest in a variety of other locations including under rocks, in termite mounds, inanimate objects and within rotten and living wood, including mangosteen trees (AntWiki 2026; Wang et al. 2022). Members of this subfamily have been observed using organic material such as plant fibres to construct nests (Shattuck & Barnett 2001a), including under the calyx of mangosteen fruit (Biosecurity Australia 2003; Sugiarto 2019). Queens of the genera *Dolichoderus* and *Technomyrmex* are capable of forming colonies without worker ants and can survive for up to 6 months without feeding, provided moisture is present (Shattuck, 2003, pers. comm.). Due to the ability for these genera to nest on mangosteen fruit, it is possible that all life stages, including fertile queens, may be present on mangosteens imported from Malaysia.

Technomyrmex butteli and an unspecified species of the genus *Dolichoderus* were previously assessed within the group 'black ants' in the existing policy for mangosteens from Thailand (DAFF 2004). The existing policy for mangosteens from Indonesia (DAFF 2012b) assessed several ant genera together under the group 'ants', which included *Dolichoderus* and *Technomyrmex*. In those policies, the URE for *Dolichoderus* spp., *Technomyrmex* spp. and *T. butteli* was assessed as not achieving the ALOP for Australia. Therefore, specific risk management measures are required for dolichoderine ants on those pathways. The existing policy for mangosteen fruit from Thailand assesses *Technomyrmex butteli* and *Dolichoderus* sp., whereas the policy for mangosteens from Indonesia is a

higher-level assessment of several ant genera. Therefore, the assessment for mangosteens from Thailand is considered the most applicable to this assessment.

The assessment for dolichoderine ants on mangosteen fruit from Malaysia builds on the previous assessment of 'black ants' on mangosteens from Thailand. However, there may be differences in the commercial production practices, climatic conditions and pest prevalence between the mangosteen from Thailand pathway, and mangosteen fruit from Malaysia pathway. These potential differences make it necessary to re-assess the likelihood that dolichoderine ants will arrive in Australia in a viable state on the mangosteen fruit from Malaysia pathway.

Previous assessments for *Dolichoderus* spp. and *T. butteli* in the existing policies rated the likelihood of distribution as High.

Mangosteen fruit from Malaysia are expected to be distributed in Australia in a similar way to the previously assessed pathway for mangosteen fruit from Thailand. Mangosteen fruit are likely to be distributed to various destinations in Australia for sale. 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. Most fruit waste would be generally disposed of via municipal waste facilities, reducing the risk of dolichoderine ants distributing to a suitable nesting site. However, a small quantity may be discarded in the environment. Any dolichoderine ants present in discarded mangosteen fruit may disperse to a suitable nesting site, as adult dolichoderine ants are highly mobile (AntWiki 2026). Dolichoderine ants are generalists with the ability to nest in a wide array of substrates, meaning there will be suitable nesting sites present year-round in Australia. Ants of both genera are also already present in Australia, indicating that the climate is suitable for their establishment, particularly in tropical and subtropical areas. Therefore, the time of year when importation occurs will not affect the likelihood of distribution for these pests. On this basis, the same rating of High for the likelihood of distribution for dolichoderine ants in the previous assessment for mangosteens from Thailand is adopted for the mangosteen fruit from Malaysia pathway.

The likelihoods of establishment and spread of dolichoderine ants in Australia from the mangosteen fruit from Malaysia pathway have also been assessed as similar to those of the previous assessments of Moderate 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 dolichoderine ants 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 dolichoderine ants in previous assessments have been adopted for the mangosteen fruit from Malaysia pathway.

In addition, the department has reviewed the latest literature—for example, Mani (2022); Prabphal (2017); Sugiarto (2019) and Wang et al. (2022). No new information has been identified that would significantly change the risk ratings for distribution, establishment, spread and consequences as set out for dolichoderine ants in the existing policies.

The risk scenario of biosecurity concern is dolichoderine ant eggs, larvae, pupae, adult workers, reproductive queens or entire nests may be present under the calyx of mangosteen fruit imported from Malaysia, which may result in the establishment and spread of these pests in Australia.

3.7.1 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 *D. thoracicus* and *T. butteli* will arrive in Australia in a viable state with the importation of mangosteen fruit from Malaysia is assessed as: **High**.

The likelihood of importation is assessed as High because *D. thoracicus* and *T. butteli* are present in Malaysia and associated with mangosteen fruit. Commercial mangosteen production and post-harvest practices in Malaysia are likely to reduce dolichoderine ant populations in the field and therefore on the fruit. However, some ants, including fertile queens, may remain undetected by sheltering under the calyx. Such individuals are likely to survive storage and transport conditions, as evidenced by interceptions of live ants on mangosteen fruit imports globally.

The following information provides supporting evidence for this assessment.

Both *Technomyrmex butteli* and *Dolichoderus thoracicus* are present in Malaysia and associated with mangosteen fruit.

- Both *D. thoracicus* and *T. butteli* are native to Malaysia (Economo & Guénard 2020).
- Populations of dolichoderine ants have been observed in mangosteen farms (Biosecurity Australia 2003; Prabphal & Khachonpisitsak 2017).
 - Dolichoderine ants of the genus *Dolichoderus* and *Technomyrmex* often associate with, or forage from, honeydew-producing Hemiptera present on mangosteen fruit (AntWiki 2026; Shattuck & Marsden 2013).

Commercial in-field production practices in Malaysia are likely to reduce the prevalence of dolichoderine ants in the field and, consequently, on the fruit. However, they do not eliminate ants entirely, and some could still be present on mangosteen fruit during harvest.

- Mangosteen fruit produced for export are managed under IPM and myGAP practices to control pests, including ants.
- If ant nests are detected either on the mangosteen tree or in the soil, they are sprayed with pesticides and where possible, removed. This reduces pest pressure and decreases the likelihood of ants being present on fruit.
- During the fruiting season, underbrush and ground cover is removed from beneath mangosteen trees, reducing the cover available for ants to shelter beneath and making any nests easier to find.
- Ants sheltering under the calyx may remain there during harvest, and be transported to the packing house.
 - The calyx of mangosteen fruit is made up of four thick sepals, which remain attached to the fruit through maturation and harvest (Choehom, Ketsa & van Doorn 2003).

- Ants of the genera *Dolichoderus* and *Technomyrmex* are known to shelter under the calyx of mangosteen fruit (Biosecurity Australia 2003).
- Both *D. thoracicus* and *T. butteli* have been observed forming nests under the calyx of mangosteen fruit (Biosecurity Australia 2003; Sugiarto 2019).

Commercial post-harvest cleaning practices are likely to reduce the prevalence of dolichoderine ants on mangosteen fruit at the packing house. However, the structure of mangosteen fruit makes it difficult to completely eliminate the ants.

- Species of *Dolichoderus* and *Technomyrmex* are medium-sized ants, ranging from 3–4.5 mm (AntWiki 2026). Further, their bodies are predominantly dark in colour (AlHajri 2021; AntWiki 2026; Hsu et al. 2022), which makes them visually distinct against the skin of mangosteen fruit at the colour index stages at which harvest generally occurs. Ants located on the surface of fruit are therefore likely to be easily detected.
- Dolichoderine ants are highly mobile and disperse readily when disturbed (Halley & Elgar 2001). Therefore, cleaning practices are likely to dislodge dolichoderine ants on the surface of mangosteen fruit, facilitating their effective removal.
- However, ants that hide and/or nest under the calyx may not be easily detected using visual inspection, and may persist on fruit despite the application of cleaning techniques.

Dolichoderine ants are likely to survive storage and transport conditions and arrive in Australia in a viable state on mangosteen fruit.

- Mangosteen fruit are usually stored and transported at 10°C to 12°C.
 - Although ants of these genera are commonly found in tropical regions, their distribution includes temperate regions with temperatures that fall below those used for storage and transport (Shattuck & Barnett 2001a, b), suggesting a capacity to survive these conditions.
- *Dolichoderus thoracicus* is often intercepted in China on imported mangosteen fruit (Yang et al. 2019). Yang et al. (2019) reported that 99.5% of exotic ants intercepted at seaports were associated with mangosteen fruit, with the most common species being *D. thoracicus*.
- *Dolichoderus thoracicus* and ants of the genus *Technomyrmex* have also been intercepted multiple times in Australia on imported mangosteen fruit.
 - These interceptions have included all life stages, including eggs, larvae, pupae and adults which suggests that all life stages can survive storage and transportation.
- Ant queens of both genera are capable of forming a colony without worker ants and can survive for up to six months without feeding, as long as moisture is present (Shattuck, 2003, pers. Comm). Therefore, if a queen is present on exported mangosteen fruit, it would be likely to survive storage and transport conditions and arrive in a viable state.

For the reasons outlined, the likelihood of importation of *D. thoracicus* and *T. butteli* on imported mangosteen fruit from Malaysia is assessed as High.

Likelihood of distribution

The likelihood that *D. thoracicus* and *T. butteli* will be distributed within Australia in a viable state as a result of the processing, sale or disposal of mangosteen fruit from Malaysia, and subsequently transfer to a susceptible part of a host is likely to be similar to the dolichoderine ants previously assessed on the mangosteen from Thailand pathway. The same rating of **High** for the likelihood of

distribution for these dolichoderine ants in the previous assessment is adopted for mangosteen fruit from Malaysia.

Overall likelihood of entry

The overall 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.

3.7.2 Likelihoods of establishment and spread

The likelihoods of establishment and spread for *D. thoracicus* and *T. butteli* are independent of the import pathway and are considered similar to those in the previously assessed pathway.

Based on the existing import policy for mangosteens from Thailand, the likelihoods of establishment and spread for dolichoderine ants are assessed as **Moderate** and **High**, respectively.

3.7.3 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 *D. thoracicus* and *T. butteli* will enter Australia as a result of trade in mangosteen fruit from Malaysia, 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**.

3.7.4 Consequences

The potential consequences of the entry, establishment and spread of *D. thoracicus* and *T. butteli* in Australia are similar to those in the previous assessment for dolichoderine ants on the mangosteen from Thailand pathway. The overall consequences in the previous assessment were assessed as Low. The overall consequences for *D. thoracicus* and *T. butteli* on the mangosteen fruit from Malaysia pathway are also assessed as **Low**.

3.7.5 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 shown in Table A.4.

Unrestricted risk estimate for <i>Dolichoderus thoracicus</i> and <i>Technomyrmex butteli</i>	
Overall likelihood of entry, establishment and spread	Moderate
Consequences	Low
Unrestricted risk	Low

The URE for *Dolichoderus thoracicus* and *Technomyrmex butteli* on the mangosteen fruit from Malaysia pathway is assessed as **Low**, which does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for these dolichoderine ants on this pathway.

3.8 Thrips

Scirtothrips hitam (GP)

One thrips species was identified on the mangosteen fruit from Malaysia pathway as a quarantine pest for Australia: *Scirtothrips hitam* (Table 3.6).

Scirtothrips hitam is not known to be present in Australia and is therefore a quarantine pest for all of Australia.

The indicative likelihood of entry for all quarantine thrips is assessed in the thrips Group PRA as Moderate (DAWR 2017), which is comprised of indicative likelihoods of importation and distribution of High and Moderate, respectively.

Scirtothrips hitam is reported from Malaysia and is associated with mangosteen fruit (Ng, Mound & Azidah 2014). Due to their small size and the protective structure of the mangosteen fruit calyx, some thrips may not be detected and removed during packing house processes such as sorting, cleaning and grading. Any *S. hitam* present on the fruit are likely to survive storage and transport conditions and be distributed through retail sale to multiple destinations in the PRA area. Entry into the external environment may occur through the disposal of infected fruit. Given *S. hitam* has a moderate host range, nymphs and adults present on discarded fruit could disperse to a new host.

After assessment of relevant pathway-specific factors (explained in sections A2.6 and A2.7) for mangosteen fruit from Malaysia, the likelihood of entry of Moderate was verified as appropriate for this thrips species on this pathway (Table 3.6).

Table 3.6 Quarantine thrips species for mangosteen fruit from Malaysia

Pest	In thrips Group PRA	Quarantine pest	On mangosteen fruit pathway	Likelihood of entry
<i>Scirtothrips hitam</i>	No	Yes	Yes	Moderate

As explained in sections A2.6 and A2.7, the risk factors considered in the likelihoods of establishment and spread, and the potential consequences associated with a pest species, are independent of the import pathway. Therefore, the assessments for the likelihood of establishment (High) and spread (High) and the potential consequences (Low) have been adopted from the scales Group PRA.

A summary of the risk assessment for 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 quarantine 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 mangosteen fruit from Malaysia pathway. Therefore, specific risk management measures are required for the quarantine thrips on this pathway.

This risk assessment, which is based on the thrips Group PRA, applies to all phytophagous quarantine thrips on the mangosteen fruit from Malaysia pathway, irrespective of their specific identification in this document. This is explained in section A2.7.

3.9 Pest risk assessment conclusions

Likelihood ratings and the consequences estimate for individual quarantine pests are set out in Table 3.8.

Of the 21 pests for which a further pest risk assessment was conducted:

- The UREs for the 21 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:
 - carambola fruit fly (*Bactrocera carambolae*)
 - oriental fruit fly (*Bactrocera dorsalis*)
 - cyanotis scale (*Aspidiotus excisus*)
 - rigid coconut scale (*Aspidiotus rigidus*)
 - dictyospermum scale (*Chrysomphalus dictyospermi*)
 - black thread scale (*Ischnaspis longirostris*)
 - trilobite scale (*Pseudaonidia trilobitiformis*)
 - Anonna mealybug (*Dysmicoccus lepelleyi*)
 - grey pineapple mealybug (*Dysmicoccus neobrevipes*)
 - cocoa mealybug (*Exallomochlus hispidus*)
 - citrus mealybug (*Hordeolicoccus heterotrichus*)
 - intercepted mealybug (*Paracoccus interceptus*)
 - mealybug (*Paraputo odontomachi*)
 - coffee mealybug (*Planococcus lilacinus*)
 - Pacific mealybug (*Planococcus minor*)
 - orange-coloured mealybug (*Pseudococcus aurantiacus*)
 - cryptic mealybug (*Pseudococcus cryptus*)
 - mango mealybug (*Rastrococcus spinosus*)
 - cocoa black ant (*Dolichoderus thoracicus*)
 - black ant (*Technomyrmex butteli*)
 - thrips (*Scirtothrips hitam*)

An overview of the decision process for the pest risk assessment for mangosteen fruit from Malaysia is presented in Figure 3.1.

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Pest risk assessments for quarantine pests

Table 3.8 Pest risk assessment conclusions for pests, and pest groups, associated with the pathway of mangosteen fruit from Malaysia

Pest name	Likelihood of						Consequences	URE
	Importation	Distribution	Entry	Establishment	Spread	EES		
Fruit flies [Diptera: Tephritidae]								
<i>Bactrocera carambolae</i> (EP)	Very Low	High	Very Low	High	High	Very Low	High	Low
<i>Bactrocera dorsalis</i> (EP)	Very Low	High	Very Low	High	High	Very Low	High	Low
Hard scales [Hemiptera: Diaspididae]								
<i>Aspidiotus excisus</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Aspidiotus rigidus</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Chrysomphalus dictyospermi</i> (GP, WA)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Ischnaspis longirostris</i> (GP, WA)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Pseudaonidia trilobitiformis</i> (GP, WA)	High	Moderate	Moderate	High	High	Moderate	Low	Low
Mealybugs [Hemiptera: Pseudococcidae]								
<i>Dysmicoccus lepelleyi</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Dysmicoccus neobrevipes</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Exallomochlus hispidus</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Hordeolicoccus heterotrichus</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Paracoccus interceptus</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Paraputo odontomachi</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Planococcus lilacinus</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Planococcus minor</i> (GP, WA)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Pseudococcus aurantiacus</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Pseudococcus cryptus</i> (GP, WA)	High	Moderate	Moderate	High	High	Moderate	Low	Low
<i>Rastrococcus spinosus</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low
Dolichoderine ants [Hymenoptera: Formicidae]								
<i>Dolichoderus thoracicus</i> (EP)	High	High	High	Moderate	High	Moderate	Low	Low

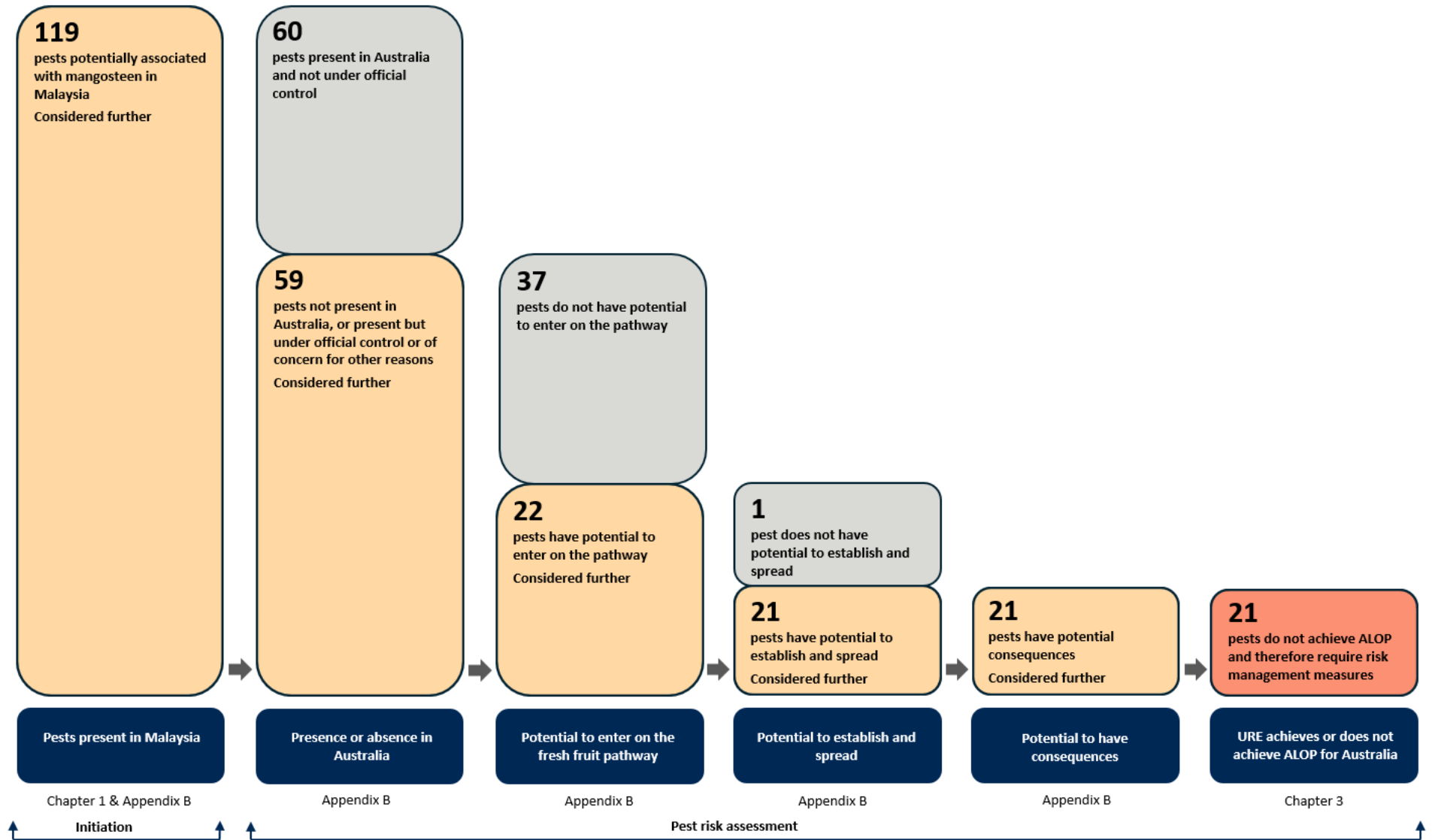
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Pest risk assessments for quarantine pests

Pest name	Likelihood of						Consequences	URE
	Importation	Distribution	Entry	Establishment	Spread	EES		
<i>Technomyrmex butteli</i> (EP)	High	High	High	Moderate	High	Moderate	Low	Low
Thrips [Thysanoptera: Thripidae]								
<i>Scirtothrips hitam</i> (GP)	High	Moderate	Moderate	High	High	Moderate	Low	Low

EP: Species has been assessed previously and import policy already exists. **GP:** Species has been assessed previously in a Group PRA, and the Group policy has been applied. **WA:** Regional quarantine pest for Western Australia. **EES:** Overall likelihood of entry, establishment and spread. **URE:** Unrestricted risk estimate.

Figure 3.1 Overview of the decision process for the pest risk assessment for mangosteen fruit from Malaysia



4 Pest risk management

Pest risk management evaluates and selects options for measures for quarantine pests identified, in Chapter 3, as posing biosecurity risks that do not achieve the ALOP for Australia. This chapter proposes specific risk management measures for those quarantine pests (section 4.1). It also proposes 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 to achieve the ALOP for Australia. The specific measures and operational system build on, formalise and strengthen the commonly applied commercial production practices for mangosteen fruit in Malaysia, as described in section 2.1, as these practices have been considered in the pest risk assessments presented in Chapter 3.

4.1 Pest risk management measures and phytosanitary procedures

Section 4.1.1 provides an overview of the proposed measures and section 4.1.2 outlines the measures for specific pests or pest groups.

4.1.1 Overview of proposed measures

The department has established specific risk management measures for the pests or pest groups assessed in Chapter 3 as posing biosecurity risks that do not achieve the ALOP for Australia. These measures have been determined by the department to be effective in mitigating the biosecurity risk of the pests or pest groups to achieve the ALOP for Australia for the same, or similar, commodities from other countries. There is no available information to suggest that these measures will not manage the biosecurity risk of the pests or pest groups associated with mangosteen fruit from Malaysia to achieve the ALOP for Australia. Therefore, the established measures are proposed for the pests or pest groups associated with mangosteen fruit from Malaysia as described in section 4.1.2.

It is important to note that multiple risk management measure options are proposed in section 4.1.2 for each pest or pest group. DOA will need to propose which option(s) it intends to use, and provide evidence to the department as to how the requirements of the selected option(s) will be met.

In addition, DOA may propose alternative options, i.e., different from those proposed in section 4.1.2. If this occurs, the department is obliged to consider the alternative option(s) in line with the principle of equivalence as outlined in section 4.1.3.

When reviewing risk management measures proposed by DOA, the department will ensure that the proposal aligns with the relevant ISPMs (as specified in section 4.1.2).

Before trade can commence, the department will require assurance that Malaysia has appropriate systems in place to effectively apply all the required phytosanitary measures in accordance with Australia's requirements. The department obtains assurance via a range of activities, including an assessment of the exporting country's historic compliance, desk and/or site audit, and bilateral agreements.

Following trade commencement, the department monitors trade performance on an ongoing basis as part of its assurance program and will take appropriate action where non-compliance is identified (see also section 4.2.8). The department also regularly monitors for new scientific information and

will review its import policy if there is information to suggest that the biosecurity risk associated with mangosteen fruit from Malaysia has changed, or where alternative risk management options become available (see also section 4.4.2).

4.1.2 Risk management measures for quarantine pests associated with mangosteen fruit from Malaysia

Proposed specific risk management measures for the 21 quarantine pests associated with mangosteen fruit from Malaysia are listed in Table 4.1.

Table 4.1 Proposed risk management measures for quarantine pests potentially associated with mangosteen fruit from Malaysia

Pest/pest group	Scientific name	Common name	Measures
Fruit flies [Diptera: Tephritidae]	<i>Bactrocera carambolae</i> [EP]	carambola fruit fly	PFA, PFPP or PFPS a
	<i>Bactrocera dorsalis</i> [EP]	oriental fruit fly	OR Non-host status, ensured by fruit quality and maturity requirements OR Fruit treatment considered effective against all life stages of <i>B. carambolae</i> and <i>B. dorsalis</i> , such as irradiation
Hard scales [Hemiptera: Diaspididae]	<i>Aspidiotus excisus</i> [GP]	cyanotis scale	Fruit treatment considered effective against all life stages of hard scales, such as methyl bromide fumigation or irradiation OR Systems approach approved by the department
	<i>Aspidiotus rigidus</i> [GP]	rigid coconut scale	
	<i>Chrysomphalus dictyospermi</i> [GP, WA]	dictyospermum scale	
	<i>Ischnaspis longirostris</i> [GP, WA]	black thread scale	
	<i>Pseudaonidia trilobitiformis</i> [GP, WA]	trilobite scale	
Mealybugs [Hemiptera: Pseudococcidae]	<i>Dysmicoccus lepelleyi</i> [GP]	Annona mealybug	Fruit treatment considered effective against all life stages of mealybugs, such as methyl bromide fumigation or irradiation OR Systems approach approved by the department
	<i>Dysmicoccus neobrevipes</i> [GP]	grey pineapple mealybug	
	<i>Exallomochlus hispidus</i> [GP]	cocoa mealybug	
	<i>Hordeolicoccus heterotrichus</i> [GP]	citrus mealybug	
	<i>Paracoccus interceptus</i> [GP]	intercepted mealybug	
	<i>Paraputo odontomachi</i> [GP]	mealybug	
	<i>Planococcus lilacinus</i> [GP]	coffee mealybug	
	<i>Planococcus minor</i> [GP, WA]	Pacific mealybug	
	<i>Pseudococcus aurantiacus</i> [GP]	orange-coloured mealybug	
	<i>Pseudococcus cryptus</i> [GP, WA]	cryptic mealybug	
	<i>Rastrococcus spinosus</i> [GP]	mango mealybug	
Dolichoderine ants	<i>Dolichoderus thoracicus</i> [EP]	cocoa black ant	

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Pest risk management

Pest/pest group	Scientific name	Common name	Measures
	<i>Technomyrmex butteli</i> [EP]	black ant	Fruit treatment considered effective against all life stages of <i>D. thoracicus</i> and <i>T. butteli</i> , such as methyl bromide fumigation or irradiation OR Systems approach approved by the department
Thrips [Thysanoptera: Thripidae]	<i>Scirtothrips hitam</i> [GP]	thrips	Fruit treatment considered effective against all life stages of thrips, such as methyl bromide fumigation or irradiation OR Systems approach approved by the department

a: PFA is a pest free area; **PFPP** is a pest free place of production; **PFPS** is a pest free production site. **EP:** Species has been assessed previously and import policy already exists. **GP:** Species has been assessed previously in a Group PRA, and the Group policy has been applied. **WA:** Regional quarantine pest for Western Australia.

The Australian Government Department of Agriculture, Fisheries and Forestry (the department) proposes the following specific risk management measures for the identified quarantine pests on the mangosteen fruit from Malaysia pathway:

- for fruit flies
 - pest free areas, pest free places of production or pest free production sites, or
 - non-host status, ensured by fruit quality and maturity requirements, or
 - fruit treatment considered effective against *B. carambolae* and *B. dorsalis*, such as irradiation.
- for hard scales, mealybugs, dolichoderine ants and thrips
 - fruit treatment considered effective against these pests, such as methyl bromide fumigation or irradiation, or
 - a systems approach considered to be effective in mitigating the risk of these pests on mangosteen fruit from Malaysia and approved by the department.

Measures for fruit flies

For the fruit flies *Bactrocera carambolae* and *B. dorsalis*, the department proposes the options of pest free areas, pest free places of production or pest free production sites, non-host status, ensured by fruit quality and maturity requirements, or fruit treatment considered to be effective against all life stages associated with mangosteen fruit, such as irradiation. The objective of each proposed 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.

Option 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 2024a) and, more specifically, ISPM 26: *Establishment of pest free areas for fruit flies (Tephritidae)* (FAO 2026d). 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 2026d). In the event of the detection of any fruit fly species of economic importance in the identified PFA, PFPP or PFPS, DOA would be required to notify the department within 48 hours of detection. The department would then assess the species, number of flies and specific information on individual flies detected (such as life stage, sex and gravidity if female), and the circumstances of the detection before advising DOA 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 Malaysia wish to use PFA, PFPP or PFPS as a measure to manage the risk posed by fruit flies on the mangosteen fruit from Malaysia pathway, DOA would need to provide a submission to the department for consideration, demonstrating the establishment of the proposed measures. The submission demonstrating PFA must fulfil requirements as set out in ISPM 4 (FAO 2024a) and ISPM 26 (FAO 2026d), 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.

Option 2: Non-host status, ensured by fruit quality and maturity requirements

Studies show that mangosteen is a conditional host of *B. carambolae* and *B. dorsalis*, consistent with ISPM 37: *Determination of host status of fruit to fruit flies (Tephritidae)* (FAO 2024b). Fruit flies are only able to infest mangosteen fruit where the pericarp is damaged to the extent the aril is exposed (Unahawutti et al. 2014). Fruit fly eggs laid in immature mangosteen fruit (i.e., at maturity stages where the skin still contains latex) are unable to survive, even if the fruit pericarp is damaged (Unahawutti & Oonthonglang 2002).

All consignments of mangosteen fruit for export to Australia must contain undamaged fruit at colour maturity index stage 2–3 at the time of pre-export phytosanitary inspection, as mangosteen fruit in this condition are considered to be non-hosts of *B. carambolae* and *B. dorsalis* (DOA Malaysia 2004; Unahawutti et al. 2014).

Should Malaysia wish to use non-host status as a measure to manage the risk posed by fruit flies on the mangosteen fruit from Malaysia pathway, DOA would need to provide a submission to the department for consideration, demonstrating that processes are in place to ensure that only undamaged fruit of maturity index stages 2–3 are packed for export to Australia. Compliance with these processes would be verified through pre-export phytosanitary inspection, in accordance with ISPM 23: *Guidelines for inspection* (FAO 2019d).

Option 3: Fruit treatment

Fruit treatment known to be effective against all life stages of fruit flies associated with fruit, such as irradiation, applied pre-export may be used as a phytosanitary measure for *B. carambolae* and *B. dorsalis*.

The department considers irradiation to be an effective treatment for *B. carambolae* and *B. dorsalis* on the mangosteen fruit from Malaysia pathway. The requirements for using irradiation as a phytosanitary measure are set out in ISPM 18: *Requirements for the use of irradiation as a phytosanitary measure* (FAO 2026c). 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. Irradiation dose rates up to a maximum of 1000 Gy are permitted for quarantine purposes for fresh fruit and vegetables, including mangosteen fruit, by Food Standards Australia New Zealand (FSANZ 2021).

The department proposes a treatment schedule of 150 Gy minimum absorbed dose, consistent with ISPM 28 Annex 7: *Irradiation treatment for fruit flies of the family Tephritidae (generic)* (FAO 2021b) for *B. carambolae* and *B. dorsalis*.

The use of irradiation as a phytosanitary measure is subject to the department's approval of the irradiation facilities identified by DOA. Should Malaysia wish to use irradiation as a phytosanitary measure, DOA would need to provide a submission to the department. The submission must fulfil requirements as set out in ISPM 18 (FAO 2026c).

The department recognises other fruit treatments, such as heat (e.g., vapour heat treatment), cold or fumigation, may also be effective treatments against *B. carambolae* and *B. dorsalis* on the mangosteen fruit from Malaysia pathway. The use of any such treatment option is subject to its approval by the department as an efficacious measure against *B. carambolae* and *B. dorsalis*. Should Malaysia wish to propose a treatment option, DOA would need to provide a submission to the department for consideration. This submission will need to include suitable information to support the claimed efficacy of the treatment to manage *B. carambolae* and *B. dorsalis* on the mangosteen fruit from Malaysia pathway.

Measures for hard scales, mealybugs, dolichoderine ants and thrips

For hard scales, mealybugs, dolichoderine ants and thrips, the department proposes the options of fruit treatment (such as methyl bromide fumigation or irradiation) or a systems approach. The objective of these proposed measures 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.

It should be noted that the risk management measure proposed by the department to manage scale insects, mealybugs and thrips on most fresh fruit import pathways is pre-export visual inspection and, if found, remedial action (DAFF 2023, 2025). However, the calyx of mangosteen fruit is thick, and forms multiple sheltered areas at the top of the fruit. Therefore, visual inspection alone is not considered to be sufficiently efficacious to detect the presence of hard scales, mealybugs and thrips on the mangosteen fruit from Malaysia pathway.

Option 1: Fruit treatment

Fruit treatment known to be effective against all life stages of hard scales, mealybugs, dolichoderine ants and thrips, such as methyl bromide fumigation or irradiation, applied pre-export may be used as a phytosanitary measure for these pests.

Methyl bromide fumigation

The department considers methyl bromide fumigation to be an effective treatment for hard scales, mealybugs, dolichoderine ants and thrips on the mangosteen fruit from Malaysia pathway. The department proposes that mangosteen fruit be fumigated prior to export for 2 hours at one of the rates specified here:

- 32 grams methyl bromide per cubic metre at a pulp temperature of 21°C or greater.
- 40 grams methyl bromide per cubic metre at a pulp temperature of 16°C to 20.9°C.
- 48 grams methyl bromide per cubic metre at a pulp temperature of 11°C to 15.9°C.
- 56 grams methyl bromide per cubic metre at a pulp temperature of 10°C to 10.9°C

The requirements for the use of fumigation as a phytosanitary measure are set out in ISPM 43: *Requirements for the use of fumigation as a phytosanitary measure* (FAO 2019e). Methyl bromide fumigation is recognised as an effective method for pest risk management when performed in an approved facility and at the specified rate recognised as effective for the target pest groups. It is advised that, where methyl bromide fumigation of fruit is adopted, it must be completed in accordance with the relevant departmental standards.

Should Malaysia wish to use methyl bromide fumigation as a phytosanitary measure, DOA would need to provide a submission to the department for consideration, demonstrating that it has processes and procedures for the registration, approval and audit of treatment facilities. The department may request on-site verification of the treatment facilities.

Irradiation

The department considers irradiation to be an effective treatment for hard scales, mealybugs, dolichoderine ants and thrips on the mangosteen fruit from Malaysia pathway. The requirements for using irradiation as a phytosanitary measure are set out in ISPM 18: *Requirements for the use of irradiation as a phytosanitary measure* (FAO 2026c). 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. Irradiation dose rates up to a maximum of 1000 Gy are permitted for quarantine purposes for fresh fruit and vegetables, including mangosteen fruit, by Food Standards Australia New Zealand (FSANZ 2021).

The department proposes a treatment schedule of 400 Gy minimum absorbed dose, consistent with the schedule recommended in the United States Department of Agriculture Treatment Manual (USDA 2026) for all insect pests except pupae and adults of the order Lepidoptera.

The use of irradiation as a phytosanitary measure is subject to the department's approval of the irradiation facilities identified by DOA. Should Malaysia wish to use irradiation as a phytosanitary measure, DOA would need to provide a submission to the department for consideration. The submission must fulfil requirements as set out in ISPM 18 (FAO 2026c).

Other fruit treatments

The department recognises other fruit treatments, such as heat (e.g., vapour heat treatment), cold or other fumigants, may also be effective treatments against hard scales, mealybugs, dolichoderine ants and thrips on the mangosteen fruit from Malaysia pathway. The use of any such treatment option is subject to its approval by the department as an efficacious measure against hard scales, mealybugs, dolichoderine ants and thrips. Should Malaysia wish to propose a treatment option, DOA would need to provide a submission to the department for consideration that includes suitable information to support the claimed efficacy of the treatment to manage hard scales, mealybugs, dolichoderine ants and thrips on the mangosteen fruit from Malaysia pathway.

Option 2: Systems approach

A systems approach integrates different risk management measures, at least 2 of which act independently, which cumulatively achieve the required level of phytosanitary protection. The requirements of a systems approach are set out in ISPM 14: *The use of integrated measures in a systems approach for risk management* (FAO 2019c).

Should Malaysia wish to use a systems approach as a measure to manage the risks posed by hard scales, mealybugs, dolichoderine ants and thrips of quarantine concern for Australia on the mangosteen fruit from Malaysia pathway, DOA will need to submit a proposal to the department for consideration. The proposal should outline all components of the system approach and provide evidence of how these components will address the risk posed by these hard scales, mealybugs, dolichoderine ants and thrips.

The department considers the following components are important for inclusion in a systems approach to manage the risks posed by hard scales, mealybugs, dolichoderine ants and thrips of quarantine concern for Australia on the mangosteen fruit from Malaysia pathway. These components are not exhaustive or definitive, and additional or alternative components may also be required and can be considered if proposed:

- registration and auditing of farms and packing houses,
- pest monitoring, preventative and management measures on the farm,
- harvest and post-harvest processes such as sorting, cleaning, grading and quality checks,
- inspection of fruit using a method appropriate for detecting pests on the skin and under the calyx,
- post-harvest safeguarding, secure handling and packing of fruit to prevent reinfestation by pests, and
- pre-export phytosanitary inspection processes and non-compliance arrangements to verify and ensure the efficacy of the systems approach.

Further details about these potential components are provided in Table C.1.

Upon receipt of a submission, the department will assess the components of the proposed system approach and whether, collectively, they effectively manage the risk of hard scales, mealybugs, dolichoderine ants and thrips of quarantine concern for Australia on the mangosteen fruit from Malaysia pathway.

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) and ISPM 24: *Guidelines for the determination and recognition of equivalence of phytosanitary measures* (FAO 2021a), the department will consider any alternative measure proposed by DOA. Alternative measures must demonstrably manage the target pests to achieve the ALOP for Australia. Evaluation of any such measure will require a technical submission from DOA 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 proposed specific risk management measures (section 4.1) are effectively applied, the phytosanitary status of mangosteen fruit from Malaysia is maintained, and these can be verified.

4.2.1 A system of traceability to source farms

The objectives of this procedure are to ensure that:

- mangosteen fruit are sourced only from farms producing commercial quality fruit
- farms from which mangosteen fruit 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 mangosteen fruit is grown/produced in an approved PFA, PFPP or PFPS, or under a systems approach, it can be verified that all fruit was sourced from the approved area, place of production or production site and produced and exported under the conditions for that pathway.

DOA must establish a system to enable traceability to where mangosteen fruit for export to Australia are sourced. DOA must ensure that export mangosteen fruit 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 or PFPS or systems approach) is used, export farms must be registered with DOA against the requirement of the measure being used. Records of registered farms and DOA audits must be kept by DOA and must be made available to the department.

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

The objectives of this procedure are to ensure that:

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

Packing houses for exporting mangosteen fruit must be registered with DOA. DOA 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 DOA audits must be kept by DOA and must be made available to the department.

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

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

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

The department provides final approval of facilities, following review of regulatory oversight provided by DOA 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 procedure are to ensure that:

- mangosteen fruit 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 2026b))
- unprocessed packaging material is not imported with mangosteen fruit from Malaysia. 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 mangosteen fruit
- all wood material associated with the consignment used in packaging and transport of mangosteen fruit complies with the department's import requirements, as published on BICON
- secure packaging is used for export of mangosteen fruit from Malaysia 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 0.16mm 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). This option is not permitted for irradiation
- **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. This option is not permitted for irradiation
- packaged mangosteen fruit from Malaysia 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 mangosteen fruit produced using a systems approach: the farm reference number and packing house reference/number
 - for mangosteen fruit where phytosanitary measures are applied at the packing house: the packing house reference/number
- where applicable, packaged mangosteen fruit from Malaysia that has undergone irradiation treatment is labelled with a statement that the mangosteen fruit 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 procedure is to ensure that the quarantine integrity of the mangosteen fruit is maintained during storage and movement.

Treated and/or inspected mangosteen fruit 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 procedure is to ensure that mangosteen fruit 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 DOA

The objective of these procedures is to ensure that Australia's import conditions have been met. All consignments of mangosteen fruit from Malaysia for export to Australia must be inspected by DOA and found free of pests of biosecurity concern for Australia. Pre-export visual inspection must be undertaken by DOA in accordance with ISPM 23: *Guidelines for inspection* (FAO 2019d) 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 2019d) 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 mangosteen fruit), 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, or as having been produced in accordance with a systems approach.

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 inspection by the Department of Agriculture, Fisheries and Forestry

The objectives of this 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 mangosteen fruit from Malaysia 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 mangosteen fruit from Malaysia 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 Uncategorized pests

If an organism that has not been categorised, including a contaminant pest, is detected on mangosteen fruit 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 Malaysia that produce mangosteen fruit 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 Malaysia has changed, or where alternative risk management or compliance-based intervention options become available.

DOA must inform the department immediately on the detection of any new pests of mangosteen fruit in Malaysia 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 Imported Food Inspection Scheme operated by the department at the border. This is a food safety risk-based inspection and testing program for verifying safety and compliance with Australia's legislative requirements for imported food. 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 1.4.1 and Schedule 19 of the Code set out the maximum residue limits for contaminants and natural toxicants in food, including imported food.

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/certification/safety-management-certificates.

Food safety requirements for food imports are published in BICON.

5 Conclusion

This draft risk analysis report was conducted to assess the proposal by Malaysia for market access to Australia for mangosteen fruit 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 draft report proposes that the importation of commercially produced mangosteen fruit to Australia from all commercial production areas of Malaysia be permitted, subject to a range of biosecurity requirements outlined in Chapter 4.

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

The department considers that the risk management measures proposed in this report will provide an appropriate level of protection against the quarantine pests identified as associated with the trade of mangosteen fruit from Malaysia.

All fresh fruit, including mangosteen fruit from Malaysia, 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 mangosteen fruit from Malaysia for human consumption. The import conditions will be communicated on BICON. The publication of import conditions on BICON is subject to Malaysia 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 of Agriculture, Fisheries and Forestry (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 2026b). A pest is 'any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products' (FAO 2026b). 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 2026b).

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 2026b).

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 2026b). 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 2026b). 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 2026b). 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 using 6 qualitative descriptors: High; Moderate; Low; Very Low; Extremely Low; and Negligible. Definitions for each of these likelihoods are given in Table A.1.

Table A.1 Nomenclature of likelihoods

Likelihood	Descriptive definition
High	The event would be very likely to occur
Moderate	The event would occur with an even likelihood
Low	The event would be unlikely to occur
Very Low	The event would be very unlikely to occur
Extremely Low	The event would be extremely unlikely to occur
Negligible	The event would almost certainly not occur

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. 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.

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*

Impact score	G			Major significance	
	F		Major significance	Significant	
	E	Major significance	Significant	Minor significance	
	D	Major significance	Significant	Minor significance	Unlikely to be discernible
	C	Significant	Minor significance	Unlikely to be discernible	
	B	Minor significance	Unlikely to be discernible		
	A	Unlikely to be discernible			
		<i>Local</i>	<i>District</i>	<i>Regional</i>	<i>National</i>
		Geographic level			

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 policy 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 2017)
- 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 2019)

- 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 *Final report for a review of pest risk assessments for spider mites (Acari: Trombidiformes: Tetranychidae)* (spider mite review) (DAFF 2024).

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 identifying the species of each relevant group determined to be associated with the import pathway based on currently available scientific literature. 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.

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The pest categorisation table does not represent a comprehensive list of all the pests associated with the entire mangosteen plant grown in Malaysia. 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 of mangosteen fruit 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), 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 'WA' 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 for the state or territory for which regional pest status is considered, such as 'WA' (Western Australia), is used to identify organisms that have been recorded in some regions of Australia, and due to interstate quarantine regulations are considered regional quarantine pests.

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

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Pest	Present in Malaysia	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							
<i>Aderus pulvinatus</i> (Champion, 1916) Synonym: <i>Xylophilus pulvinatus</i> Champion, 1916 [Aderidae]	Yes (Yunus & Ho 1980)	No records found	No. Not known to be associated with mangosteen fruit. Adults of <i>A. pulvinatus</i> have been reported on the leaves of mangosteen trees (Yunus & Ho 1980) and larvae live in rotten wood, leaf litter and under bark (Majka 2011).	Assessment not required	Assessment not required	Assessment not required	No
<i>Araecerus fasciculatus</i> (De Geer, 1775) Synonym: <i>Araecerus coffeae</i> (Fabricius, 1801) [Anthribidae] Coffee bean weevil	Yes (Waterhouse 1993)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Carpophilus dimidiatus</i> (Fabricius, 1792) [Nitidulidae] Corn-sap beetle	Yes (Yunus & Ho 1980)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Endaeus calophylli</i> Marshall, 1923 [Curculionidae]	Yes (Yunus & Ho 1980)	No records found	No. Not known to be associated with mangosteen fruit. <i>Endaeus calophylli</i> has been reported on the leaves of mangosteen trees in Malaysia (Yunus & Ho 1980).	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Hypothenemus hampei</i> (Ferrari, 1867) Synonym: <i>Cryphalus hampei</i> Ferrari, 1867 [Curculionidae] Coffee berry borer	Yes (Waterhouse 1993; Yunus & Ho 1980)	No records found	No. Not known to be associated with mangosteen fruit. There is a single report of <i>H. hampei</i> associated with the flowers of mangosteen trees in Malaysia (Yunus & Ho 1980). No information indicating association of any life stage with mangosteen fruit has been identified.	Assessment not required	Assessment not required	Assessment not required	No
<i>Nodina fulvitaris</i> Jacoby, 1896 [Chrysomelidae]	Yes (Yunus & Ho 1980)	No records found	No. Not known to be associated with mangosteen fruit. <i>Nodina fulvitaris</i> has been reported on the flowers of mangosteen trees (Yunus & Ho 1980). <i>Nodina</i> species are leaf beetles, with adults that feed on leaves and flowers, while larvae feed on the leaves, roots or sap of host plants (Bieńkowski 2010).	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	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			
<i>Nodina malayana</i> Bryant, 1941 [Chrysomelidae]	Yes (Yunus & Ho 1980)	No records found	No. Not known to be associated with mangosteen fruit. <i>Nodina malayana</i> has been reported on the leaves of mangosteen trees (Yunus & Ho 1980). <i>Nodina</i> species are leaf beetles, with adults that feed on leaves and flowers, while larvae feed on the leaves, roots or sap of host plants (Bierkowski 2010).	Assessment not required	Assessment not required	Assessment not required	No
<i>Psilopholis vestita</i> (Sharp, 1881) [Scarabaeidae]	Yes (Yunus & Ho 1980)	No records found	No. Not known to be associated with mangosteen fruit. <i>Psilopholis vestita</i> has been reported on mangosteen trees (Yunus & Ho 1980), but adults feed on the leaves while eggs are laid in the soil and larvae feed on roots of host plants (Jayarathnam 1992).	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
Diptera							
<i>Bactrocera carambolae</i> Drew & Hancock, 1994 [Tephritidae] Carambola fruit fly	Yes (Drew & Hancock 1994; PHA 2026)	No records found	Yes. Mangosteen is considered a non-host for <i>B. carambolae</i> while the fruit is intact, with resistance probably due to the hardness and thickness of the pericarp and latex secretion (Unahawutti et al. 2014). However, the flesh is susceptible to infestation if the skin is broken (Unahawutti et al. 2014). Eggs could be laid into exposed flesh as tephritid fruit flies lay eggs under the fruit skin and larvae feed within the fruit (Fletcher 1989).	Yes. Imported mangosteen fruit may be distributed across Australia. If there were viable eggs and larvae in the fruit, they could potentially survive fruit storage and transport conditions and develop into adults. Adults are able to fly and could therefore disperse to new hosts.	Yes. This species is highly polyphagous with a host range of over 100 host plants, including capsicum, guava, lemon, lime and mango (Allwood et al. 1999; Marchioro 2016). Many hosts are widespread across Australia. <i>Bactrocera carambolae</i> has established in areas with a wide range of climatic conditions (Marchioro 2016), with similar climates occurring in Australia. Its wide host range and geographic distribution suggests that <i>B. carambolae</i> could establish and spread in Australia.	Yes. <i>Bactrocera carambolae</i> is a major economic pest of numerous fruit crops (Danjuma et al. 2014; Lemos et al. 2014; Marchioro 2016). The larvae cause premature fruit ripening, fruit rot and fruit drop (Allwood & Drew 1997; Radonjić, Hrnčić & Perović 2019). Potential consequences include crop losses and quarantine restrictions on trade, both within Australia and internationally, to areas where this species is not present. Economic losses after <i>B. carambolae</i> established in Brazil were estimated at US\$30.7 million in the first year (Marchioro 2016).	Yes (EP)

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<p><i>Bactrocera dorsalis</i> (Hendel, 1912) Synonyms: <i>Bactrocera invadens</i> Drew, Tsuruta & White, 2005; <i>B. papayae</i> Drew & Hancock, 1994; <i>B. philippinensis</i> Drew & Hancock, 1994 [Tephritidae] Oriental fruit fly</p>	<p>Yes (PHA 2026; Waterhouse 1993)</p>	<p>No. Eradicated from mainland Australia (EPPO 2026; Hancock et al. 2000).</p>	<p>Yes. Mangosteen is considered a non-host for <i>B. dorsalis</i> while the fruit is intact, with resistance probably due to the hardness and thickness of the pericarp and latex secretion (Unahawutti et al. 2014). However, the flesh is susceptible to infestation if the skin is broken (Unahawutti et al. 2014). Eggs could be laid into exposed flesh as tephritid fruit flies lay eggs under the fruit skin and larvae feed within the fruit (Fletcher 1989).</p>	<p>Yes. Imported mangosteen fruit may be distributed across Australia. If there were viable eggs and larvae in the fruit, they could potentially survive fruit storage and transport into adults. Adults are able to fly and could therefore disperse to new hosts.</p>	<p>Yes. This highly polyphagous species can infest more than 470 individual plant taxa across 78 plant families (McQuate & Liquido 2017). <i>Bactrocera dorsalis</i> is highly invasive, having spread rapidly around the world to 75 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 2026; White & Elson-Harris 1992), which have similar climates to parts of Australia. Its wide host range and geographic distribution suggest that <i>B. dorsalis</i> could establish and spread in Australia.</p>	<p>Yes. <i>Bactrocera dorsalis</i> is one of the world's most destructive fruit fly pests (Qin et al. 2018). The larvae cause premature fruit ripening, fruit rot and fruit drop (Allwood & Drew 1997; Radonjić, Hrnčić & Perović 2019). Potential consequences include crop losses and quarantine restrictions on trade, both within Australia and internationally, to areas where this species is not present. A detection of <i>B. dorsalis</i> (then recorded as <i>B. papayae</i>) near Cairns in 1995 cost \$33.5 million to eradicate over 4 years. The estimated cost to industry at the time was \$100 million (Cantrell, Chadwick & Cahill 2002; PHA 2008)</p>	<p>Yes (EP)</p>

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Drosophila albomicans</i> (Duda, 1923) [Drosophilidae] Vinegar fly	Yes (Yu, Lin & Chang 1999)	No records found	No. Unlikely to be associated with imported commercial quality fruit. Although Yunus & Ho (1980) report <i>D. albomicans</i> as being associated with mangosteen fruit, it only infests over-ripe or decaying fruit (USDA-APHIS 2005). Such fruit do not meet export quality standards and would be detected and removed during harvest or through the sorting and grading practices at the packing house.	Assessment not required	Assessment not required	Assessment not required	No
<i>Drosophila bipectinata</i> (Duda, 1923) [Drosophilidae]	Yes (Yunus & Ho 1980)	Yes (Bock 1978)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Drosophila immigrans</i> Sturtevant, 1921 [Drosophilidae] Pomace fly	Yes (Yunus & Ho 1980)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Drosophila melanogaster</i> Meigen, 1830 [Drosophilidae] Vinegar fly	Yes (CABI 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Zaprionus multistriatus</i> (Duda, 1923) [Drosophilidae]	Yes (Yunus & Ho 1980)	No records found	No. Unlikely to be associated with imported commercial quality fruit. Although Yunus & Ho (1980) report <i>Z. multistriatus</i> as being associated with mangosteen, flies of this genus are unable to pierce intact fruit skin and larvae feed principally on yeast and bacteria in decomposing fruit (Joshi et al. 2014). Such fruit do not meet export quality standards and would be detected and removed during harvest or through the sorting and grading practices at the packing house.	Assessment not required	Assessment not required	Assessment not required	No
Hemiptera							
<i>Aonidiella orientalis</i> (Newstead, 1894) Synonym: <i>Aspidiotus osbeckiae</i> Green 1896 [Diaspididae] Oriental yellow scale	Yes (García Morales et al. 2026)	Yes (García Morales et al. 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	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			
<i>Aphis aurantii</i> Boyer de Fonscolombe, 1841 Synonym: <i>Toxoptera aurantii</i> (Boyer de Fonscolombe, 1841) [Aphididae] Black citrus aphid	Yes (Waterhouse 1993; Yunus & Ho 1980)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Aspidiotus destructor</i> Signoret, 1869 [Diaspididae] Coconut scale	Yes (García Morales et al. 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Aspidiotus excisus</i> Green, 1896 [Diaspididae] Cyanotis scale	Yes (García Morales et al. 2026)	No records found	Yes. <i>Aspidiotus excisus</i> is associated with mangosteen fruit (Chen, Wong & Wu 2014). <i>Aspidiotus excisus</i> is small and has a translucent scale cover (Miller & Davidson 2005), which means it is possible this pest will remain undetected during harvest and the sorting and grading practices at the packing house.	Yes. <i>Aspidiotus excisus</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit, in other countries (Chen, Wong & Wu 2014; DAWE 2021; Suh 2016). This species is polyphagous, with hosts from 34 genera in 29 families, including mangosteen, pineapple and chilli, with many hosts available in Australia (García Morales et al. 2026).	Yes. Assessed in the scales Group PRA (DAWE 2021).	Yes. Assessed in the scales Group PRA (DAWE 2021).	Yes (GP)

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Aspidiotus rigidus</i> Reyne, 1947 [Diaspididae] Rigid coconut scale	Yes (García Morales et al. 2026)	No records found	Yes. <i>Aspidiotus rigidus</i> is a pest of mangosteen and adults have been intercepted on mangosteen fruit at retail in San Francisco (Watson et al. 2015).	Yes. <i>Aspidiotus rigidus</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit, (Watson et al. 2015). This species is polyphagous, with hosts from 7 genera in 3 families, including mangosteen (García Morales et al. 2026).	Yes. Assessed in the scales Group PRA (DAWE 2021).	Yes. Assessed in the scales Group PRA (DAWE 2021).	Yes (GP)
<i>Ceroplastes rubens</i> Maskell, 1893 [Coccidae] Pink wax scale	Yes (García Morales et al. 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Chrysomphalus aonidum</i> (Linnaeus, 1758) [Diaspididae] Black scale	Yes (García Morales et al. 2026)	Yes (APPD 2026; García Morales et al. 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Chrysomphalus dictyospermi</i> (Morgan, 1889) [Diaspididae] Dictyospermum scale	Yes (García Morales et al. 2026)	Yes. Under official control (Regional) for WA (DPIRD 2026). Present in NSW, NT and Qld (APPD 2026).	Yes. <i>Chrysomphalus dictyospermi</i> is associated with mangosteen fruit (Chen, Wong & Wu 2014). <i>Chrysomphalus dictyospermi</i> may remain undetected during harvest and packing of mangosteen fruit as it small (1.5–2.0 mm long) (CABI 2026) and is reddish brown in appearance (Rosen 1990), which would be difficult to detect on mature mangosteen fruit.	Yes. <i>Chrysomphalus dictyospermi</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit, in other countries (Chen, Wong & Wu 2014; DAWE 2021). This species is polyphagous, with hosts from 211 genera in 84 families including citrus, with many hosts available in Australia (García Morales et al. 2026).	Yes. Assessed in the scales group PRA (DAWE 2021).	Yes. Assessed in the scales group PRA (DAWE 2021).	Yes (GP, WA)
<i>Coccus viridis</i> (Green, 1889) [Coccidae] Florida wax scale	Yes (García Morales et al. 2026)	Yes (García Morales et al. 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Comstockaspis perniciosae</i> (Comstock, 1881) [Diaspididae] San Jose scale	Yes (García Morales et al. 2026)	Yes (García Morales et al. 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway					Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences		
<i>Diaspis boisduvalii</i> Signoret, 1869 [Diaspididae] Boisduval scale	Yes (García Morales et al. 2026; Yunus & Ho 1980)	Yes (APPD 2026; García Morales et al. 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Dysmicoccus lepelleyi</i> Betrem, 1937 [Pseudococcidae] Annona mealybug	Yes (Williams 2004)	No records found	Yes. <i>Dysmicoccus lepelleyi</i> is a pest of mangosteen (García Morales et al. 2026) and it has been intercepted in the US on imported mangosteen fruit (Williams 2004).	Yes. <i>Dysmicoccus lepelleyi</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit, (Williams 2004). This species is polyphagous, with hosts from 28 genera in 19 families, including mangosteen (García Morales et al. 2026), with many of these hosts available in Australia.	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP)	

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Pest	Present in Malaysia	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			
<i>Dysmicoccus neobrevipes</i> Beardsley, 1959 [Pseudococcidae] Grey pineapple mealybug	Yes (DOA Malaysia 2024a; García Morales et al. 2026)	No records found	Yes. <i>Dysmicoccus neobrevipes</i> feeds on the leaves, flowers and fruit of mangosteen in Malaysia (DOA Malaysia 2024a). <i>Dysmicoccus neobrevipes</i> may remain undetected during harvest and packing of mangosteen fruit as mealybugs tend to congregate in cryptic locations such as within cracks, crevices and under the fruit calyx (Hofmeyr et al. 2016).	Yes. <i>Dysmicoccus neobrevipes</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit, in other countries (DAWR 2019). <i>Dysmicoccus neobrevipes</i> is highly polyphagous, with hosts from 70 genera in 41 families, including mangosteen, maize and guava, with many hosts available in Australia (García Morales et al. 2026).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP)

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Pest	Present in Malaysia	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			
<i>Exallomochlus hispidus</i> (Morrison, 1921) [Pseudococcidae] Cocoa mealybug	Yes (DOA Malaysia 2024a; García Morales et al. 2026)	No records found	Yes. <i>Exallomochlus hispidus</i> is a major pest of mangosteen and is associated with the skin of fruit (Indarwatmi et al. 2021). <i>Exallomochlus hispidus</i> may remain undetected during harvest and packing of mangosteen fruit as mealybugs tend to congregate in cryptic locations such as within cracks, crevices and under the fruit calyx (Hofmeyr et al. 2016).	Yes. <i>Exallomochlus hispidus</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit in other countries (DAWR 2019). <i>Exallomochlus hispidus</i> is polyphagous, with hosts from 54 genera in 32 families, including mangosteen, lemon and guava, with many hosts available in Australia (García Morales et al. 2026).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP)
<i>Hemiberlesia lataniae</i> (Signoret, 1869) [Diaspididae] Quince scale	Yes (García Morales et al. 2026)	Yes (García Morales et al. 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Hordeolicoccus heterotrichus</i> (Williams, 2004) [Pseudococcidae] Citrus mealybug	Yes (García Morales et al. 2026)	No records found	Yes. <i>Hordeolicoccus heterotrichus</i> has been intercepted in the US on mangosteen fruit (Williams 2004).	Yes. <i>Hordeolicoccus heterotrichus</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit (Williams 2004). This species is polyphagous, with hosts from 8 genera in 8 families, including mangosteen (García Morales et al. 2026), with many of these hosts available in Australia.	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP)
<i>Icerya seychellarum</i> (Westwood, 1855) [Margarodidae] Seychelles scale	Yes (García Morales et al. 2026)	Yes (García Morales et al. 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	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			
<i>Ischnaspis longirostris</i> (Signoret, 1882) [Diaspididae] Black thread scale	Yes (García Morales et al. 2026)	Yes. Under official control (Regional) for WA (DPIRD 2026). Present in NT and Qld (APPD 2026).	Yes. <i>Ischnaspis longirostris</i> is associated with <i>Garcinia</i> spp. (DAWE 2021). <i>Ischnaspis longirostris</i> may remain undetected during harvest and packing of mangosteen fruit as diaspid scales are small and tend to conceal themselves in cryptic areas of host plants where they are protected from pesticides and predators (Miller & Davidson 2005).	Yes. <i>Ischnaspis longirostris</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports in other countries (DAWE 2021). This species is highly polyphagous, with hosts from 162 genera in 55 families, including mangosteen, mango and avocado, with many hosts available in Australia (García Morales et al. 2026).	Yes. Assessed in the scales group PRA (DAWE 2021).	Yes. Assessed in the scales group PRA (DAWE 2021).	Yes (GP, WA)
<i>Maconellicoccus hirsutus</i> (Green, 1908) [Pseudococcidae] Grape mealybug	Yes (García Morales et al. 2026)	Yes (García Morales et al. 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Milviscutulus mangiferae</i> (Green, 1889) [Coccidae] Green shield scale	Yes (García Morales et al. 2026)	Yes (García Morales et al. 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Paracoccus interceptus</i> (Lit, 1997) [Pseudococcidae] Intercepted mealybug	Yes (Ben-Dov 1994)	No records found	Yes. Adults of <i>P. interceptus</i> have been intercepted in the US on mangosteen fruit (Williams 2004).	Yes. <i>Paracoccus interceptus</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit (Williams 2004). This species is polyphagous, with hosts from 25 genera in 18 families, including mangosteen (García Morales et al. 2026), with many of these hosts available in Australia.	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP)

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Paraputo odontomachi</i> (Takahashi, 1951) [Pseudococcidae]	Yes (García Morales et al. 2026)	No records found	Yes. Adults of <i>P. odontomachi</i> have been intercepted in the US on mangosteen fruit (Williams 2004).	Yes. <i>Paraputo odontomachi</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit (Williams 2004). This species is polyphagous, with hosts from 5 genera in 5 families, including mangosteen (García Morales et al. 2026), with many of these hosts available in Australia.	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP)
<i>Planococcus citri</i> (Risso, 1813) [Pseudococcidae] Citrus mealybug	Yes (García Morales et al. 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Planococcus lilacinus</i> (Cockerell, 1905) [Pseudococcidae] Coffee mealybug	Yes (García Morales et al. 2026)	Yes, Under official control for Australia, only present in the Torres Strait (APPD 2026).	Yes. <i>Planococcus lilacinus</i> has been intercepted in Australia and the US on mangosteen fruit (Williams 2004).	Yes. <i>Planococcus lilacinus</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit (Williams 2004). This species is polyphagous with hosts from 88 genera in 41 families (García Morales et al. 2026), including mangosteen (Nurbaya et al. 2022), with many of these hosts available in Australia.	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP)

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Planococcus minor</i> (Maskell, 1897) [Pseudococcidae] Pacific mealybug	Yes (García Morales et al. 2026)	Yes. Under official control (Regional) for WA (DPIRD 2026). Present in NSW, NT, Qld, SA (APPD 2026).	Yes. Adults of <i>P. minor</i> have been intercepted in Australia on mangosteen fruit (Williams 2004).	Yes. <i>Planococcus minor</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit (Williams 2004). This species is highly polyphagous with hosts from 273 genera in 84 families (García Morales et al. 2026), with many of these hosts available in Australia.	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP, WA)

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Pest	Present in Malaysia	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			
<i>Pseudaonidia trilobitiformis</i> (Green, 1896) [Diaspididae] Trilobe scale	Yes (García Morales et al. 2026)	Yes. Under official control (Regional) for WA (DPIRD 2026). Present in NT, Qld (APPD 2026).	Yes. <i>Pseudaonidia trilobitiformis</i> has been intercepted in the US on mangosteen fruit (USDA-APHIS 2006).	Yes. <i>Pseudaonidia trilobitiformis</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit (USDA-APHIS 2006). This species is highly polyphagous, with hosts from 118 genera in 51 families (García Morales et al. 2026), with many of these hosts available in Australia.	Yes. Assessed in the scales Group PRA (DAWE 2021).	Yes. Assessed in the scales Group PRA (DAWE 2021).	Yes (GP, WA)

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Pest	Present in Malaysia	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			
<i>Pseudococcus aurantiacus</i> Williams, 2004 [Pseudococcidae] Orange-coloured mealybug	Yes (Williams 2004)	No records found	Yes. <i>Pseudococcus aurantiacus</i> has been intercepted in the US on mangosteen fruit (Williams 2004).	Yes. <i>Pseudococcus aurantiacus</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit (Williams 2004). This species is polyphagous, with hosts from 11 genera in 11 families, including mangosteen (García Morales et al. 2026), with many of these hosts available in Australia.	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP)

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Pseudococcus cryptus</i> Hempel, 1918 [Pseudococcidae] Cryptic mealybug	Yes (DOA Malaysia 2024a; García Morales et al. 2026; Williams 2004)	Yes. Under official control (Regional) for WA (DPIRD 2026). Present in Qld (APPD 2026; Business Queensland 2022).	Yes. <i>Pseudococcus cryptus</i> is associated with mangosteen fruit (EFSA Panel on Plant Health (PLH) et al. 2022; García Morales et al. 2026). <i>Pseudococcus cryptus</i> may remain undetected during harvest and packing of mangosteen fruit as mealybugs tend to congregate in cryptic locations such as within cracks, crevices and under the fruit calyx (Hofmeyr et al. 2016).	Yes. <i>Pseudococcus cryptus</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports in other countries (EFSA Panel on Plant Health (PLH) et al. 2022; García Morales et al. 2026). <i>Pseudococcus cryptus</i> is polyphagous, with hosts from 89 genera in 50 families, including mangosteen, pineapple and citrus, with many hosts available in Australia (García Morales et al. 2026).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP, WA)
<i>Pseudococcus longispinus</i> (Targiono Tozzetti, 1867) [Pseudococcidae] Long tailed mealybug	Yes (Williams 2004)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Pulvinaria psidii</i> Maskell, 1893 [Coccidae] Green shield scale	Yes (Williams 2004)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	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			
<i>Rastrococcus spinosus</i> (Robinson, 1918) [Pseudococcidae] Mango mealybug	Yes (Williams 2004)	No records found	Yes. <i>Rastrococcus spinosus</i> has been intercepted in the US on mangosteen fruit (Williams 2004).	Yes. <i>Rastrococcus spinosus</i> has the capacity to survive fruit storage and transport conditions, as it has been intercepted on commercial fruit imports, including mangosteen fruit (Williams 2004). This species is polyphagous, with hosts from 25 genera in 19 families, including mangosteen (García Morales et al. 2026), with many of these hosts available in Australia.	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes. Assessed in the mealybugs Group PRA (DAWR 2019).	Yes (GP)
<i>Saissetia oleae</i> (Olivier, 1791) [Coccidae] Black scale	Yes (Williams 2004)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Hymenoptera							
<i>Anochetus graeffei</i> Mayr, 1870 [Formicidae] Trap-jaw ant	Yes (Khoo 1990)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Anoplolepis gracilipes</i> (Smith, 1857) [Formicidae] Yellow crazy ant	Yes (GISD 2026)	Yes. Under official control (Regional) for NSW, NT, Qld and WA (CSIRO 2022; DPIRD 2026; NSW DPI 2022; QDAF 2016). Limited distribution in NSW, NT and Qld (APPD 2026).	Yes. <i>Anoplolepis gracilipes</i> has symbiotic relationships with honeydew-producing Hemiptera (Lee & Yang 2022), which are strongly associated with the calyx of the fruit. Through this association, <i>A. gracilipes</i> workers could be present on the fruit, particularly in cryptic locations such as under the calyx, increasing the likelihood of importation. Mangosteen fruit with ants under the calyx may not be detected and excluded from export during harvest and packing.	Yes. <i>Anoplolepis gracilipes</i> has the capacity to survive fruit storage and transport as they have been intercepted on imported mangosteen fruit (Yang et al. 2019). Imported mangosteen fruit may be widely distributed throughout Australia. Ants are highly mobile and, if present on mangosteen fruit, they could potentially disperse to a new suitable environment. <i>Anoplolepis gracilipes</i> is a generalist scavenger and can survive on a variety of food sources (Kaiser-Bunbury et al. 2014) that are readily available in Australia.	No. There is no information indicating that <i>A. gracilipes</i> queens are associated with mangosteen fruit. Although worker ants could enter Australia on mangosteen fruit, they would not be able to establish a new colony upon arrival as colonies of this species require a fertilised queen to establish or continue (Zeng 2023).	Assessment not required	No
<i>Camponotus vitreus</i> (Smith, 1860) Synonym: <i>Colobopsis vitrea</i> (Smith, 1860) [Formicidae]	Yes (Economic & Guénard 2020)	Yes (ALA 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Carebara affinis</i> (Jerdon, 1851) [Formicidae]	Yes (Economic & Guénard 2020)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Dilobocondyla fulva</i> Viehmeyer, 1916 [Formicidae]	Yes (Economomo & Guénard 2020)	No records found	No. Not known to be associated with mangosteen fruit. There is one record of <i>D. fulva</i> found nesting in hollow twigs of a mangosteen tree (Wang et al. 2022). Information about <i>D. fulva</i> is limited, but ants in this genus nest inside the wood of trees (Varghese 2006) and are therefore not considered to be associated with mangosteen fruit.	Assessment not required	Assessment not required	Assessment not required	No

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			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<p><i>Dolichoderus thoracicus</i> (Smith, 1860) Synonym: <i>Dolichoderus bituberculatus</i> (Mayr, 1862) [Formicidae] Cocoa black ant</p>	<p>Yes (DOA Malaysia 2024a; Economo & Guénard 2020)</p>	<p>No records found</p>	<p>Yes. <i>Dolichoderus thoracicus</i> has symbiotic relationships with honeydew-producing Hemiptera, which are strongly associated with the mangosteen calyx (Kalshoven & van der Laan 1981). <i>Dolichoderus thoracicus</i> can form nests underneath the calyx of mangosteen fruit (Sugiarto 2019), and therefore colonies with queens could potentially be present on imported mangosteen fruit.</p>	<p>Yes. <i>Dolichoderus thoracicus</i> has the capacity to survive storage and transport as they have been intercepted on imported mangosteen fruit (Yang et al. 2019). Imported mangosteen fruit may be widely distributed throughout Australia. Ants are highly mobile and, if present on mangosteen fruit, they could potentially disperse to a new suitable environment. Members of this genus are generalist scavengers that can survive on a variety of food sources (Shattuck & Marsden 2013) that are readily available in Australia.</p>	<p>Yes. This species is widely distributed throughout Southeast Asia (Economo & Guénard 2020) in areas which have similar climatic conditions to parts of Australia. <i>Dolichoderus thoracicus</i> can form nests in almost any sheltered location (Shattuck & Marsden 2013), including on some fruit such as mangosteen and rambutan (Sugiarto 2019). This wide range of suitable habitats and food sources suggests that <i>D. thoracicus</i> could establish and spread in Australia.</p>	<p>Yes. <i>Dolichoderus thoracicus</i> is used as a biological control agent for pests of cocoa in Malaysia (Bakar et al. 2021). However, this species has been increasingly recognised as an urban pest following outbreaks in Taiwan (Hsu et al. 2022). This species is a highly adaptable urban pest, capable of reaching extremely high population densities with one instance finding 18 million individuals within a single residence (Hsu et al. 2025). <i>Dolichoderus thoracicus</i> also forms symbiotic relationships with honeydew-producing Hemiptera and has been reported facilitating infestations of aphids and scales (Hsu et al. 2025).</p>	<p>Yes (EP)</p>

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			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Dorylus vishnui</i> Wheeler, 1913 [Formicidae]	Yes (Economic & Guénard 2020)	No records found	No. Not known to be associated with mangosteen fruit. Colonies of <i>D. vishnui</i> have been recorded in mangosteen farms (Prabphal & Khachonpisitsak 2017). Information about <i>D. vishnui</i> is limited, but ants in this genus nest in soil (Berghoff et al. 2002; Wang et al. 2022) and are therefore not considered to be associated with mangosteen fruit.	Assessment not required	Assessment not required	Assessment not required	No
<i>Iridomyrmex anceps</i> (Roger, 1863) [Formicidae]	Yes (Economic & Guénard 2020)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Monomorium destructor</i> (Jerdon, 1851) Synonym: <i>Trichomyrmex destructor</i> (Jerdon, 1851) [Formicidae] Destructive trailing ant	Yes (AntWeb 2026)	Yes (AntWeb 2026; APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Monomorium floricola</i> (Jerdon, 1851) [Formicidae]	Yes (Economic & Guénard 2020)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Monomorium pharaonis</i> (Linnaeus, 1758) [Formicidae] Pharoah ant	Yes (Economato & Guénard 2020)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Oecophylla smaragdina</i> (Fabricius, 1775) [Formicidae] Arboreal ant	Yes (Economato & Guénard 2020)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Overbeckia subclavata</i> Viehmeyer, 1916 [Formicidae]	Yes (Economato & Guénard 2020)	No records found	No. Not known to be associated with mangosteen fruit. <i>Overbeckia subclavata</i> nests have been found in hollow branches of mangosteen trees (Wang et al. 2022). Information about <i>O. subclavata</i> is limited, but ants in this genus nest in hollow branches and twigs (Heterick 2019) and <i>O. subclavata</i> nests have only ever been found in hollow stems or branches (Klimeš et al. 2022). This species is therefore not considered to be associated with mangosteen fruit.	Assessment not required	Assessment not required	Assessment not required	No

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			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Paratrechina longicornis</i> (Latreille, 1802) [Formicidae] Longhorn crazy ant	Yes (Economato & Guénard 2020)	Yes (Economato & Guénard 2020)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Plagiolepis bicolor</i> Forel, 1901 [Formicidae]	Yes (Economato & Guénard 2020)	No records found	No. Not known to be associated with mangosteen fruit. Colonies of <i>P. bicolor</i> have been recorded in hollow twigs of mangosteen trees (Wang et al. 2022). Information about <i>P. bicolor</i> is limited, but ants in this genus nest under the bark of trees, in rotten wood, twigs or the soil (Bolton 1973) and are therefore not considered to be associated with mangosteen fruit.	Assessment not required	Assessment not required	Assessment not required	No
<i>Plagiolepis exigua</i> Forel, 1894 [Formicidae]	Yes (Economato & Guénard 2020)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Rhopalomastix johorensis</i> Wheeler, 1929 [Formicidae]	Yes (Economomo & Guénard 2020)	No records found	No. Not known to be associated with mangosteen fruit. Colonies of <i>R. johorensis</i> have been recorded under bark and in hollow mangosteen twigs (Wang et al. 2022). Information about <i>R. johorensis</i> is limited, but ants in this genus nest in the bark of living trees (Yong, Jaitrong & Peeters 2021) and are therefore not considered to be associated with mangosteen fruit.	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Solenopsis geminata</i> (Fabricius, 1804) [Formicidae] Tropical fire ant	Yes (Economato & Guénard 2020)	Yes. Under official control (Regional) for Qld and WA (DPIRD 2026; QDAF 2023). Present in NT (APPD 2026).	No. Not known to be associated with mangosteen fruit. Colonies of <i>S. geminata</i> have been recorded on the ground in mangosteen farms (Nipitwattanaphon et al. 2020). <i>Solenopsis geminata</i> colonies are formed in large mounds of exposed soil and in the roots of dead trees (Nipitwattanaphon et al. 2020) and are therefore not considered to be associated with mangosteen fruit.	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Stictoponera binghamii</i> (Forel, 1900) Synonym: <i>Gnamptogenys binghamii</i> (Forel, 1900) [Formicidae]	Yes (Economomo & Guénard 2020)	No records found	No. Not known to be associated with mangosteen fruit. Colonies of <i>S. binghamii</i> have been recorded in the cavities of fallen decaying mangosteen wood (Wang et al. 2022). Information about <i>S. binghamii</i> is limited, but ants in this genus nest on the ground in leaf litter and fallen branches (Gusti et al. 2024; Wang et al. 2022) and are therefore not considered to be associated with mangosteen fruit.	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Tapinoma andamanense capsicola</i> Forel, 1911 [Formicidae]	Yes (Economic & Guénard 2020)	No records found	No. Not known to be associated with mangosteen fruit. Colonies of <i>T. andamanense capsicola</i> have been recorded on the ground in hollow twigs of mangosteen trees (Wang et al. 2022). Information about <i>T. andamanense capsicola</i> is limited, but ants of this genus nest on the ground in leaf litter, under loose bark and in fallen branches (Wang et al. 2022) and are therefore not considered to be associated with mangosteen fruit.	Assessment not required	Assessment not required	Assessment not required	No
<i>Technomyrmex albipes</i> (Smith, 1861) [Formicidae] White-footed ant	Yes (AntWeb 2026)	Yes (AntWeb 2026; APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Technomyrmex butteli</i> Forel, 1913 [Formicidae] Black ant	Yes (AntWeb 2026)	No records found	Yes. Members of this genus predominantly feed on honeydew produced by Hemiptera (AntWiki 2026), which are strongly associated with the mangosteen fruit calyx (Kalshoven & van der Laan 1981). <i>Technomyrmex butteli</i> has been identified as occasionally nesting under the calyx of mangosteen fruit (Biosecurity Australia 2003). Therefore, there is the potential for <i>T. butteli</i> colonies to be imported on mangosteen fruit.	Yes. <i>Technomyrmex butteli</i> has the capacity to survive storage and transport as members of this genus have been intercepted in Australia on imported mangosteen fruit. Imported mangosteen fruit will likely be distributed throughout Australia via the wholesale and retail trade pathway. Ants are highly mobile and, if present on mangosteen fruit, they could potentially disperse to a new suitable environment.	Yes. This species is distributed throughout Indonesia and Malaysia (Economio & Guénard 2020), which have similar climatic conditions to parts of Australia. Members of this genus are opportunistic scavengers, which can survive on a variety of food sources (CABI 2026). <i>Technomyrmex</i> spp. can form nests in almost any sheltered location (Sunamura, Terayama & Eguchi 2024; Warner, Scheffrahm & Cabrera 2002) including on some fruit such as mangosteen (Biosecurity Australia 2003). This wide range of suitable habitats and food sources suggests that <i>T. butteli</i> could establish and spread in Australia.	Yes. Exotic <i>Technomyrmex</i> species are regarded as high priority invasive ants in Australia (Environment and Invasives Committee 2019). Invasive ant species will compete for resources with native species (GISD 2026). Ants can cause indirect damage through protecting honeydew-producing pests, such as aphids and mealybugs. There is also the potential for this species to impact native invertebrates in regions lacking native predacious ants, as invasive ants have been implicated in the decline of many non-ant invertebrate species (GISD 2026).	Yes (EP)

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Tetraponera nitida</i> (Smith, 1860) [Formicidae]	Yes (AntWeb 2026)	Yes (AntWeb 2026; APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Tetraponera pilosa</i> (Smith, 1858) [Formicidae]	Yes (AntWeb 2026)	No records found	No. Not known to be associated with mangosteen fruit. Colonies of <i>T. pilosa</i> have been recorded in dead twigs of mangosteen trees (Wang et al. 2022), which aligns with the common nesting behaviour of this genus of nesting in twigs (Ward & Downie 2005).	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	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			
Lepidoptera							
<i>Adoxophyes privatana</i> (Walker, 1863) [Tortricidae] Apple leaf-curling moth	Yes (Hill 2008; Waterhouse 1993)	No records found	No. Unlikely to be present on imported mangosteen fruit. <i>Adoxophyes privatana</i> is associated with mangosteen trees (Robinson et al. 2001) but eggs are laid on the leaves of host plants (Meijerman & Ulenberg 2026). Larvae web several leaves, and occasionally fruit, together to form a nest in which to feed and pupate (Meijerman & Ulenberg 2026). Larvae feed on the outside of fruit from within the nest, and crawl away or drop to the ground when disturbed (Meijerman & Ulenberg 2026). Adults are not associated with the fruit. Webbing on the fruit is conspicuous, and any infested fruit are likely to be detected and removed during harvest and the sorting and grading practices at the packing house.	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Aetholix flavibasalis</i> (Guenée, 1854) [Crambidae] Leafroller	Yes (Robinson et al. 2023)	Yes (ALA 2026; APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Ardozyga clavigularis</i> (Meyrick, 1935) Synonym: <i>Glycerophthora clavigularis</i> Meyrick, 1935 [Gelechiidae]	Yes (Robinson et al. 2023; Yunus & Ho 1980)	No records found	No. Not known to be associated with mangosteen fruit. <i>Ardozyga clavigularis</i> is associated with the leaves of mangosteen trees (Yunus & Ho 1980). Information about <i>A. clavigularis</i> is limited and no information indicating association of any life stage with mangosteen fruit has been identified.	Assessment not required	Assessment not required	Assessment not required	No
<i>Dudua aprobola</i> (Meyrick, 1886) [Tortricidae]	Yes (CABI 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Eudocima phalonia</i> (Linnaeus, 1763) Synonym: <i>Eudocima fullonia</i> (Clerck, 1764) [Erebidae] Fruit-piercing moth	Yes (CABI 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Hyposidra talaca</i> (Walker, 1860) [Geometridae] Black looper	Yes (Waterhouse 1993)	Yes. Under official control (Regional) for WA (DPIRD 2026). Present in NSW and Qld (ALA 2026).	No. Not known to be associated with mangosteen fruit. <i>Hyposidra talaca</i> larvae feed on the leaves of mangosteen trees (Herbison-Evans & Crossley 2026). Eggs are laid under scales, cracks and crevices of the bark of host trees (Roy et al. 2017) and pupation occurs in the soil (Waterhouse 1993).	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Orgyia postica</i> (Walker, 1855) [Erebidae] Cocoa tussock moth	Yes (CABI 2026)	No records found	No. Unlikely to be present on imported mangosteen fruit. <i>Orgyia postica</i> is associated with mangosteen trees (CABI 2026), but larvae feed on the flowers and leaves of host plants and pupation occurs on the leaves and stems (Sanchez & Laigo 1968). Adult females are flightless and remain on leaves and stems to lay eggs (Sanchez & Laigo 1968). While <i>O. postica</i> larvae have been recorded attacking fruit on mango trees, this feeding is purely external and causes visible damage (Fasih et al. 1989; Gupta & Singh 1986). The larvae are very hairy and colourful (CAAS 1992; PHA 2015), as well as highly mobile (Sanchez & Laigo 1968), so they are likely to be detected and removed during harvest or through the sorting and grading practices at the packing house.	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Pagodiella hekmeyeri</i> (Heylaerts, 1885) Synonym: <i>Pagodiella heckmeyeri</i> (Heylaerts, 1885) [Psychidae] Pagoda bagworm	Yes (Robinson et al. 2023)	No records found	No. Not known to be associated with mangosteen fruit. <i>Pagodiella hekmeyeri</i> is associated with mangosteen trees (Robinson et al. 2023), but larvae feed on the leaves of host plants and pupate in cocoons that are attached to the leaf surface (Ong et al. 2020).	Assessment not required	Assessment not required	Assessment not required	No
<i>Phyllocnistis citrella</i> Stainton, 1856 [Gracillariidae] Citrus leaf miner	Yes (Waterhouse 1993; Yunus & Ho 1980)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Stictoptera columba</i> (Walker, 1856) [Euteliidae] Leaf-eating caterpillar	Yes (Holloway 1985)	No records found	No. Not known to be associated with mangosteen fruit. <i>Stictoptera columba</i> is associated with mangosteen trees (Robinson et al. 2023), but larvae feed on the young leaves of mangosteen trees and drop to the ground to pupate in the soil (Ooi, Winotai & Peña 2002). Moths of this genus lay eggs on the leaves of hosts (Muniappan et al. 2012; Ooi, Winotai & Peña 2002).	Assessment not required	Assessment not required	Assessment not required	No
<i>Stictoptera cucullioides</i> Guenée, 1852 [Euteliidae]	Yes (Yunus & Ho 1980)	Yes (ALA 2026; Herbison-Evans & Crossley 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Stictoptera grisea</i> Moore, 1868 [Euteliidae] Leaf-eating caterpillar	Yes (Holloway 1985)	No records found	No. Not known to be associated with mangosteen fruit. <i>Stictoptera grisea</i> is associated with mangosteen trees (Robinson et al. 2023), but moths of this genus lay eggs on the leaves and larvae feed on leaves before dropping to the ground and pupating in the soil (Muniappan et al. 2012; Ooi, Winotai & Peña 2002).	Assessment not required	Assessment not required	Assessment not required	No
<i>Stictoptera signifera</i> (Walker, 1857) [Euteliidae] Leaf-eating caterpillar	Yes (Holloway 1985)	No records found	No. Not known to be associated with mangosteen fruit. <i>Stictoptera signifera</i> is associated with mangosteen trees (Robinson et al. 2023), but larvae feed on the young leaves and drop to the ground to pupate in the soil (Ooi, Winotai & Peña 2002). Moths of this genus lay eggs on leaves of mangosteen trees (Muniappan et al. 2012; Ooi, Winotai & Peña 2002).	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Tetramoera schistaceana</i> (Snellen, 1851) [Tortricidae] Sugarcane shoot borer; white borer	Yes (Robinson et al. 2023)	No records found	No. Not known to be associated with mangosteen fruit. <i>Tetramoera schistaceana</i> is associated with mangosteen trees (Robinson et al. 2023), but this species is primarily a pest of sugarcane and larvae bore into the shoots of hosts, or feed externally on stems (BSES Limited 2011). No life stage is known to be associated with fruit.	Assessment not required	Assessment not required	Assessment not required	No
Thysanoptera							
<i>Heliethrips haemorrhoidalis</i> (Bouché, 1833) [Thripidae] Greenhouse thrips	Yes (Mound & Azidah 2009)	Yes (Mound, Tree & Paris 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Megalurothrips usitatus</i> (Bagnall, 1913) [Thripidae] Bean flower thrips	Yes (Mound & Azidah 2009)	Yes (Mound, Tree & Paris 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
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<i>Scirtothrips dorsalis</i> Hood, 1919 [Thripidae] Chilli thrips	Yes (Hill 2008)	Yes (APPD 2026) <i>Scirtothrips dorsalis</i> was previously assessed in the thrips Group PRA as a vector of quarantine orthotospoviruses. Therefore, it is a regulated article for Australia (DAWR 2017).	No. While <i>Scirtothrips dorsalis</i> can vector quarantine orthotospoviruses, none of these viruses have been recorded in Malaysia, nor are they able to infect mangosteen trees. Therefore, further assessment is not required for the mangosteen fruit from Malaysia pathway.	Assessment not required	Assessment not required	Assessment not required	No
<i>Scirtothrips hitam</i> Ng, Mound & Azidah, 2014 [Thripidae]	Yes (Ng, Mound & Azidah 2014)	No records found	Yes. <i>Scirtothrips hitam</i> has been collected from mangosteen trees in the field (Ng, Mound & Azidah 2014). This species is closely related to the pest species <i>S. dorsalis</i> , which can be associated with mangosteen fruit (Affandi & Emilda 2009). <i>Scirtothrips</i> species are routinely intercepted on horticultural products at the Australian border (DAWR 2017), including on mangosteen. This means it is possible <i>S. hitam</i> could be associated with imported mangosteen fruit.	Yes. Imported mangosteen fruit will likely be distributed throughout Australia. <i>Scirtothrips hitam</i> is polyphagous and widespread in tropical Asia (Ng, Mound & Azidah 2014). Hosts and suitable environments for this species are available in parts of Australia. Thrips present on discarded mangosteen fruit could potentially disperse to a new host within close proximity.	Yes. Thrips Group PRA applies (DAWR 2017).	Yes. Thrips Group PRA applies (DAWR 2017).	Yes (GP)

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<i>Selenothrips rubrocinctus</i> (Giard, 1901) [Thripidae] Red-banded thrips	Yes (DOA Malaysia 2024a)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Thrips florum</i> Schmutz, 1913 [Thripidae] Scab thrips	Yes (DOA Malaysia 2024a)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Thrips hawaiiensis</i> (Morgan, 1913) [Thripidae] Flower thrips	Yes (Mound & Azidah 2009)	Yes (Mound, Tree & Paris 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
Trombidiformes							
<i>Polyphagotarsonemus latus</i> (Banks, 1904) [Tarsonemidae] Broad mite	Yes (Waterhouse 1993)	Yes (APPD 2026; CABI 1986)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Tetranychus urticae</i> Koch, 1836 [Tetranychidae] Two-spotted spider mite	Yes (Waterhouse 1993)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Tyrophagus putrescentiae</i> (Schrank, 1781) [Acaridae] Mould mite	Yes (Waterhouse 1993)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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ALGAE							
<i>Cephaleuros virescens</i> Kunze ex E.M. Fries [Trentepohliales: Trentepohliaceae] Algal leaf spot	Yes (CABI 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
FUNGI							
<i>Aspergillus niger</i> Tiegh. [Eurotiales: Aspergillaceae] Fruit rot	Yes (Nithiyaa et al. 2012)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Brooksia tropicalis</i> Hansf. [Dothideales: Incertae sedis] Sooty mould	Yes (Farr & Rossman 2026; Johnston 1960)	Yes. Under official control (Regional) for WA (DPIRD 2026). Present in Qld (Hansford 1956; Paulus, Gadek & Hyde 2007).	No. Not known to be associated with mangosteen fruit. <i>Brooksia tropicalis</i> grows superficially, as an easily detected sooty mould, on honeydew produced by sap-sucking Hemiptera on leaves and petioles of mangosteen trees (Lim & Sangchote 2003).	Assessment not required	Assessment not required	Assessment not required	No

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<i>Colletotrichum gloeosporioides</i> (Penz.) Penz. & Sacc. Synonym: <i>Glomerella cingulata</i> (Stoneman) Spaud. & H. Schrenk [Glomerellales: Glomerellaceae] Anthracnose	Yes (Farr & Rossman 2026)	Yes (APPD 2026; Farr & Rossman 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Corticium koleroga</i> (Cooke) Höhn Synonym: <i>Pellicularia koleroga</i> Cooke [Corticiales: Corticiaceae] Thread blight	Yes (Lee et al. 2012)	No records found	No. Unlikely to be associated with imported commercial quality fruit. <i>Corticium koleroga</i> has been recorded on mangosteen trees (Marchionatto 1927) but typically infects twigs and branches of woody plants before spreading to the surface of leaves (Lourd & Alves 1987). <i>Corticium koleroga</i> may also spread to young fruit of host plants, including mangosteen (Yaacob & Tindall 1995). Young fruit that are infected with fungi of this genus develop symptoms very quickly (Tims & Mills 1943). These symptoms include white mycelial threads that spread across the entire surface	Assessment not required	Assessment not required	Assessment not required	No

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			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
			of young fruit (Wolf & Bach 1927). In the unlikely event that infection of woody material is not managed and spreads to the fruit, symptoms are likely to be detected and removed during harvest or through the sorting and grading practices at the packing house.				
<i>Corynespora cassiicola</i> (Berk. & M.A. Curtis) C.T. Wei [Pleosporales: Corynesporascaceae]	Yes (Shivas et al. 1996)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Distoseptispora adscendens</i> (Berk.) R. Zhu & H. Zhang Synonym: <i>Sporidesmium adscendens</i> (Berk.) [Distoseptisporales: Distoseptisporaceae]	Yes (Lee et al. 2012)	No records found	No. Not known to be associated with mangosteen fruit. One record has been found of <i>D. adscendens</i> forming lesions on the leaves of mangosteen trees (Lee et al. 2012).	Assessment not required	Assessment not required	Assessment not required	No
<i>Fusarium oxysporum</i> Schldl. [Hypocreales: Nectriaceae] Fusarium wilt	Yes (Nithiyaa et al. 2012)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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<i>Ganoderma philippii</i> (Bres & Henn. ex Sacc.) Bres. [Polyporales: Ganodermataceae] Red root	Yes (Farr & Rossman 2026)	No records found	No. Not known to be associated with mangosteen fruit. <i>Ganoderma philippii</i> infects the roots, and occasionally branches, of mangosteen trees (CABI 2026).	Assessment not required	Assessment not required	Assessment not required	No
<i>Grallomyces portoricensis</i> F. Stevens [Incertae sedis: Incertae sedis] Sooty mould	Yes (Farr & Rossman 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Lasiodiplodia theobromae</i> (Pat.) Griffon & Maubl. Synonym: <i>Botryodiplodia theobromae</i> Pat. [Botryosphaerales: Botryosphaeriaceae] Diplodia pod rot of cocoa	Yes (Farr & Rossman 2026)	Yes (APPD 2026; Farr & Rossman 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Macrophomina phaseolina</i> (Tassi) Goid. Synonym: <i>Tiarosporella phaseolina</i> (Tassi) Aa. [Botryosphaerales: Botryosphaeriaceae] Charcoal rot	Yes (CABI 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Marasmiellus scandens</i> (Masse) Dennis & D.A. Reid [Agaricales: Omphalotaceae] White thread blight	Yes (Farr & Rossman 2026; Lim & Sangchote 2003)	No records found	No. Not known to be associated with mangosteen fruit. <i>Marasmiellus scandens</i> grows on twigs, branches and the underside of the leaves of mangosteen trees (Lim & Sangchote 2003).	Assessment not required	Assessment not required	Assessment not required	No
<i>Marasmius crinis-equi</i> F. Muell. ex Kalchbr. [Agaricales: Marasmiaceae] Horse-hair blight	Yes (Farr & Rossman 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<i>Meliola garciniae</i> H.S. Yates [Meliolales: Meliolaceae] Black mildew	Yes (Farr & Rossman 2026; Lim & Sangchote 2003)	No records found	No. Not known to be associated with mangosteen fruit. <i>Meliola garciniae</i> grows superficially, as an easily detected black mildew, on honeydew produced by Hemiptera on the leaves and petioles of mangosteen trees (Lim & Sangchote 2003).	Assessment not required	Assessment not required	Assessment not required	No

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Appendix B: Initiation and categorisation for pests of mangosteen fruit from Malaysia

Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<p><i>Necator salmonicolor</i> (Berk. & Broome) K.H. Larss., Redhead & T.W. May</p> <p>Synonyms: <i>Corticium salmonicolor</i> Berk. & Broome; <i>Erythricium salmonicolor</i> (Berk. & Broome) Burds.</p> <p>[Corticiales: Corticiaceae]</p> <p>Pink disease</p>	Yes (Farr & Rossman 2026)	Yes. Under official control (Regional for WA (DPIRD 2026). Present in NSW and Qld (APPD 2026; Farr & Rossman 2026).	No. Not known to be associated with mangosteen fruit. <i>Necator salmonicolor</i> grows on the branches and shoots of mangosteen trees, causing the leaves above the infection point to wilt and die (Lim & Sangchote 2003). This fungus infects bark and is not associated with fruit (Ploetz et al. 2003).	Assessment not required	Assessment not required	Assessment not required	No
<p><i>Neocosmospora solani</i> (Mart.) L. Lombard & Crous</p> <p>Synonym: <i>Fusarium solani</i> (Mart.) Sacc.</p> <p>[Hypocreales: Nectriaceae]</p>	Yes (Chehri, Salleh & Zakaria 2015)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<p><i>Pestalotiopsis microspora</i> (Speg.) G.C. Zhao & N. Li</p> <p>[Amphisphaeriales: Pestalotiopsidaceae]</p> <p>Pestalotiopsis leaf blight</p>	Yes (Mohamed-Azni et al. 2022)	Yes (Pak et al. 2017)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
<p><i>Pestalotiopsis versicolor</i> (Speg.) Steyaert</p> <p>[Amphisphaeriales: Pestalotiopsidaceae]</p> <p>Pestalotiopsis leaf blight</p>	Yes (CABI 2026; Farr & Rossman 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Appendix B: Initiation and categorisation for pests of mangosteen fruit from Malaysia

Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Phomopsis</i> sp. [Diaporthales: Diaporthaceae] Phomopsis fruit rot	Yes. However, the <i>Phomopsis</i> sp. responsible for Phomopsis fruit rot in Malaysia has not been identified (CABI 2026).	Yes. <i>Phomopsis</i> species have been recorded from Australia (APPD 2026), but some species are absent.	No. Unlikely to be associated with imported commercial quality fruit. Phomopsis fruit rot of mangosteen occurs when fruit are already damaged, usually post-harvest, and causes hardening of the skin and lesions on fruit (Lim & Sangchote 2003; Zakaria 2022). Such fruit do not meet export quality standards and would be detected and removed during harvest or through the sorting and grading practices at the packing house.	Assessment not required	Assessment not required	Assessment not required	No
<i>Pyrrhoderma noxium</i> (Corner) L.W. Zhou & Y.C. Dai Synonyms: <i>Phellinidium noxium</i> (Corner) Bondartseva & S. Herrera; <i>Phellinus noxius</i> (Corner) G. Cunn. [Hymenochaetales: Hymenochaetaceae] Brown root disease	Yes (Johnston 1960)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No

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Appendix B: Initiation and categorisation for pests of mangosteen fruit from Malaysia

Pest	Present in Malaysia	Present within Australia	Potential to enter on pathway				Pest risk assessment required
			Potential for importation	Potential for distribution	Potential for establishment and spread	Potential for economic consequences	
<i>Sporidesmium tropicale</i> M.B. Ellis [Sporidesmiales: Sporidesmiaceae]	Yes (Lee et al. 2012)	No records found	No. Not known to be associated with mangosteen fruit. <i>Sporidesmium tropicale</i> infects the leaves of mangosteen trees in Malaysia (Lee et al. 2012).	Assessment not required	Assessment not required	Assessment not required	No
<i>Zignoëlla garciniae</i> Henn. [Chaetosphaeriales: Chaetosphaeriaceae] Zignoëlla stem canker	Yes (Lim & Sangchote 2003)	No records found	No. Not known to be associated with mangosteen fruit. <i>Zignoëlla garciniae</i> infects the stems and branches of mangosteen trees in Malaysia (Lim & Sangchote 2003).	Assessment not required	Assessment not required	Assessment not required	No
OOMYCETE							
<i>Phytophthora palmivora</i> (E.J. Butler) E.J. Butler [Peronosporaceae] Coconut budrot	Yes (CABI 2026)	Yes (APPD 2026)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	No
No soft scale species associated with commercially produced mangosteen fruit were identified by Malaysia in their Technical Market Access Submission. Application of the <i>Final group pest risk analysis for soft and hard scale insects on fresh fruit, vegetable, cut-flower and foliage imports</i> (DAWE 2021) did not identify any soft scales that are associated with the mangosteen fruit from Malaysia pathway. A further literature search found no soft scale species that are likely to be present on the mangosteen fruit from Malaysia pathway.							

Appendix C: Potential components of a systems approach to manage hard scales, mealybugs, dolichoderine ants and thrips on mangosteen fruit from Malaysia

The department considers a systems approach, combined with operational systems, could be used to reduce the risks of quarantine hard scales, mealybugs, dolichoderine ants and thrips on mangosteen fruit from Malaysia to achieve the ALOP for Australia.

A systems approach integrates different risk management measures, at least 2 of which act independently, which cumulatively achieve the required level of phytosanitary protection. The requirements of a systems approach are set out in ISPM 14: *The use of integrated measures in a systems approach for pest risk management* (FAO 2019c).

Potential components of a systems approach to manage the risks associated with hard scales, mealybugs, dolichoderine ants and thrips on mangosteen fruit from Malaysia pathway are outlined in Table C.1. A brief explanation of how these components contribute to risk reduction and provide assurance that the systems approach is effectively implemented is also provided.

Table C.1 Potential components of a systems approach for hard scales, mealybugs, dolichoderine ants and thrips on the mangosteen fruit from Malaysia pathway

Example component	How the component contributes to risk reduction and assurance
Registration and auditing of farms and packing houses	Registration and auditing by DOA provide assurance that mangosteen fruit for export are only sourced from approved farms and packing houses and produced in accordance with the requirements of the systems approach.
Integrated Pest Management (IPM) and farm hygiene practices	Good farm hygiene and IPM practices help reduce pest prevalence and the risk of pest establishment by removing pest reservoirs (e.g., weeds, ant nests, dead branches) and applying cultural and physical control activities (e.g., pruning, tree spacing, sticky traps). These practices reduce pest pressure in the field, thus lowering the risk of fruit infestation.
Pest monitoring and management practices on the farm	Effective pest monitoring and timely control measures minimise the risk of hard scales, mealybugs, dolichoderine ants and thrips of quarantine concern for Australia being present on export fruit, particularly where populations may increase rapidly during conditions favourable to pest development. Maintaining low pest pressure at harvest improves the effectiveness of post-harvest processes and reduces the likelihood of pests remaining on fruit intended for export.
Fruit processing under secure conditions	Processing only one type of fruit for a single market (i.e., mangosteen fruit for export to Australia) at a time prevents contact with other fruit that may carry pests, reducing the risk of cross-contamination.
Fruit sorting	Sorting fruit at harvest or upon arrival at the packing house reduces the pest load entering the packing process and supports the effectiveness of export-grade processing. Removing infested fruit, either in the field or at a designated receival area that is separate from the cleaning and packing areas, reduces the risk of pests contaminating fruit intended for export.
Fruit cleaning	Cleaning fruit reduces the risk of hard scales, mealybugs, dolichoderine ants and thrips of quarantine concern for Australia being present on export fruit. Mangosteen fruit require a cleaning technique that physically dislodges pests of concern, including those in cryptic or sheltered locations under the calyx. Examples of suitable cleaning techniques include brushing and high-pressure treatments (water or air), or a combination of both.
Post-cleaning check to verify effective cleaning	Using an appropriate method to check the fruit for pests after cleaning provides assurance that the cleaning process has effectively removed hard scales, mealybugs, dolichoderine ants and thrips of quarantine concern for Australia. Detection of pests at this stage indicates that further corrective action is required before fruit proceeds to export.

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Appendix C: Potential components of a systems approach to manage hard scales, mealybugs, dolichoderine ants and thrips on mangosteen fruit from Malaysia

Example component	How the component contributes to risk reduction and assurance
Fruit grading	Fruit grading reduces risk by ensuring that only fruit meeting export quality standards are packed for export. Fruit showing signs of pest damage, physical injury or defects that could harbour pests are removed, reducing the risk of fruit infested with pests of quarantine concern for Australia entering the export pathway.
Safeguarding and secure packaging of fruit	Safeguarding fruit after processing and the use of clean, secure packaging maintains the phytosanitary status of fruit, by preventing reinfestation prior to export.
Pre-export phytosanitary inspection, certification and management of non-compliance	Phytosanitary inspection and certification verify that fruit are free from pests of quarantine concern for Australia, and that the consignment meets import requirements. Management of non-compliance arrangements ensures that any identified issues are addressed prior to export, supporting the integrity of the overall systems approach.

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 2026b).
Agvet chemicals	Agricultural and veterinary chemicals, including a range of products developed to protect crops, livestock and domestic animals; safeguard our environment from invasive weeds and pests; and meet consumer needs for things such as household insecticides and pool and spa chemicals.
Appropriate level of protection (ALOP)	The level of protection deemed appropriate by the Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory (WTO 1995).
Appropriate level of protection (ALOP) for Australia	The <i>Biosecurity Act 2015</i> defines the appropriate level of protection (or ALOP) for Australia as a high level of sanitary and phytosanitary protection aimed at reducing biosecurity risks to very low, but not to zero.
Area	An officially defined country, part of a country or all or parts of several countries (FAO 2026b).
Area of low pest prevalence	An area, whether all of a country, part of a country or all or parts of several countries, as defined by the competent authorities, in which a specific pest is present at low levels and which is subject to effective surveillance or control (FAO 2026b).
Aril	The edible flesh of mangosteen fruit.
Arthropod	The largest phylum of animals, including the insects, arachnids and crustaceans.
Australian territory	Australian territory as referenced in the <i>Biosecurity Act 2015</i> refers to Australia, Christmas Island and Cocos (Keeling) Islands and any external Territory to which that provision extends.
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 <i>Biosecurity Act 2015</i> defines a BIRA as an evaluation of the level of biosecurity risk associated with particular goods, or a particular class of goods, that may be imported, or proposed to be imported, into Australian territory, including, if necessary, the identification of conditions that must be met to manage the level of biosecurity risk associated with the goods, or the class of goods, to a level that achieves the ALOP for Australia. The risk analysis process is regulated under legislation.
Biosecurity measures	The <i>Biosecurity Act 2015</i> defines biosecurity measures as measures to manage any of the following: biosecurity risk, the risk of contagion of a listed human disease, the risk of listed human diseases entering, emerging, establishing themselves or spreading in Australian territory, and biosecurity emergencies and human biosecurity emergencies.
Biosecurity risk	The <i>Biosecurity Act 2015</i> refers to biosecurity risk as the likelihood of a disease or pest entering, establishing or spreading in Australian territory, and the potential for the disease or pest causing harm to human, animal or plant health, the environment, economic or community activities.
Calyx	A collective term referring to all of the sepals of a flower and fruit.
Climacteric	A fruit that continues to ripen after harvesting.

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Glossary, acronyms and abbreviations

Term or abbreviation	Definition
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 2026b).
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO 2026b).
Crawler	An intermediate, mobile nymph stage of certain arthropods.
DOA	Malaysia's Department of Agriculture.
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 2026b).
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 2026b).
EP	Existing policy. This denotes that a pest species has previously been assessed in another policy published by the department.
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO 2026b).
FAO	Food and Agriculture Organization of the United Nations.
Fresh	Living; not dried, deep-frozen or otherwise conserved (FAO 2026b).
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.
General surveillance	An official process whereby information on pests in an area is obtained through various non-official or official sources other than surveys (FAO 2026b).
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.
Good Manufacturing Practices (GMP)	A set of principles and guidelines implemented to ensure that all aspects of food processing adhere to respective safety and quality standards.
Goods	The <i>Biosecurity Act 2015</i> defines goods as an animal, a plant (whether moveable or not), a sample or specimen of a disease agent, a pest, mail or any other article, substance or thing (including, but not limited to, any kind of moveable property).
Group Policy (GP)	This refers to the <i>Final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports</i> (thrips Group PRA) (DAWR 2017), the <i>Final group pest risk analysis for mealybugs and the viruses they transmit on fresh fruit, vegetable, cut-flower and foliage imports</i> (mealybugs Group PRA) (DAWR 2019), the <i>Final group pest risk analysis for soft and hard scale insects on fresh fruit, vegetable, cut-flower and foliage imports</i> (scales Group PRA) (DAWE 2021) and the <i>Final report for a review of pest risk assessments for spider mites (Acari: Trombidiformes: Tetranychidae)</i> (DAFF 2024).
Gummosis	A disorder that can occur in mangosteen fruit, where the latex sap within the fruit skin leaks out and causes yellow spots on the skin surface.
Hazard Analysis and Critical Control Point (HACCP)	A management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product (FDA 2022). In Malaysia, HACCP certification is administered by the Ministry of Health.
High-pressure air (HPA)	High-pressure air is a cleaning technique that utilises an engine to accelerate air through a hose and nozzle (air gun), generating a strong and directed pressurised air stream.

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Glossary, acronyms and abbreviations

Term or abbreviation	Definition
Host	An organism that harbours a parasite, mutual partner, or commensal partner, typically providing nourishment and shelter.
Host range	Species capable, under natural conditions, of sustaining a specific pest or other organism (FAO 2026b).
Import permit	Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2026b).
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 2026b).
Inspection	Official visual examination of plants, plant products or other regulated articles to determine if pests are present or to verify conformity with phytosanitary requirements (FAO 2026b).
Integrated Pest Management (IPM)	Integrated Pest Management is the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations. It combines biological, chemical, physical and crop specific (cultural) management strategies and practices to grow healthy crops and minimize the use of pesticides, reducing or minimizing risks posed by pesticides to human health and the environment for sustainable pest management (FAO 2026a).
Intended use	Declared purpose for which plants, plant products or other articles are imported, produced or used (FAO 2026b).
Interception (of a pest)	The detection of a pest during inspection or testing of an imported consignment (FAO 2026b).
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 FAO, the Interim Commission on Phytosanitary Measures or the Commission on Phytosanitary Measures, established under the IPPC (FAO 2026b).
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO 2026b).
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 etc., forming part of a consignment (FAO 2026b). Within this report a 'lot' refers to a quantity of fruit of a single variety, harvested from a single production site during a single pick and packed at one time.
Mature fruit	Commercial maturity is the start of the ripening process. The ripening process will then continue and provide a product that is acceptable to consumers. Maturity assessments include colour, starch, index, soluble solids content, flesh firmness, acidity, and ethylene production rate.
myGAP	The Malaysian Good Agricultural Practices program, which all export farms must be registered under.
National Plant Protection Organization (NPPO)	Official service established by a government to discharge the functions specified by the IPPC (FAO 2026b).
NSW	The state of New South Wales in Australia.
NT	The Northern Territory of Australia.

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Glossary, acronyms and abbreviations

Term or abbreviation	Definition
Nymph	The immature form of some insect species that undergoes incomplete metamorphosis. It is not to be confused with larva, as a nymph's form is already that of the adult in general, but lacking wings.
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 2026b).
Pathogen	A biological agent that can cause disease to its host.
Pathway	Any means that allows the entry or spread of a pest (FAO 2026b).
Peduncle	A plant stalk, supporting either flowers or fruit either in a cluster or singularly.
Pericarp	The skin around the flesh of a fruit, consisting of 3 layers, the epicarp, mesocarp, and endocarp.
Pest	Any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products (FAO 2026b).
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 2026b).
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 2026b).
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 2026b).
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 2026b).
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 2026b).
Pest risk assessment (for quarantine pests)	Evaluation of the probability of the introduction and spread of a pest and the magnitude of the associated potential economic consequences (FAO 2026b).
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 2026b).
Pest risk management (for quarantine pests)	Evaluation and selection of options to reduce the risk of introduction and spread of a pest (FAO 2026b).
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 2026b).
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 2026b).
Phytosanitary action	An official operation, such as inspection, testing, surveillance of treatment, undertaken to implement phytosanitary measures or to enable phytosanitary certification (FAO 2026b).
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 2026b).
Phytosanitary certification	Use of phytosanitary procedures leading to the issue of a phytosanitary certificate (FAO 2026b).

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Glossary, acronyms and abbreviations

Term or abbreviation	Definition
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 2026b). In this risk analysis the term 'phytosanitary measure' and 'risk management measure' may be used interchangeably.
Phytosanitary procedure	An official method on how to perform a phytosanitary action (FAO 2026b).
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 2026b).
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 2026b).
Production site	In this report, a production site is a continuous planting of mangosteen trees 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.
Pupa	An inactive life stage that only occurs in insects that undergo complete metamorphosis, for example, butterflies (Lepidoptera), beetles (Coleoptera), flies (Diptera) and wasps, bees and ants (Hymenoptera).
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 2026b).
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 2026b).
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 2026b).
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 2026b).
Regulated pest	A quarantine pest or a regulated non-quarantine pest (FAO 2026b).
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.
Sepal	Leaf-like structures that form the outermost part of a flower and fruit.
Specific surveillance	An official process whereby information on pests in an area is obtained through surveys (FAO 2026b).
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO 2026b).
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures.

Term or abbreviation	Definition
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 whereby information on pests in an area is obtained through general surveillance, specific surveillance or a combination of both (FAO 2026b).
Survey (of pests)	An official procedure conducted over a defined period to determine the presence or absence of pests, or the boundaries or characteristics of a pest population, in an area, place of production or production site (FAO 2026b).
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.
Trash	Soil, splinters, twigs, leaves and other plant material, other than fruit as defined in the scope of this risk analysis. Examples include 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 2026b).
Unrestricted risk estimate (URE)	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.
WA	The state of Western Australia.
WTO	World Trade Organization.

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