Australian Government
Department of Agriculture, Fisheries and Forestry

Draft pest risk analysis for khapra beetle (*Trogoderma granarium*) — Part 1

November 2025

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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 Australian Government Department of Agriculture, Fisheries and Forestry following the conditions specified within the related Biosecurity Advice, which is available at: https://www.awe.gov.au/biosecurity-trade/policy/risk-analysis/memos

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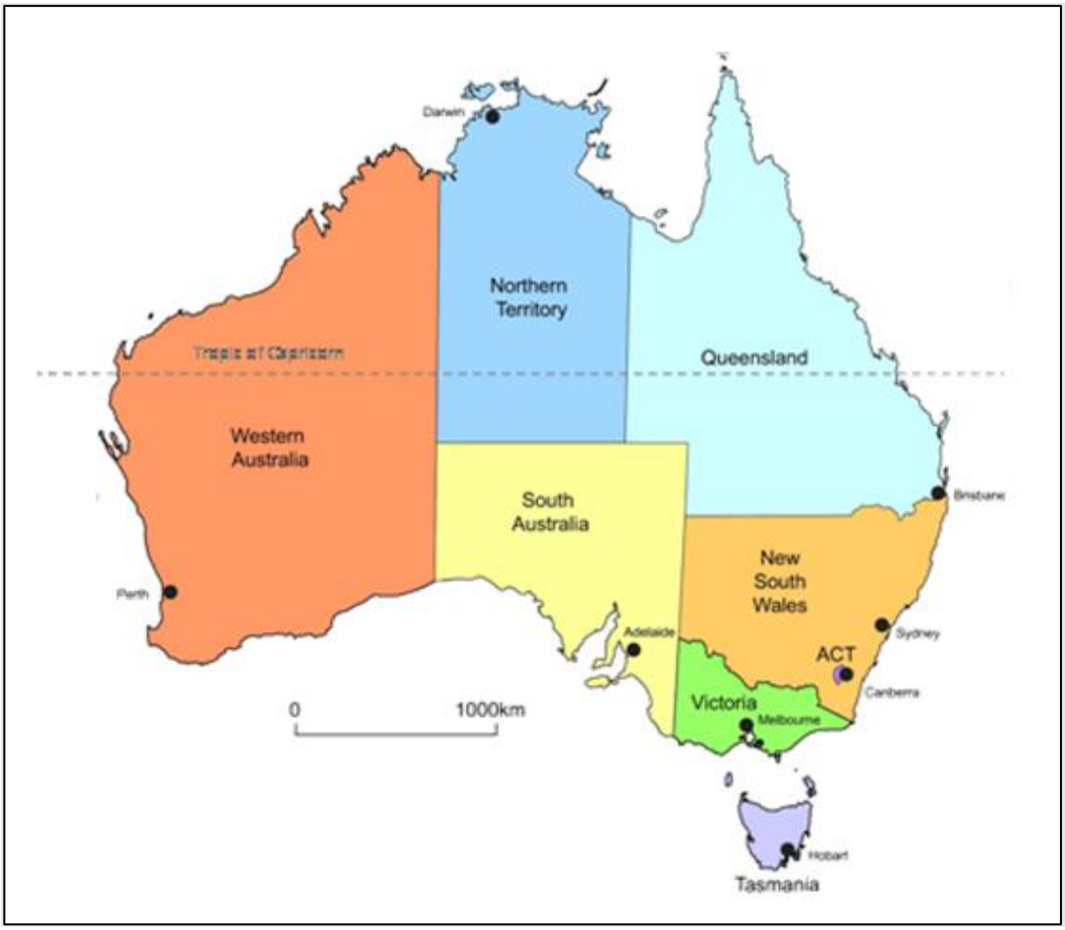

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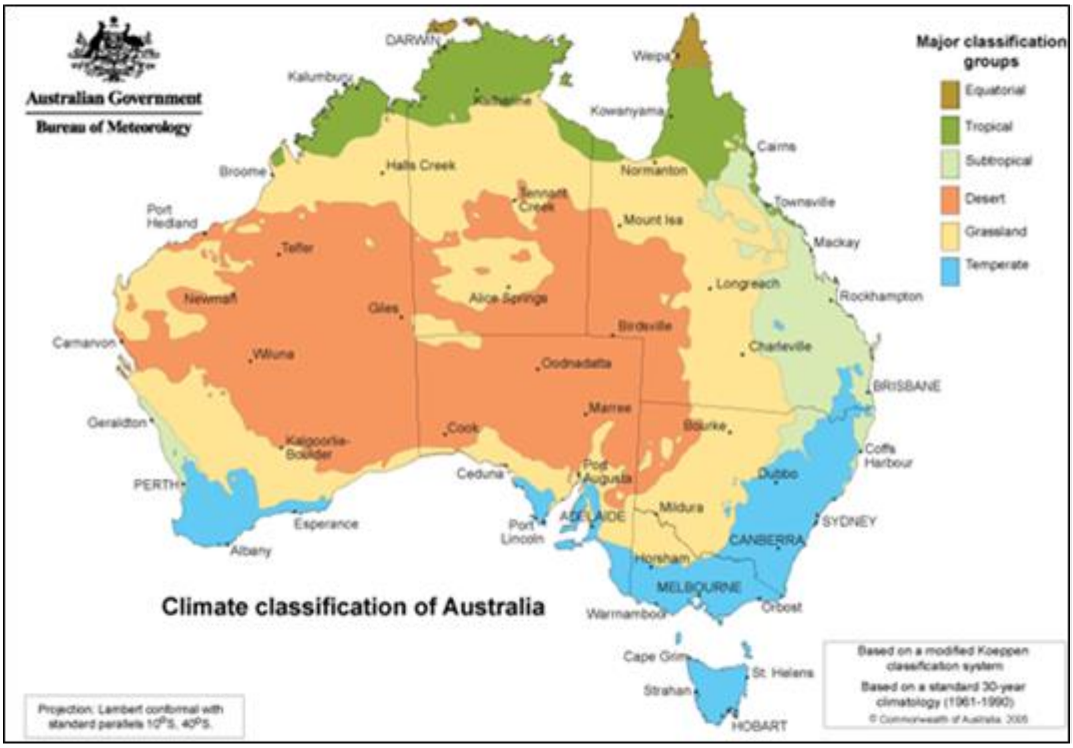


Summary

The Australian Government Department of Agriculture, Fisheries and Forestry (the department) initiated this pest risk analysis (PRA) in response to the introduction of emergency measures to manage the biosecurity risks of khapra beetle (*Trogoderma granarium*). Khapra beetle is one of the most destructive storage pests globally. It is currently not present in Australia. It is number one pest for the Australian grain industry and number two on the National Priority Plant Pests list. In response to a marked increase in detections of khapra beetle at the Australian border in 2019-2020, Australia introduced emergency measures to manage the biosecurity risks of khapra beetle associated with the importation of plant products and sea containers, in phases from September 2020.

The International Plant Protection Convention (IPPC) and the 'World Trade Organisation Agreement on the Application of Sanitary and Phytosanitary Measures' (SPS Agreement) require that phytosanitary measures against the introduction of new pests be technically justified. The IPPC's International Standards for Phytosanitary Measures (ISPM) No. 1 states that countries may take appropriate emergency action on a pest posing a potential threat to its territories; however, it requires that the action be evaluated as soon as possible to justify the continuation of the action.

The department is undertaking the PRA for khapra beetle in two parts, Part 1 for plant product pathways and Part 2 for sea container pathways. The PRA meets Australia's international obligations to review the emergency measures for khapra beetle. This draft report is for Part 1 of the PRA.

This draft report presents pest risk assessments for khapra beetle associated with imported plant product pathways, evaluates existing emergency measures and their basis, and proposes risk management measures for this beetle to achieve the appropriate level of protection (ALOP) for Australia.

The proposed risk management measures are mostly consistent with the existing emergency measures and include the same factors used as bases to determine the measures. Proposed changes from the existing emergency measures include:

- One of the following risk management measures are required for high-risk plant products and other-risk plant products, including seed for planting, imported from any country for research purposes:
  - Use only in biosecurity containment (Approved Arrangement class 5),
  - pre-export inspection and phytosanitary certification endorsed with additional declaration, OR
  - apply for an import permit.
- The additional declaration for the inspection of the treated goods be revised to:

  "Following treatment, representative samples were inspected and found free from all live insects, including *Trogoderma* spp.".
- The current list of 'target-risk khapra beetle countries' be revised to include 8 additional countries. These countries are Angola, Chad, Guinea, Jordan, Kazakhstan, Tajikistan, Tanzania and Turkmenistan.
- The current Australia's list of *Trogoderma* species of biosecurity concern be updated to remove *Trogoderma serraticorne*.

- Offshore treatment providers will be required to be registered and approved under one of the Australian pre-border biosecurity treatment provider schemes, Australian Fumigation Accreditation Scheme (AFAS) or AusTreat.

This draft report proposes specific areas that are subject to a review by the department based on evidence. These areas include:

- List of 'target-risk khapra beetle countries'
- List of 'high-risk plant products'
- List of plant products excluded from the risk management measures
- Australia's list of *Trogoderma* species of biosecurity concern to Australia
- The controlled atmosphere treatments currently approved provisionally by the department will continue to be accepted as provisional treatments and are subject to a review by the department based on evidence.

In addition, this draft report proposes operational systems for the assurance, maintenance, and verification of phytosanitary status to ensure that the proposed risk management measures are effectively applied, the phytosanitary status of the plant products is maintained, and that these can be verified.

The emergency measures will remain in place until the PRA is finalised following stakeholder consultation on the draft report and consideration of the comments received. However, if there is evidence to trigger a review by the department on any specific areas and the review indicates a certain change needs to be made, the change may be implemented before the PRA is finalised. Should this be the case, the department will engage with relevant stakeholders prior to the implementation.

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

1 Introduction

1.1 Australia's biosecurity policy framework

Australia's biosecurity policies aim to protect Australia against the risks that may arise from exotic pests entering, establishing, and spreading in Australia, thereby threatening Australia's unique flora and fauna, as well as those agricultural industries that are relatively free from serious pests. The risk analysis process is an important part of Australia's biosecurity 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 risk analysis, weed risk assessments, biological control agent risk analysis 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

This PRA was initiated by the department in response to the introduction of emergency measures to manage the biosecurity risks of khapra beetle (*Trogoderma granarium*).

Khapra beetle had previously been intercepted at the Australian border only a few times each year. There was a marked increase in the rate of interceptions in 2019 and 2020, when there were 11 and 16 interceptions, respectively (see more information in section 2.4). In addition to the increase in interceptions, khapra beetle was intercepted in goods with which it had not been previously associated, and in shipments from countries that were not known to have khapra beetle at the time. These detections were significant and indicative of a changing pathway risk profile and resulted in the introduction of emergency measures against khapra beetle by Australia.

Australia initially notified trading partners of the intention to implement emergency measures to manage the risk of khapra beetle entering Australia with imported plant products and sea containers through a World Trade Organisation Sanitary and Phytosanitary (WTO SPS) notification

(G/SPS/N/AUS/502) on 4 August 2020. Subsequently, Australia introduced emergency measures in phases from September 2020.

The introduction of emergency measures against khapra beetle is consistent with the IPPC and the SPS Agreement. The ISPM No. 1 (FAO 2016a) states that countries may take appropriate emergency action on a pest posing a potential threat to its territories and require that phytosanitary measures against the introduction of new pests be technically justified. The ISPM No. 1 also states that the emergency measures be evaluated as soon as possible to justify their continuance. Therefore, the department is undertaking this PRA to review and evaluate the emergency measures introduced against khapra beetle.

The PRA is undertaken in 2 parts:

- Part 1 for the biosecurity risks of khapra beetle associated with plant product pathways; and
- Part 2 for the biosecurity risks of khapra beetle associated with sea container pathways.

This draft report is for Part 1 of the PRA.

1.2.2 Scope

The scope of this PRA is limited to khapra beetle in association with plant product pathways to:

- assess the biosecurity risks of khapra beetle,
- evaluate the efficacy of current emergency measures, and
- propose ongoing risk management measures that will reduce the biosecurity risks to achieve the ALOP for Australia.

1.2.3 Existing policy

1.2.3.1 Australia's regulation for khapra beetle prior to the introduction of emergency measures

Khapra beetle is a quarantine pest for Australia and Australia has had regulations in place to manage the risk of introduction of khapra beetle since 1921. The specific import pathways regulated for the beetle and the required measures varied over time.

1.2.3.2 Existing emergency measures

Explanation of bases and terminologies

The following bases and terminologies are used by the department in determining existing emergency measures:

- **Category of plant product host**

  The department classifies plant products that are hosts of khapra beetles (see section 2.2.4) into 2 categories, 'high-risk plant products' or 'other-risk plant products'. The classification is based on factors such as scientific reports on plant products being main hosts, good hosts or preferred hosts for the beetle and records of interceptions of the beetle on plant products in international trade.

  The term 'international trade' used here refers to movement of goods across international borders, via all modes of arrival and either for commercial use or non-commercial use.

‘**High-risk plant products’** (Table 1.1) are plant products with scientific reports indicating that they are main hosts, good hosts or preferred hosts for khapra beetle and/or plant product hosts on which the beetle has been intercepted on multiple occasions in international trade.

Table 1.1 Current list of ‘high-risk plant products’

High-risk plant products [a]	
Common name	**Scientific name**
bean seed	*Phaseolus* spp.
celery seed	*Apium graveolens*
chickpeas	*Cicer arietinum*
coriander seed	*Coriandrum sativum*
cucurbit seed	*Cucurbita, Cucumis, Citrullus spp.*
cumin seed	*Cuminum cyminum*
dried chillies/capsicum	*Capsicum spp.*
faba bean, broad bean	*Vicia faba*
fennel seed	*Foeniculum vulgare*
lentils	*Lens culinaris*
mung beans, cowpeas	*Vigna spp.*
pea seed	*Pisum sativum*
peanuts	*Arachis hypogaea*
pigeon pea seed	*Cajanus cajan*
rice	*Oryza sativa*
safflower seed	*Carthamus tinctorius*
soybean	*Glycine max*
wheat seed	*Triticum spp.*

[a] including all synonyms and subordinate taxa of the species listed

‘**Other-risk plant products’** are all plant products that are hosts of khapra beetle (Table 2.1) other than high-risk plant products (Table 1.1).

- **Category of country of export**

  The department classifies a country of export into 2 categories, ‘target-risk khapra beetle countries’ or ‘other-risk khapra beetle countries’, based on the status of khapra beetle in that country.

  ‘Target-risk khapra beetle countries’ (Table 1.2) are countries where khapra beetle is assessed as being present.

  ‘Other-risk khapra beetle countries’ are all countries other than ‘target-risk khapra beetle countries’.

Table 1.2 Current list of 'target-risk khapra beetle countries'

Target-risk khapra beetle countries	
Afghanistan	Morocco
Albania	Myanmar
Algeria	Nepal
Bangladesh	Niger
Benin	Nigeria
Burkina Faso	Oman
Côte d'Ivoire (Ivory Coast)	Pakistan
Cyprus	Qatar
Egypt	Saudi Arabia
Ghana	Senegal
Greece	Somalia
India	South Sudan
Iran, Islamic Republic of	Sri Lanka
Iraq	Sudan
Israel	Syrian Arab Republic
Kuwait	Timor-Leste
Lebanon	Tunisia
Libya	Türkiye
Mali	United Arab Emirates
Mauritania	Yemen

- **Mode of arrival into Australia of plant product**

  The department classifies mode of arrival into Australia of plant products into the following 2 categories:

  - Freight — Arrival as high value freight or low value freight (air or sea), except for arrival as unaccompanied personal effects. In this PRA, these modes of arrival are termed 'freight modes of arrival'.
    - High value freight are goods valued above $1,000, arriving in Australia via air or sea freight.
    - Low value freight are goods valued at or below $1,000, arriving in Australia via air or sea freight.
  - Non-freight — Arrival with passengers including crew (ship or aircraft) as accompanied or unaccompanied baggage, arrival as unaccompanied personal effects (air or sea), or arrival via international mail (air or sea). In this PRA, these modes of arrival are termed 'non-freight modes of arrival'.

- **Intended use in Australia of plant product**

  The department classifies intended use in Australia of plant products into the following 3 categories:

  - personal use such as for consumption or planting

- commercial use such as for consumption, processing, or planting
- use for research purposes.

Phased introduction of emergency measures

The phased introduction of emergency measures for plant products are summarised below:

3 September 2020 — Phase 1

Not permitted entry for 'high-risk plant products' imported from any country, arriving via low value freight for personal use.

15 October 2020 — Phase 2

Not permitted entry for 'high-risk plant products' imported from any country, arriving via any non-freight mode of arrival for any intended use.

30 September 2021 — Phase 3

Pre-export treatment, followed by pre-export inspection and phytosanitary certification with additional declarations for 'high-risk plant products' imported from 'target-risk khapra beetle countries', arriving via any freight mode of arrival for any commercial use except for planting.

AND

Pre-export inspection and phytosanitary certification with additional declaration for 'high-risk plant products' imported from 'other-risk khapra beetle countries', arriving via any freight mode of arrival for any commercial use except for planting.

28 April 2022 — Phases 4 & 5

Pre-export inspection and phytosanitary certification with additional declaration for 'other-risk plant products' imported from any country, arriving via any mode of arrival for any intended use except for research purposes.

AND

Pre-export inspection and phytosanitary certification with additional declaration for seeds of either 'high-risk plant products' or 'other-risk plant products' imported from any country, arriving via any freight mode of arrival for planting except for research purposes.

Details of the phased introduction of emergency measures for plant products can be found through the WTO SPS notifications (G/SPS/N/AUS/502/Add. 1-17).

Existing emergency measures

The existing emergency measures are outlined in Table 1.3. Plant products that are excluded from the emergency measures are listed in Table 1.4. Approved pre-export treatment are listed in Table 1.5.

More details of existing emergency measures can be found on the department's website: Measures for plant products under the khapra beetle urgent actions - DAFF and the Biosecurity Import Conditions (BICON) system at bicon.agriculture.gov.au/BiconWeb4.0.

Table 1.3 Existing emergency measures

Note: Different colour-shades approximately denote different levels of risk and different types of measures, with reducing shading denoting lower level of risk and less stringent measure.

Risk category of imported plant product	Country of export	Mode of arrival into Australia	Intended use in Australia	Emergency measure	Notes
High-risk plant product **Exclusion:** Plant products listed in Table 1.4 are excluded from emergency measures	All countries	Passengers, including crew (air or sea) as accompanied or unaccompanied baggage	All uses	Not permitted entry	Refer to as Measure 1 in Chapter 4 (sections 4.1.2 and 4.5)
		Unaccompanied personal effects (air or sea)			
		International mail (air or sea)			
		Low-value freight (air or sea)	Personal use	Not permitted entry	Refer to as Measure 2 in Chapter 4 (sections 4.1.2 and 4.5)
	Target-risk khapra beetle countries	High-value freight (air or sea)	Commercial use (other than seed for planting)	Pre-export treatment **(a)** with treatment certificate, followed by Pre-export inspection, AND Phytosanitary certificate with additional declarations to attest that the goods have been treated **(b)** and inspected **(c).** **(a)** Approved pre-export treatments are listed in Table 1.3 **(b)** Additional declarations required to testify that the goods have been treated are dependent on the treatment applied. **(c)** Additional declaration to testify the treated goods have been inspected: *'Following treatment, representative samples were inspected and found free from all live species of Trogoderma.'*	Refer to as Measure 3 in Chapter 4 (sections 4.1.2 and 4.5)
		Low-value freight (air or sea)			Refer to as Measure 3 in Chapter 4 (sections 4.1.2 and 4.5) To demonstrate the goods have been imported for commercial use, one of the following documents is required: • supplier's declaration • manufacturer's declaration • commercial invoice, or • importer declaration

Risk category of imported plant product	Country of export	Mode of arrival into Australia	Intended use in Australia	Emergency measure	Notes
	Other-risk countries	High-value freight (air or sea)	Commercial use (<u>other than seed for planting</u>)	Pre-export inspection, AND Phytosanitary certificate with additional declaration *'Representative samples were inspected and found free from evidence of any species of Trogoderma (whether live, dead or exuviae) in Australia's list of Trogoderma species of biosecurity concern'.*	Refer to as Measure 4 in Chapter 4 (sections 4.1.2 and 4.5)
		Low-value freight (air or sea)			Refer to as Measure 4 in Chapter 4 (sections 4.1.2 and 4.5) To demonstrate the goods have been imported for commercial use, one of the following documents is required: • supplier's declaration • manufacturer's declaration • commercial invoice, or • importer declaration
	All countries	Low-value freight (air or sea)	Seed for planting (<u>commercial use only</u>) **Exclusion:** seed for planting imported through post-entry quarantine (PEQ) in Australia	Pre-export inspection, AND Phytosanitary certificate with additional declaration '*Representative samples were inspected and found free from evidence of any species of Trogoderma (whether live, dead or exuviae) in Australia's list of Trogoderma species of biosecurity concern*'.	Refer to as Measure 5 in Chapter 4 (sections 4.1.2 and 4.5)
			Pelleted or coated seed for planting (<u>commercial use only</u>) **Exclusion:** seed for planting imported through PEQ in Australia	<u>Option 1</u> Pre-export inspection of a bare seed sample of an identified seed lot, AND Phytosanitary certificate with additional declaration '*Representative samples were inspected and found free from evidence of any species of Trogoderma (whether live, dead or exuviae) in Australia's list of Trogoderma species of biosecurity concern*'. <u>Option 2</u>	

Risk category of imported plant product	Country of export	Mode of arrival into Australia	Intended use in Australia	Emergency measure	Notes
				Where no bare seed is available, an import permit is required. Application for an import permit must include: - Details of the pelleting or coating process - Quality control processes to manage stored product pests - Other relevant information that contributes to the management of risk	
	All countries	High-value freight (air or sea)	Seed for planting (except for research purposes) **Exclusion:** seed for planting imported through PEQ in Australia	Pre-export inspection, AND Phytosanitary certificate with additional declaration '*Representative samples were inspected and found free from evidence of any species of Trogoderma (whether live, dead or exuviae) in Australia's list of Trogoderma species of biosecurity concern*'.	Refer to as Measure 6 in Chapter 4 (sections 4.1.2 and 4.5)
			Pelleted or coated seed for planting (except for research purposes) **Exclusion:** seed for planting imported through PEQ in Australia	Option 1 Pre-export inspection of a bare seed sample of an identified seed lot, AND Phytosanitary certificate with additional declaration '*Representative samples were inspected and found free from evidence of any species of Trogoderma (whether live, dead or exuviae) in Australia's list of Trogoderma species of biosecurity concern*'. Option 2 Where no bare seed is available, an import permit is required. Application for an import permit must include: - Details of the pelleting or coating process - Quality control processes to manage stored product pests - Other relevant information that contributes to the management of risk	

Risk category of imported plant product	Country of export	Mode of arrival into Australia	Intended use in Australia	Emergency measure	Notes
Other-risk plant product **Exclusion:** Plant products listed in Table 1.4 are excluded from emergency measures	All countries	Passengers, including crew (air or sea) as accompanied or unaccompanied baggage Unaccompanied personal effects (air or sea) International mail (air or sea) High-value freight (air or sea) Low-value freight (air or sea)	All uses (except for research purposes) **Exclusion:** seed for planting imported through PEQ in Australia	Pre-export inspection, AND Phytosanitary certificate with additional declaration *'Representative samples were inspected and found free from evidence of any species of Trogoderma (whether live, dead or exuviae) in Australia's list of Trogoderma species of biosecurity concern'*. For pelleted or coated seed: Pre-export inspection can be conducted on a bare seed sample of an identified seed lot. Where no bare seed sample is available, an import permit is required. Application of an import permit must include: - Details of the pelleting or coating process - Quality control processes to manage stored product pests - Other relevant information that contributes to the management of risk	Refer to as Measure 7 in Chapter 4 (sections 4.1.2 and 4.5)

Table 1.4 List of plant products excluded from the emergency measures

Excluded plant products
• Commercially prepared and packaged goods that have been thermally processed so that the nature of the material has been transformed from their original raw form, such as retorted, blanched, roasted, fried, par-boiled, boiled, puffed, malted or pasteurised
• Goods that are commercially milled or ground to a powder, meal or flakes and packaged in bags less than or equal to 25kg
• Breakfast cereals, instant cereal beverage mixes, couscous meal mixes and snack foods (including muesli bars, granola bars and wholefood bars/balls, trail mixes) that are commercially prepared and retail packaged*
• Bakery and bread mixes (including whole seeds) that are commercially prepared and retail packaged*
• Commercially prepared and packaged herbal teas, with or without seeds (including loose leaf and teabags)
• Goods that are chemically processed and preserved such as with a Formalin Propionic Acid fixative, Formalin Acetic acid alcohol, Carnoy's fixative or ethanol
• Fresh fruits and fresh vegetables
• Commercially prepared, shelled nuts packaged under strong vacuum**
• Commercially manufactured frozen or freeze-dried food (perishable foodstuffs only)
• Commercially prepared and retail packaged* peppercorn grinders**
• Commercially vacuum-sealed green coffee bean trade samples imported as mail or passenger baggage or low value freight (below dutiable customs value)**
• Frozen plant samples for plant research (including through the use of liquid nitrogen and freeze drying)
• Oils derived from vegetables or seed
• Preserved or pickled
• Goods that have been refined or extracted to obtain specific components from plant-based raw materials (including starch, lecithin, protein, cellulose, sugars and pigments)
• Medicinal cannabis plant parts other than seed products irradiated at or above 1 kGy**

*An imported good is considered retail packaged if it has been commercially prepared and packaged overseas and is in a final state that requires no further processing, packaging or labelling prior to retail sale or consumer use in Australia.
** exclusion applies only for 'other-risk plant products'

Table 1.5 Approved pre-export treatments

Treatment type	Approved treatment schedule	Treatment methodology that must be followed
Methyl bromide fumigation	80 g/m^3 for 48 hrs at 21°C	Methyl Bromide Fumigation Methodology
Heat treatment	≥ 60°C (measured at the core of the goods) for a minimum of 120 minutes	Heat Treatment Methodology
Controlled atmosphere – High CO_2 atmosphere at atmospheric pressure*	≥ 80% CO_2 concentration at ≥ 25°C at atmospheric pressure for a minimum duration of 28 consecutive days	Controlled Atmosphere Treatment Methodology
Controlled atmosphere – High CO_2 atmosphere at high pressure*	≥ 95% CO_2 concentration at ≥ 20°C at ≥ 30 bar for a minimum duration of 3 consecutive hours OR ≥ 95% CO_2 concentration, at ≥ 20°C at ≥ 20 bars for a minimum duration of 5 consecutive hours	

Controlled atmosphere – Low O_2 atmosphere (with N_2 balance) at atmospheric pressure*	≤1% O_2 concentration at ≥ 25°C at atmospheric pressure for a minimum duration of 22 consecutive days OR ≤1% O_2 concentration at ≥ 28°C at atmospheric pressure for a minimum duration of 12 consecutive days	

*All controlled atmosphere treatments listed in this table are provisionally approved by the department

1.2.3.3 Australia's regulatory policy

The *Biosecurity Act 2015* and its subordinate legislation provides the legal basis for preventing and managing the introduction into Australia of pests and diseases that may cause harm to human, animal or plant health or the environment.

1.2.3.4 Domestic arrangements

The Australian Government is responsible for regulating the movement of goods 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 goods. After imported goods 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 Consultation

Prior to and after announcement of the emergency measures, the department engaged with relevant stakeholders (including peak industry bodies, state and territory governments, trading partners and general public) on the implementation of the emergency measures. Details are provided in Appendix D.

On 7 July 2022, the department notified stakeholders of the commencement of a PRA for khapra beetle. The PRA has been initiated to assess the biosecurity risks of khapra beetle associated with various import pathways, to evaluate the efficacy of emergency measures, and to ensure that ongoing risk management measures are scientifically justified and effective in managing the biosecurity risks of this pest to achieve the ALOP for Australia.

On 26 and 27 August 2025, the department notified stakeholders that the PRA for khapra beetle will be undertaken in 2 parts, Part 1 for plant product pathways and Part 2 for sea container pathways.

1.2.5 Overview of this pest risk analysis

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 2024). A pest is 'any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products' (FAO 2024).

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

This PRA was conducted in the following three consecutive stages:

1) Initiation—identification of:

- the pest (khapra beetle), and
- the pathway being assessed in the PRA (plant product pathways)

2) Pest risk assessment—this was conducted in 2 sequential steps:

2a. Pest categorisation: examination of khapra beetle to determine whether it meets the criteria for 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 of the khapra beetle through the identified plant product pathways and the potential consequences. The combination of the likelihoods and consequences gives an overall estimate of the biosecurity risk of khapra beetle, known as the unrestricted risk estimate (URE).

3) Pest risk management— where the URE is determined as not achieving the ALOP for Australia, evaluating the current emergency measures for khapra beetle and proposing necessary phytosanitary measures to reduce the biosecurity risk to achieve 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 and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests’ (FAO 2024).

1.2.5.1 Where in the PRA specific information can be found

For information on:

- the method for PRA: see Appendix A
- scope of this PRA: see section 1.2.2
- existing emergency measures: see section 1.2.3.2
- initiation and pest categorisation for khapra beetle (and for other Trogoderma species that are associated with plant product pathways): see Appendix B
- pest information for khapra beetle: see Chapter 2
- further pest risk assessments for khapra beetle associated with plant product pathways: see Chapter 3
- review of the global distribution of khapra beetle and classification of countries based on the status of khapra beetle: see section 4.2.1 and Appendix C
- evaluation of the bases for current emergency measures: see section 4.2
- evaluation of excluding some forms of plant products from emergency measures: see section 4.3
- evaluation of the required ‘freedom from Trogoderma species’ in the additional declaration on the phytosanitary certificate: see section 4.4
- evaluation of current emergency measures: See section 4.5

- proposed risk management measures for pathways where the URE does not achieve the ALOP for Australia: see section 4.6
- operational systems for the assurance, maintenance, and verification of phytosanitary status: see section 4.7
- terms used in this PRA: see Glossary, acronyms, and abbreviations at the end of this report.

1.2.5.2 Section, table and figure numbering

Sections, tables and figures are numbered sequentially with the chapter number or appendix letter. Examples are: section 3.1 and section 3.2 for sections in Chapter 3, section A1 and section A2 for sections in Appendix A, Figure 2.1 and Figure 2.2 for figures in Chapter 2, and Table B.1 and Table B.2 for tables in Appendix B.

1.2.6 Next steps

The department has notified 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 PRA and proposed risk management measures, and to draw attention to any scientific, technical, or other gaps in the data, or misinterpretations or errors.

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 received during the consultation period.

The final report will be published on the department website along with a notice advising stakeholders of the release. The department will also notify the 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.

2 Pest information

This chapter presents information on khapra beetle that is relevant to biosecurity risk and its management.

2.1 Taxonomy

Scientific name: *Trogoderma granarium* Everts, 1898
Common name: khapra beetle
Order: Coleoptera
Family: Dermestidae

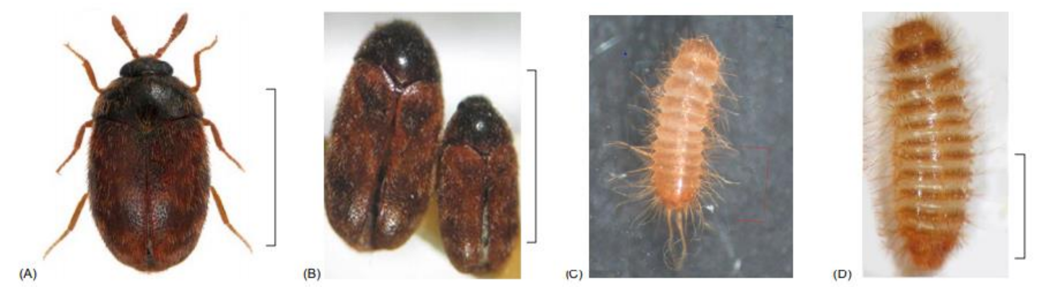
2.2 Biology

2.2.1 Life cycle

2.2.1.1 Life stages

Khapra beetle develops through four life stages: egg, larva, pupa, and adult. Images for khapra beetle adults and larvae are provided in Figure 2.1.

Figure 2.1 Images for adults and larvae of khapra beetle



(A) adult female; (B) comparison of adult female (left) and adult male (right); (C) young larvae; (D) mature larvae. Scale bar: (A), (B), (D) = 2 mm; (C) = 1 mm (Source FAO 2012)

Egg

Eggs are generally laid between grains or in cracks and crevices of storage structures (Lindgren & Vincent 1959). The khapra beetle egg is cylindrical, and milky white in colour when first laid, but as development proceeds the egg turns a pale yellowish colour (Singh et al. 2017). Eggs measure 0.7 mm in length and 0.2 mm in diameter (Howe & Burges 1955). Eggs often hatch within 4 to 7 days after laying, depending on temperature (Yadav & Srivastava 2017), although delayed hatching has been observed up to 30 days (Riaz, Shakoori & Ali 2014).

Larva

At hatching, the larvae are yellowish white and have brownish hairs. The larval colour changes to reddish or golden with increasing age (Hadaway 1956). First instar larvae are 1.6 mm to 1.8 mm long and 0.25 mm to 0.3 mm wide. In late to final larval instars males are smaller than females with average lengths of 3.5 mm and 5 mm, respectively (Hadaway 1956). Larvae can pass through 4 to 10 instars depending on temperature, diet and whether diapause has occurred (Borzoui, Naseri & Namin 2015; Burges 1960). The time between larval instars can vary significantly according to temperature and sex. Under favourable conditions, the male larva moults four times and the larval duration lasts for 30 to 50 days. In the case of females, larval duration is slightly longer. Under unfavourable conditions, such as low temperatures and insufficient food, larval development can be delayed by induction of diapause and some individuals may survive as larvae for more than six years before pupating (Burges 1962a).

Pupa

Pupation occurs enclosed in the last larval skin. The dorsal surface of the pupa is covered with hairs and the hairs along the median line form a distinct ridge (Lindgren, Vincent & Krohne 1955). Female pupae (5 mm) are larger than male pupae (3.5 mm) (Singh et al. 2017). The pupal stage lasts 3 to 5 days for males and 3 to 6 days for females (Hadaway 1956).

Adult

After the pupal stage, adult beetles emerge and become sexually mature in 2 to 3 days. Adult khapra beetle are oblong to oval shaped, measuring 1.6 mm to 3 mm in length, brown, and black in colour and are covered with fine hairs (Hadaway 1956). Adult females are larger than adult males and lighter in colour (Hadaway 1956; Lindgren, Vincent & Krohne 1955). Although both sexes have fully developed wings, neither can fly (Lindgren, Vincent & Krohne 1955). Adults are relatively short lived, but their reported life span varies with temperature and adult females have been reported to live up to 20 days (Riaz, Shakoori & Ali 2014). Adult females can produce up to approximately 80 eggs at 30°C (Riaz, Shakoori & Ali 2014). However, oviposition is also temperature dependent and declines outside the optimal range of 25-35°C (Riaz, Shakoori & Ali 2014). Adults derived from diapausing larvae have been reported to lay more eggs than those derived from non-diapausing larvae (Karnavar 1972).

2.2.1.2 Life cycle duration

Environmental conditions are known to influence the life cycle duration of khapra beetle. The reported life cycle duration of khapra beetle is highly variable from 24 days at 34°C to 35°C (Hadaway 1956), 39 to 45 days at 30°C and up to 220 days at or below 21°C (Lindgren, Vincent & Krohne 1955).

The influence of different food types on development period of khapra beetle has been documented, for example, for sorghum, millet, and wheat (Saliheen 2005); for barley, rice, rye, wheat and walnut (Borzoui, Naseri & Namin 2015); for four different oil seeds (sesame, flax, soybean and coconut) and for five different grains (basmati rice, Egyptian rice, corn, oat and wheat) (Awadalla et al. 2023). Depending on food and environmental conditions, khapra beetle can have up to 10 generations per year (Athanassiou, Phillips & Wakil 2019).

2.2.2 Environmental conditions

Khapra beetle thrives in hot, dry conditions with a mean temperature greater than 20°C and a relative humidity below 50%. Optimal temperatures for development of khapra beetle are reported to be between 32˚C and 35˚C (Lindgren, Vincent & Krohne 1955). The intrinsic rate of population increase of khapra beetle shows an increasing trend from 20˚C until a maximum of 34-35˚C and then sharply declines at higher temperatures (Papanikolaou et al. 2019).

At temperatures below 20°C, khapra beetle survives but does not mate nor lay eggs (Hadaway 1956). Oviposition does not vary markedly between 27°C and 35°C, and is not significantly affected by relative humidity (Odeyemi & Hassan 1993). It has been noted that khapra beetle cannot develop or complete its development at temperatures ≤20˚C or ≥40°C (Riaz, Shakoori & Ali 2014). Temperatures above 40°C are reported to be unfavourable for khapra beetle (Ahmad et al. 2014; Burges 2008) although khapra beetle is considered a highly heat-tolerant species (Lindgren, Vincent & Krohne 1955; Lindgren & Vincent 1959).

Photoperiod also has some impact on development. It has been reported that the larval food consumption increases under conditions of constant darkness, however constant light accelerates larval development (Sohi 1947, cited in Athanassiou, Phillips & Wakil 2019; Odeyemi & Hassan 1993).

2.2.3 Diapause

A key feature of khapra beetle contributing to its status as a successful storage and hitchhiker pest is the ability of mature larvae to undergo facultative diapause. Diapause can be triggered by a range of unfavourable conditions such as extreme temperatures, isolated rearing, high population densities, and insufficient food (Burges 1959b, 1962a, 1963; Rees & Banks 1998). Diapausing larvae have an enhanced tolerance to starvation, insecticides, and extreme temperatures (Athanassiou, Phillips & Wakil 2019; Banks 1977), allowing them to persist until favourable conditions become available.

The diapause period may last for several years, and termination of diapause is often erratic (Burges 1959a, 1962a). During the diapause state, larvae remain inactive and live in cracks and crevices or any other concealed places. Diapausing larvae may sporadically feed and continue to moult, but not complete development (Athanassiou, Phillips & Wakil 2019). In the presence of food, they may emerge from their resting sites at irregular intervals and feed. Most of these return to concealed places and revert to the diapause condition although a few may pupate (Nair & Desai 1973).

Under favourable conditions, diapausing individuals can break diapause, mature, breed rapidly, and quickly expand population (Burges 1959b, 1962a). Non-diapausing larvae continually feed and accumulate large quantities of metabolites, mainly lipids. These stored materials are used for energy production during food scarcity, and for egg or sperm production once they become adults. Adult fecundity is proportionate with the amount of reserve materials in their body (Karnavar 1972, 1973, 1984). Adults that have passed through diapause are larger and have higher fecundity than those which did not go through diapause in their larval stage (Karnavar 1972; Karnavar 1984). Diapause can also affect pheromone production by females and the associated male response (Bell 1994; Gothi, Tamhankar & Rahalkar 1984).

The cryptic and immobilized in refuges behaviours of diapausing larvae is a challenge for their detection (Athanassiou, Phillips & Wakil 2019). Diapausing larvae are considered the life stage that contributes to the spread of khapra beetle in different eco-zones (Banks 1977).

Contributing to the persistence of khapra beetle is their ability to also undergo retrogressive moulting, or retrogressive development, under starvation conditions (Shivananjappa et al. 2023). Late instar larvae have been observed to survive a 3-month period of starvation, moulting up to 6 times and reducing their body mass by about half, on average. When reprovisioned with food, most larvae resumed the normal trajectory of development and pupated within a month. This unusual phenomenon, mainly associated with Dermestid species for the few cases reported, allows larvae to reduce their size and energetic requirements to survive for periods of up to several years during periods of privation. Khapra beetle larvae can therefore persist for long periods in empty storage facilities or empty containers used for international grain shipments (Shivananjappa et al. 2023).

2.2.4 Hosts

Khapra beetle can potentially feed on any dried material of plant origin (Bhattacharya & Pant 1968; Lindgren & Vincent 1959; Lindgren, Vincent & Krohne 1955). The beetle has preference for grains and grain products (Ahmedani et al. 2007a; Bhattacharya & Pant 1968; Lindgren, Vincent & Krohne 1955) but also infests spices (Al-Iraqi & Abdulla 2013; Kavallieratos et al. 2019), herbs (Kavallieratos et al. 2019), seeds, pulses (Kavallieratos et al. 2019), nuts (Borzoui, Naseri & Namin 2015; Kavallieratos et al. 2019), dried fruits (Degri & Zainab 2013; Kavallieratos et al. 2019) and dried vegetables (Degri & Zainab 2013).

This PRA considers plant products listed in Table 2.1 as hosts of khapra beetle, hereafter referred to as plant product hosts or plant products. They are considered hosts because they can be infested by khapra beetle, can harbour the beetle, act as a food source, facilitate the beetle's development and/or facilitate the completion of the beetle's life cycle.

Table 2.1 List of plant product hosts of khapra beetle

Plant product hosts of khapra beetle
• Seeds and grains (all species)
• Spices and dried herbs (all species)
• Plant gums and resins (except those chemically extracted or highly processed)
• Processed seed, grain, nut, tuber, and corm products, such as flours, meals, and flakes (all species)
• Dried fruits (all species)
• Nuts (all species)
• Dried vegetables (all species) and dried mushrooms (all species)
• Unprocessed plant products (excluding fresh fruits, fresh vegetables, nursery stock, herbarium specimens, fresh cut flowers, coir peat, peat, and timber)

The nutritional qualities of different plant product hosts vary in their effects on khapra beetle development, including growth rate, development time and fecundity (Awadalla et al. 2023; Borzoui, Naseri & Namin 2015; Saliheen 2005). Oil seeds and dried fruits are generally less suitable compared to cereals and pulses (Athanassiou, Phillips & Wakil 2019). While older larvae can infest and feed on sound kernels, young larvae cannot damage sound kernels but will feed on the soft germ of the seed. Therefore, the presence of cracked kernels enhances the beetle's development and infestation can occur faster when intact kernels coexist with already infested or cracked kernels (Athanassiou, Phillips & Wakil 2019).

2.2.5 Infestation and damage

Khapra beetle infestations are generally found in stored plant products (Chimoya & Abdullahi 2011; Ebrahimi 2020; French & Venette 2005), packaging materials (Day & White 2016; Hussain et al. 2019) and cracks and crevices of storage facilities (Day & White 2016; Lindgren, Vincent & Krohne 1955). Figure 2.2 shows khapra beetle infestation of stored plant products and Figure 2.3 shows khapra beetle infestation of storage facilities.

Infestation in grains negatively affects the grain nutritional quality (Athanassiou, Phillips & Wakil 2019). Heavy infestations of khapra beetle in plant products are characterised by a large number of larvae and their cast skins, and the plant products such as grains can be turned into a powdery mass.

In bulk commodities, infestations usually concentrate in the surface layers, where numerous larval exuviae, broken setae and frass (excrement) are present (Figure 2.2). The greatest damage tends to occur in the top 30 cm, but can also occur at greater depths close to corners and walls of bins (Rees & Banks 1998).

Figure 2.2 Infestation of stored products with khapra beetle

(A) Infested wheat grain; (B) infested rape seeds; (C) totally destroyed wheat grain (dust and remains of grains); (D) larval exuviae (cast skins) contaminating stored product. Source: FAO 2012

Figure 2.3 Khapra beetle infestation in storage facilities

Signs of infestation in (A, B) cracks in a storage facility; (C) pallet; and (D) bags. Source: DAFF

Khapra beetle is considered a dirty feeder because it contaminates the product at the same time as it is feeding on the product (Stibick 2007). Cast larval skins may cause dermal irritation to people who handle heavily infested grain (Stibick 2007). Bristly larval hairs that rub off and remain in grains can pose serious gastrointestinal health risks if swallowed, particularly to children, who may subsequently develop health issues such as vomiting and diarrhea (Stibick 2007).

2.3 Global distribution of khapra beetle

2.3.1 Habitat

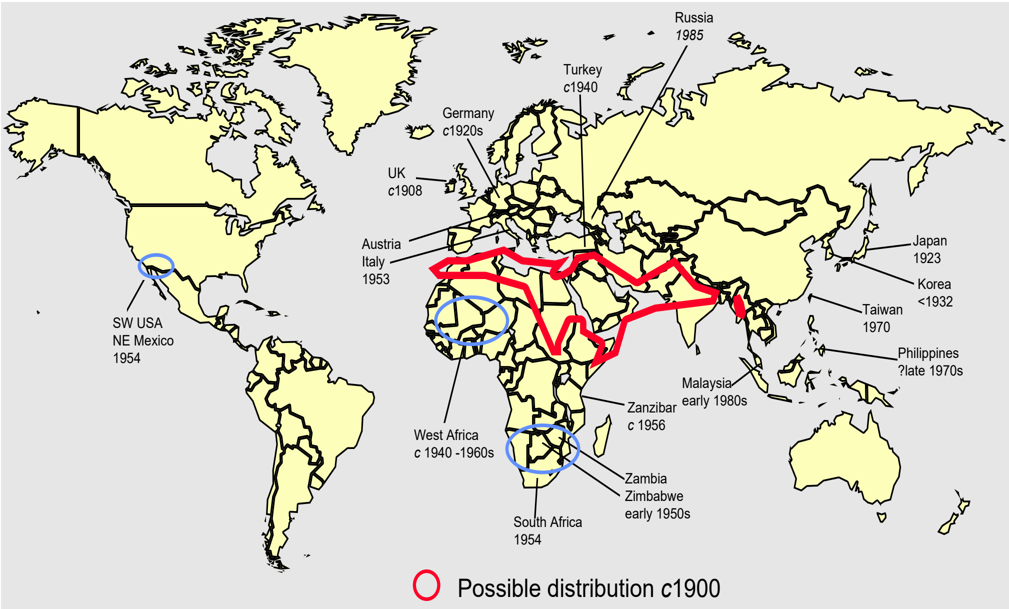
Khapra beetle is considered a synanthropic pest (Athanassiou, Phillips & Wakil 2019), meaning that it is generally found in close association with humans and in human created and managed environments. Khapra beetle has not been reported to be a field pest. It is a storage pest, found in grain storage facilities, warehouses, processing plants, pantries and many other human-associated environments where host material is found.

2.3.2 Origins and spread

Khapra beetle was first reported from India in 1894 (Singh et al. 2017) and is considered to be native to India (Rahman, Sohi, and Sapra 1945, cited in Lindgren, Vincent & Krohne 1955).

Around 1900, khapra beetle was present in various countries in north Africa, west Asia and south Asia (Map 3). Khapra beetle has since spread to different countries/regions in several waves (Map 3). Between 1900 and 1930s, this pest was found in northern Europe (the United Kingdom, Germany) and east Asia (Japan and Korea). Following World War II, there was a major expansion into Türkiye, Italy, Austria, southwest USA, northwest Mexico, and west and southern Africa. Prior to the 1960s, khapra beetle had spread to several countries/regions where grain and grain products were stored, but it was eradicated or is no longer present in some of these countries/regions (Athanassiou, Phillips & Wakil 2019). In the 1980s, the beetle spread into central Asia and was detected in Kazakhstan, Tajikistan, Turkmenistan, and Uzbekistan.

Map 3 Geographic spread of khapra beetle[a]



[a] Noting that khapra beetle has been eradicated or is no longer present in some countries/regions shown on this map.
Source: Rees & Banks 1998

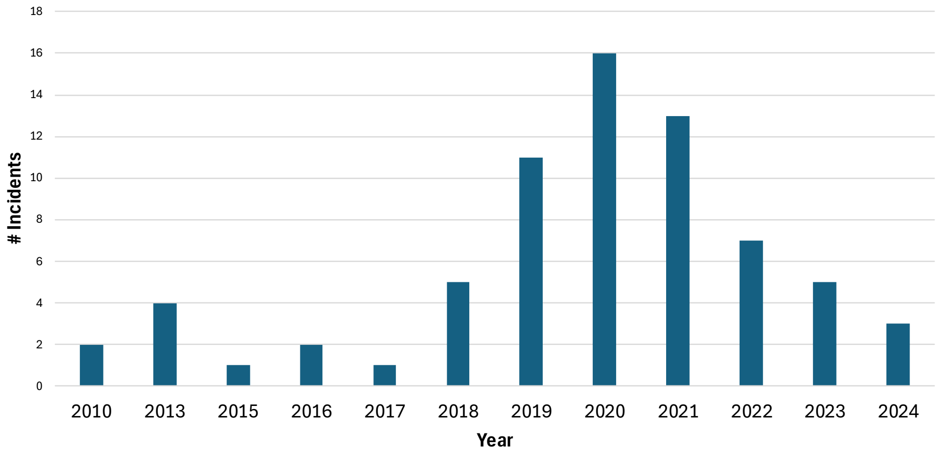
2.3.3 Current distribution

Information on current distribution of khapra beetle is variable in the literature. Therefore, this PRA includes a review of global distribution of khapra beetle. Outcomes of the review are outlined in section 4.2.1 and Appendix C.

2.4 Interceptions of khapra beetle

Khapra beetle was previously intercepted at the Australian border only a few times each year prior to a marked increase in 2019 and 2020 when there were 11 and 16 interceptions, respectively. Yearly interceptions of khapra beetle on goods arriving in Australia during 2010-2024 are provided in Figure 2.4.

Figure 2.4 Yearly interceptions of khapra beetle in Australia from January 2010 to December 2024



Source: Department of Agriculture Fisheries and Forestry

Khapra beetle has been intercepted in plant products in international trade since the 1900s. For example, Lindgren, Vincent & Krohne (1955) reviewed the literature on khapra beetle detections between 1916 and 1954 and reported that khapra beetle was intercepted in England in wheat from Bombay and Karachi and barley from India. The paper describes imports of plant products from India as the primary source for the pest entering other countries.

The number of interceptions of khapra beetle has increased since the 2000s. For example, in the USA, khapra beetle was intercepted an average of 4 times per year in 2000 to 2004, an average of 6 times per year in 2005 and 2006, and an average of 15 times per year from 2007 to 2009. High numbers of interceptions were also reported in 2011 and 2013, and a spike was reported in 2012 (USDA-APHIS 2012).

Examples of khapra beetle interceptions during 2010-2023 on imported goods in international trade include:

2010 Khapra beetle was intercepted in the USA in goods from India (dried beans, organic rice) and Saudi Arabia (rice) (Hagstrum 2025) and in Australia in goods from Pakistan (rice) (DAFF, unpublished).

2011 Khapra beetle was intercepted in Vietnam in goods from India (corn, soya bean, barley, millet) (Day & White 2016), and in the USA in goods from India (barley, rice, safflower seed), Pakistan (rice), Saudi Arabia (rice, seeds, and spices) and UAE (beans) (Hagstrum 2025).

2012 Khapra beetle was intercepted in the USA in goods from India (rice, lentils), Iraq (pepper seed), Saudi Arabia (pumpkin seed, cumin seed, rice), Sudan (beans) and UAE (moong dal, urad dal, rice) (Hagstrum 2025).

2013 Khapra beetle was intercepted in the USA in goods from India (seed, dried beans), Pakistan (rice), Saudi Arabia (rice) and Sudan (dried beans) (Hagstrum 2025) and in Australia in goods from India (rice) (DAFF, unpublished).

2014 Khapra beetle was intercepted in the USA in goods from Pakistan (chickpeas, rice), Saudi Arabia (rice) and Sudan (Acacia seed, faba beans, pigeon pea) (Hagstrum 2025).

2015 Khapra beetle was intercepted in the USA in goods from India (chickpeas, peanuts, rice, soybean) (Hagstrum 2025) and in Australia in goods from Sri Lanka (coriander seed) (DAFF, unpublished).

2016 Khapra beetle was intercepted in the USA in goods from India (dried beans, cumin seed, moong dal), Nepal (moong dal), Saudi Arabia (rice) and Sudan (dried beans) (Hagstrum 2025) and in Australia in goods from Pakistan (rice) (DAFF, unpublished).

2017 Khapra beetle was intercepted in the USA in goods from Bangladesh (rice), Pakistan (rice), Saudi Arabia (rice) and Sudan (chickpeas, dried berries, Hibiscus leaves, and jujubes) (Hagstrum 2025) and in Australia in goods from India (chickpeas) (DAFF, unpublished).

2018 Khapra beetle was intercepted in the USA in goods from India (coriander seed), from Sudan (Faba bean) and Türkiye (dried dates) (CBP 2021) and in Australia in goods from Saudi Arabia (rice), India (mung bean) and Nigeria (maize) (DAFF, unpublished).

2019 Khapra beetle was intercepted in the USA in goods from Kuwait (spices) (CBP 2019) and in Australia in goods from India (rice), Thailand (rice) and Burkina Faso (cowpeas) (DAFF, unpublished).

2020 Khapra beetle was intercepted in Australia in goods from Iran (rice), India (wheat flour and spices), Thailand (rice) and PNG (copra meal) (DAFF, unpublished).

2021 Khapra beetle was intercepted in Australia in goods from Thailand (prawn food, meat processing products and rice), Netherlands (mushroom compost), India (rice), Czech Republic (timber) and Vietnam (aquaculture feed) (DAFF, unpublished).

2022 Khapra beetle was intercepted in Australia in goods from Thailand (rice), Pakistan (rice), India (Spices and rice), Sudan (food stuff) and Italy (maize grits) (DAFF, unpublished).

2023 Khapra beetle was intercepted in Australia in goods from Bangladesh (rice) and India (rice) (DAFF, unpublished).

2024 Khapra beetle was intercepted in Vietnam in goods from Pakistan (maize) (Abbas 2024) and Australia in goods from Pakistan (rice) and passenger baggage from Ghana (beans) (DAFF, unpublished).

2025 Khapra beetle was intercepted in Australia in goods from Pakistan (rice) and the USA (soy meal with brewer’s yeast) (DAFF, unpublished).

The interception data indicate that while khapra beetle has been intercepted in various plant products, it is intercepted in some plant products more often than others.

The interception data show that the beetle has also been intercepted in association with goods arriving from countries where khapra beetle is not known to be established. This could be because sea containers that carried the goods were contaminated with khapra beetle as they may harbour a residual population of the beetle resulting from a previous shipment of an infested good. Therefore, the department considers that the 'presence' status of khapra beetle in a country should not be determined from interception data in international trade alone.

2.5 Plant products as pathways for khapra beetle

A pathway is defined as 'any means that allows the entry or spread of a pest' (FAO 2024).

Australia is an island and the closest land mass to Australia is Papua New Guinea where khapra beetle is not known to occur. In addition, the adults of khapra beetle do not fly (Hadaway 1956), hence natural dispersal is not a viable transmission pathway for the beetle to Australia. The spread of khapra beetle is known to be largely reliant on human activities (Lindgren, Vincent & Krohne 1955). The small size and cryptic behaviour of both larvae and adults make them difficult to detect. It is acknowledged that widespread international trade and movement of goods across the globe has increased the risk of introducing and spreading khapra beetle populations and threatening global food security (Ahmedani et al. 2007a; Athanassiou, Phillips & Wakil 2019).

All plant products that are hosts of khapra beetle (Table 2.1) are potential pathways for the entry of khapra beetle into Australia. This is supported by the interception data (section 2.4). All life stages of khapra beetle are known to infest or contaminate plant products (Singh et al. 2017). Figure 2.5 provides examples of plant products infested with khapra beetle.

Figure 2.5 Examples of plant products infested with khapra beetle

A: wheat (adults, larvae and cast skin); B: Wheat (adults and larvae); C: Canola (larvae)

The risk scenario of biosecurity concern is khapra beetle arriving in Australia via infested or contaminated plant products.

2.6 Control of khapra beetle

Control of khapra beetle can be challenging due to various reasons, including its cryptic behaviour of hiding in places that help protect the beetle from harmful conditions and its tolerance to adverse conditions during diapause.

Many studies have been published trialling methods to control khapra beetle including fumigation, contact insecticides, heat treatment, modified or controlled atmosphere, low pressure, irradiation, low or freezing temperature, diatomaceous earth, plant extracts and biological control. Many of these methods have not yet been accepted by the department as phytosanitary treatments for khapra beetle. This is due to various reasons, including reported limitations of the specific method, lack of efficacy data and/or results obtained or extrapolated from laboratory studies and not yet verified in commercial settings.

3 Pest risk assessment for khapra beetle

The pest categorisation (Table B.1 in Appendix B) confirms that khapra beetle (*T. granarium*) is a quarantine pest for Australia and further pest risk assessment is required for this pest.

This chapter assesses the likelihoods of entry, establishment and spread, and the associated potential consequences khapra beetle may cause if it were to enter, establish and spread in Australia. The assessment follows the methodology presented in Appendix A.

Explanations on the approach used in assessing each of the likelihoods and consequences are provided here.

Likelihood of importation

The likelihood of importation of khapra beetle is expected to be affected by the status of the beetle in the country where plant products are exported from. Therefore, the likelihood of importation of khapra beetle is assessed separately for:

- plant products exported from a target-risk khapra beetle country pathway (see section 3.1.1.1)
- plant products exported from an other-risk khapra beetle country pathway (see section 3.1.1.2)

Likelihood of distribution

Khapra beetle arriving in Australia on a plant product is already associated with a suitable host and will be distributed within Australia along with its host.

After arriving in Australia, plant products exported from either target-risk or other-risk khapra beetle countries are expected to be distributed in Australia in the same way. As such, a single assessment of the likelihood of distribution is considered applicable to both plant products exported from a target-risk khapra beetle country and plant products exported from an other-risk khapra beetle country pathways (see section 3.1.2).

Likelihood of establishment, likelihood of spread and potential consequences

Factors considered in assessing the likelihood of establishment, the likelihood of spread and the potential consequences are conditions and events that occur in Australia and therefore are independent of the pathway through which the beetle has entered Australia. Therefore, one assessment for each of the likelihood of establishment (see section 3.2), the likelihood of spread (see section 3.3) and the potential consequences (see section 3.4) is applicable to both plant products exported from a target-risk khapra beetle country and plant products exported from an other-risk khapra beetle country pathways.

3.1 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.

3.1.1 Likelihood of importation

3.1.1.1 Likelihood of importation on plant products exported from a target-risk khapra beetle country pathway

The likelihood that khapra beetle will arrive in Australia in a viable state with the importation of plant products from a target-risk khapra beetle country pathway is assessed as: **High**.

The likelihood of importation for this pathway is assessed as High because khapra beetle is present in 'target-risk khapra beetle countries', plant products may be infested with the beetle and the beetle may not be effectively controlled by commercial practices used for stored plant products. Due to its relatively small size and cryptic and refuge seeking behaviour, the beetle may not be detected and may be exported. If associated with the export commodities, the beetle can survive storage and transportation and arrive in Australia in a viable state, as demonstrated by numerous interceptions of live khapra beetle by Australia and other countries.

The following information provides supporting evidence for this assessment.

Khapra beetle is present in 'target-risk khapra beetle countries' and plant products in a target-risk khapra beetle country may be infested with the beetle.

- Khapra beetle is known to be present in 'target-risk khapra beetle countries' (Appendix C).
- Khapra beetle can infest almost any dried material of plant origin (Athanassiou, Phillips & Wakil 2019; Bhattacharya & Pant 1968; Lindgren & Vincent 1959; Lindgren, Vincent & Krohne 1955; Rees & Banks 1998).
- Khapra beetle has been recorded infesting over 100 plant products, including grain (such as rice, wheat, barley, maize and sorghum) and grain products (such as flour and rice cake), herbs, malt, nuts, oilseeds, peanuts, pulses and spices (Ahmedani et al. 2007a; Athanassiou, Phillips & Wakil 2019; Bhattacharya & Pant 1968; Borzoui, Naseri & Namin 2015; Hagstrum & Subramanyam 2009; Kavallieratos et al. 2019; Lindgren & Vincent 1959; Lindgren, Vincent & Krohne 1955; Rees & Banks 1998).
    - Plant product hosts of khapra beetle are discussed in more details in section 2.2 of this report.
- Khapra beetle lays eggs on plant products and has a high capacity for population increase under favourable conditions (Lindgren & Vincent 1959; Lindgren, Vincent & Krohne 1955). Infested commodities can contain all life stages of eggs, larvae, pupae and adults (Lindgren, Vincent & Krohne 1955).

Infested plant products may be exported.

- Pest management methods used as standard commercial practices for stored plant products may not be effective in managing the khapra beetle risk.
    - Khapra beetle larvae have proved to be tolerant to insecticides at the dose rates effective for other major stored-product insect species (Kavallieratos et al. 2016; Kavallieratos et al. 2017a). In addition, diapausing larvae of khapra beetle are reported to be particularly tolerant to both chemical and non-chemical control methods, including fumigants and extreme temperatures (Athanassiou, Phillips & Wakil 2019; Banks 1977; Bell & Wilson 1995; Wilches et al. 2016).
- Khapra beetle in plant products destined for export may escape detection, because current methods of detecting khapra beetle mostly rely on visual inspection, which may fail to detect

the infestation. Khapra beetle is relatively small and cryptic and can seek hidden places as refuges (Bell & Wilson 1995; Lindgren, Vincent & Krohne 1955; Stibick 2007; Wilches et al. 2016), which make detection difficult.

Khapra beetle, if present on exported plant products, will likely arrive in Australia in viable state. There has been a long history of interceptions of live khapra beetle in international trade since the pest was first reported in India in 1890s.

- Transportation conditions from the country of export to Australia is not expected to significantly affect the viability of khapra beetle.
- Numerous interceptions of live khapra beetle in international trade have been well documented in the literature, such as Day & White (2016), Hagstrum (2025) and Athanassiou, Phillips & Wakil (2019).
    - Examples of interceptions of khapra beetle in international trade is provided in section 2.4 of this report.
- The historical introduction of khapra beetle into England in the 1900s is linked to imported commercial consignments of grain from India and Pakistan (Lindgren, Vincent & Krohne 1955). Noting that the beetle is no longer present in England.
- Commodities on which khapra beetle has been intercepted in international trade include beans, broad bean/faba bean, celery seed, chickpeas, coriander seed, cowpeas, cucurbit seed, cumin seed, dried hibiscus flowers, dried pepper (chillies, capsicum), lentils, millet, mung beans, pea and fennel seed, peanut, pigeon pea, rice, safflower, soybeans, and wheat (CBP 2021; NAPPO 2023; Perez-Mendoza & Brodel 2013).
- The commodities with the highest numbers of khapra beetle interceptions by the USA, include rice, squash, chickpeas, cumin, lentils, soybeans, beans, black lentils, wheat, coriander and cantaloupe (Perez-Mendoza & Brodel 2013).
- After reviewing the interceptions of khapra beetle in international trade, Rees & Banks (1998) concluded that the most important commodity for the transport of *T. granarium* around the world has probably been rice, followed by oilseed/oilseed cake and shelled peanuts. This is because rice is a highly traded commodity, and intra-tropical trade has probably been a major means by which this pest has moved to other areas of the world (Rees & Banks 1998).
- Khapra beetle has also been intercepted on plant products for personal use (Day & White 2016; Pasek 1998). Stibick (2007) reported the interception of khapra beetle on plant products for personal use and/or in passenger baggage in the USA between 1985 and 2005 and noted that 88% of the airport interceptions occurred in passenger baggage on more than 75 hosts.
- Khapra beetle has been intercepted in Australia on plant products in personal effects, in airline baggage and mail, such as on rice in personal effects from Iran, Pakistan and Saudi Arabia, on lentils, cumin and cardamom in airline baggage from India, on foodstuff in airline baggage from Sudan and on cowpeas in air mail from Burkina Faso (DAFF unpublished).
- These interceptions of live khapra beetle demonstrate that khapra beetle can survive transportation and/or storage in international trade.
- There is high volume of non-commercial consignments arriving in Australia every year. For example, approximately 41 million air cargo consignments, 152 million international mail articles and 21 million passengers arrived in Australia from 2017 to 2018. A portion of these

non-commercial consignments is expected to come from target-risk khapra beetle countries and thus pose the risk of carrying khapra beetle into Australia.

For the reasons outlined, the likelihood of importation for khapra beetle from a target-risk khapra beetle country is assessed as High.

3.1.1.2 Likelihood of importation on plant products from an other-risk khapra beetle country pathway

The likelihood that khapra beetle will arrive in Australia in a viable state with importation of plant products from an other-risk khapra beetle country pathway is assessed as: **Very Low**.

The likelihood of importation for this pathway is assessed as Very Low because, due to small sizes and cryptic and refuge seeking behaviour of khapra beetle, the lag period before incursions in other-risk khapra beetle countries being recognised cannot be entirely ruled out, thus there is a small possibility that khapra beetle may be associated with plant products exported from an other-risk khapra beetle country.

The following information provides supporting evidence for this assessment.

- Although khapra beetle is not known to be present in other-risk khapra beetle countries, the beetle has been intercepted in plant products exported from 'other-risk khapra beetle countries'.
    - As examples, khapra beetle was detected on rice from Thailand, copra meal from PNG, plant-based gums from Spain and mushroom compost from the Netherlands (DAFF unpublished).
- It is uncertain if these interceptions were due to a lag period before incursions in new countries were recognised and/or were a result of contamination from infested sea containers.
- The lag period before incursions in 'other-risk khapra beetle countries' cannot be entirely ruled out. This is because:
    - the small sizes and cryptic and refuge seeking behaviour may enable khapra beetle to remain undetected for some time before incursions are recognised, and
    - khapra beetle is known to be more tolerant to various chemical and non-chemical control methods compared to other storage pests. Therefore, the beetle may not be effectively controlled by the methods used to control other storage pests known to be present in 'other-risk khapra beetle countries'.
- Thus, there is a small possibility that khapra beetle may be associated with plant products exported from an other-risk khapra beetle country.

For the reasons outlined, the likelihood that khapra beetle will arrive in Australia in a viable state with importation of plant products from an other-risk khapra beetle country is assessed as Very Low.

3.1.2 Likelihood of distribution

The likelihood that khapra beetle will be distributed within Australia in a viable state as a result of processing, sale or disposal of plant products from either a target-risk khapra beetle country or an other-risk khapra beetle country, and subsequently transfer to a host is assessed as: **High**.

The likelihood of distribution is assessed as High because khapra beetle arriving in Australia with a plant product is already associated with a suitable host and would be distributed within Australia with its host; the beetle's viability is unlikely affected by storage, transit and transportation conditions during distribution; and the beetle can also reach other hosts available in Australia during transit, storage and household use.

The following information provides supporting evidence for this assessment.

Khapra beetle arriving in Australia with plant products is already associated with its hosts and would be distributed within Australia with its hosts.

- Khapra beetle arriving in Australia with infested plant products does not need to move from the import pathway to find a host as the plant products continue to serve as a host of the beetle.

Khapra beetle is unlikely to be affected by storage, transit and transportation conditions during distribution and will likely arrive at destinations in a viable state.

- Commercial shipments of imported plant products will be distributed via extensive transport networks to multiple destinations in Australia. Conditions encountered during storage, transit and transportation to the destinations, such as temperature and humidity, are unlikely to affect the viability of khapra beetle.

Khapra beetle associated with imported plant products can also reach other hosts available in Australia during transit, transport and household use.

- Khapra beetle feeds upon a wide spectrum of dried material of plant origin (Athanassiou, Phillips & Wakil 2019; Bhattacharya & Pant 1968; Lindgren & Vincent 1959; Lindgren, Vincent & Krohne 1955; Rees & Banks 1998) and there are abundant hosts available in Australia. Plant hosts include grains and grain products, herbs, spices, nuts, oilseeds, dried fruits or dried vegetables, and pulses (Ahmedani et al. 2007a; Athanassiou, Kavallieratos & Boukouvala 2016; Athanassiou, Phillips & Wakil 2019; Bhattacharya & Pant 1968; Borzoui, Naseri & Namin 2015; Hagstrum & Subramanyam 2009; Kavallieratos et al. 2019; Lindgren, Vincent & Krohne 1955; Rees & Banks 1998).
- Both adults and larvae can crawl short distances (Rees & Banks 1998). Adults and larvae can move from imported plant products to local hosts nearby.
- The third and fourth instar larvae of khapra beetle have shown to be able to penetrate through plastic packaging to infest wheat grains (Hussain et al. 2019), increasing the opportunity of insects reaching local hosts.
- When a suitable host is not available, khapra beetle can enter diapause, extending the time frame for it to reach local hosts in Australia. Diapausing larvae can survive for several years without food until suitable hosts and development conditions become available (Burges 1962a; Nair & Desai 1972).
- Imported plant products stored prior to processing and/or consumption may be kept in the same facilities as, or in proximity to, local hosts, providing the opportunity for the adults and larvae to move to these local hosts.
- If imported plant products are introduced to bulk grain storage facilities, adult and larvae can potentially reach local hosts as there are few physical barriers inside such facilities.

- Khapra beetle arriving in passenger baggage may find suitable hosts in households, such as pantries or kitchens where various plant products such as herbs, spices, nuts, pulses, rice, and wheat flour are often stored.
- Imported plant products for further processing in Australia may generate waste and/or by-products, which could still be infested with khapra beetle and may be discarded and/or stored close to local hosts.
- It is recognised that most waste produced from commercial use, retail sale and household consumption is likely to be discarded in managed waste systems and would pose minimal biosecurity risk.

For the reasons outlined, the likelihood that khapra beetle will be distributed within Australia in association with imported plant products and subsequently transfer to a host is assessed as High.

3.1.3 Overall likelihood of entry

The overall likelihood of entry is determined by combining the likelihood of importation with the likelihood of distribution using the matrix of rules shown in Table A.2 (Appendix A) and present in Table 3.1.

Table 3.1 Overall likelihood of entry of khapra beetle

Pathway	Likelihood of importation	Likelihood of distribution	Overall likelihood of entry (importation x distribution)
Plant products exported from a target-risk khapra beetle country	High	High	**High**
Plant products exported from an other-risk khapra beetle country	Very Low	High	**Very Low**

3.2 Likelihood of establishment

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

The likelihood of establishment is assessed as High because hosts for khapra beetle are widely available in Australia such as in warehouses, packing houses, processing facilities and households; the climatic conditions suitable for the beetle are available in various parts of Australia; the beetle can also establish in managed environments, such as in warehouses and processing plants. In areas where hosts are limited and/or climatic conditions are not favourable, khapra beetle can enter diapause; diapausing larvae have high tolerance to starvation and extreme conditions; and the beetle has a high reproductive potential under favourable conditions.

The following information provides supporting evidence for this assessment.

Hosts for khapra beetle are widely available in Australia. Insufficient food can trigger diapause and diapausing larvae of khapra beetle have high tolerance to starvation.

- Khapra beetle has a wide range of plant product hosts. Suitable plant product hosts include grain and grain products, spices, nuts, oilseeds, and pulses (Athanassiou, Kavallieratos & Boukouvala 2016; Lindgren, Vincent & Krohne 1955; Rees & Banks 1998; Ahmedani et al. 2007a; Athanassiou, Phillips & Wakil 2019; Bhattacharya & Pant 1968; Borzoui, Naseri & Namin 2015; Hagstrum & Subramanyam 2009; Kavallieratos et al. 2019). These hosts are widely available in Australia such as in warehouses, packing houses, storage facilities, food processing plants and households.

- The development rate of khapra beetle can be influenced by the host species as well as by the cultivars or hybrids within a species (Athanassiou, Kavallieratos & Boukouvala 2016; Borzoui, Naseri & Namin 2015; Golizadeh & Abedi 2016, 2017; Majd-Marani et al. 2017, 2018; Seifi, Naseri & Razmjou 2016). For example, the beetle was reported to develop higher populations on wheat and triticale and lower populations on barley and maize (Athanassiou, Kavallieratos & Boukouvala 2016).
- Different forms of the same host species can also influence the development rate of khapra beetle. For example, the beetle prefers the cracked wheat kernels to the intact wheat kernels, and population on cracked kernels can build up 3 or more times higher than that on intact wheat kernels (Athanassiou, Kavallieratos & Boukouvala 2016).
- Diapausing larvae of khapra beetle have high tolerance to starvation. Insufficient food can trigger diapause (Burges 1959b, 1962a, 1963; Rees & Banks 1998). When food becomes available, the beetle can break diapause and start to reproduce.

Climatic conditions suitable for khapra beetle are available in various parts of Australia. Khapra beetle can also establish in managed environments in areas where climatic conditions may not be favourable. Unfavourable conditions can trigger diapause and diapausing larvae of khapra beetle have high tolerance to extreme conditions.

- Khapra beetle can survive and breed under hot dry condition and has been shown to survive in grain with a moisture content as low as 2% (Rees & Banks 1998). Low relative humidity combining with high temperatures are key conditions for rapid development and establishment of the beetle (Banks 1977).
- Reported optimal climatic conditions for the development of khapra beetle was 33 – 37°C and 45-75% relative humidity (Howe 1958). Papanikolaou et al. (2019) indicated that the estimated minimum and maximum temperatures for khapra beetle to stop its population increase are 18.44˚C and 40.00˚C, respectively.
- Khapra beetle reproduces sexually, involving male and female, and has a high reproductive potential and may produce many generations per year under favourable conditions (Lindgren, Vincent & Krohne 1955).
- Depending on food and environmental condition, the beetle can have up to 10 generations per year and can multiply remarkably fast under warm and dry conditions (Athanassiou, Kavallieratos & Boukouvala 2016; Kavallieratos et al. 2017b).
- Khapra beetle can also reproduce adequately at a minimum temperature of 24°C and relative humidity of 1% (Howe 1965). It can reach pest status at mean monthly temperatures of at least 20°C for four consecutive months with relative humidity of less than 50% (Howe 1958; Howe & Lindgren 1957).
- The global distribution of khapra beetle (Athanassiou, Phillips and Wakil 2019; Appendix C) suggests that the pest can establish in a wide range of climatic conditions.
- The establishment and quick spread of khapra beetle in the 1950s and early 1960s in southwest USA, which has a climate similar to many parts of Australia, indicates this pest's potential establishment and spread in Australia (Rees & Banks 1998).
- Banks (1977) discussed in detail the areas where climatic conditions are suitable for khapra beetle's establishment in Australia. The study found that much of the dry interior of Australia, including some grain growing areas, provide suitable conditions for this pest to

establish, while Australia's coastal population centres, except Adelaide, appear to be unsuitable due to the influence of high relative humidity (Banks 1977).

- Banks (1977) noted that, in addition to suitable climatic conditions, khapra beetle can also establish in managed environments in areas where climatic conditions may not be favourable. Previous occurrence of the pest in maltings, peanut processing plants and storage in Europe are examples of such managed environments (Banks 1977). Warehouses, food storage and processing areas, dwellings or other built environments in Australia should provide suitable conditions for the establishment of khapra beetle.
- Khapra beetle is known to establish in a variety of places such as grain stores, food stores, malthouses, seed processing plants, fodder production plants, dried milk factories, merchant stores, and in stores of packing materials such as used sacks, bags, and crates, as noted by Dwivedi & Shekhawat (2004) and Yadav & Srivastava (2017).
- Diapausing larvae of khapra beetle have high tolerance to extreme conditions. Unfavourable conditions can trigger diapause and under favourable conditions diapausing individuals can break diapause, mature, breed rapidly, and quickly expand population (Burges 1959b).

Khapra beetle, particularly diapausing larvae, have higher tolerance to extreme conditions (chemical and non-chemical) than many other storage pests. Commercial practices and control measures for storage pests in Australia are unlikely to have major impact on khapra beetle to establish in Australia.

- The storage practices and pest control measures in Australia involve hygiene, aeration cooling, regular monitoring and fumigation (e.g. GRDC 2010, 2013, 2018). Stored grain pests in Australia include beetles, such as *Rhyzopertha dominica* and *Tribolium* spp., and moths, such as *Sitotroga cerealella* and *Plodia interpunctella* (e.g. GRDC 2010, 2013, 2018). Larvae of khapra beetle have been shown to develop faster than and outperform other storage pests in the same environment (Kavallieratos et al. 2017b).
- Diapausing larvae of khapra beetle have high tolerance to various chemical and non-chemical control methods (Bell & Wilson 1995; Stibick 2007; Wilches et al. 2016). Refuge seeking behaviour and diapause make the detection and control of khapra beetle extremely difficult (Bell & Wilson 1995; Stibick 2007; Wilches et al. 2016).
- Measures applied to manage the existing pests are unlikely to have major influence on the ability of khapra beetle to establish in Australia.

For the reasons outlined, the likelihood that khapra beetle will establish within Australia is assessed as High.

3.3 Likelihood of spread

The likelihood that khapra beetle will spread within Australia, based on a comparison of factors in the source and destination areas that affect the expansion of the geographic distribution of the pest is assessed as: **Moderate**.

The likelihood of spread is assessed as Moderate because the climatic conditions suitable for the beetle are available in various parts of Australia; the beetle can also establish in managed environments, such as in warehouses and processing plants, in areas where climatic conditions may not be favourable. Its natural spread occurs over short distances, and its long-distance spread is primarily through human activity. The beetle has demonstrated the ability to spread quickly once being introduced to a new area.

The following information provides supporting evidence for this assessment.

Climatic conditions and managed environments suitable for the spread of khapra beetle are available in various parts of Australia.

- Climatic conditions in various parts of Australia would be suitable for the spread of khapra beetle because they have the same or similar climatic conditions to regions in which this pest currently occurs.
- Managed environments suitable for the spread of khapra beetle are also available in Australia, e.g. conditions in grain processing or handling facilities are suitable for the local spread of khapra beetle. Storage facilities full of grain constitute a uniquely uniform habitat for khapra beetle to disperse within the same facility.

Natural spread of khapra beetle occurs over short distances. Its long-distance spread is primarily through human activity. Natural barriers to insect movement exist between different areas within Australia, however, khapra beetle can be moved across these natural barriers through human activities.

- The biological and behavioural characteristics of khapra beetle are suitable for short distance dispersal rather than long distance dispersal. Based on Rees & Banks (1998), such biological characters include:
    - adults are short-lived and do not fly
    - both adults and larvae can walk limited distances
    - young larvae are small, light and hairy, and may be blown about in the wind
    - larvae may also hitch a lift on rodents, farm animals or the clothing of workers
- The beetle is largely reliant on human activity for its long-distance dispersal (Rees & Banks 1998) and it has been spread to many parts of the world through movement of infested commodities.
- The pest was first reported from India in 1894 (Singh et al. 2017) and had spread to Europe, Africa, America as well as other Asian countries over 19th century (Rees & Banks 1998), although some populations have since been eradicated.
- Agricultural commodity networks between Australian grain processing facilities can facilitate the spread of khapra beetle. Adults and larvae can move from the established populations to create new infestations.
- The movement of feed grade grains and stockfeed, generally during dry seasons, can also assist long-distance movement of khapra beetle. Feed grade grain can include a large percentage of weather damaged and cracked grains, and a higher proportion of dust and screenings, well suited to support feeding activity of khapra beetle.
- Natural barriers exist between different areas within Australia. Arid areas and long geographic distances exist between the east and the west, for example, the Nullarbor Plain. The Bass Strait separates the mainland from Tasmania. Climatic differentials occur between the north and the south. These natural barriers can limit the natural spread of flightless adults and larvae of khapra beetle from one such area to another.
- Khapra beetle can be moved across these natural barriers via human-assisted activities such as the transportation of infested plant material, containers and machinery.

- Domestic trade of plant commodities and commercial distribution systems of food sources can facilitate the spread of khapra beetle throughout Australia.
- Grain handling and food processing facilities are situated in metropolitan and rural locations throughout Australia. Distribution of infested agricultural commodities between processing and warehouse facilities and subsequent distribution through retail outlets to household throughout Australia would facilitate the spread khapra beetle to multiple locations.
- Storages, transport vessels, pallets and bags can remain infested for years after the initial source of insects has been removed, as larvae can survive adverse conditions as diapause larvae (Rees & Banks 1998), which would further facilitate spread of khapra beetle.

Some organisms with potential to be natural enemies of khapra beetle are present in Australia. However, these organisms naturally occurring in Australia are not expected to be effective in controlling the spread of khapra beetle.

- Potential natural enemies of khapra beetle could include *Metarhizium anisopliae* (Khashaveh, Safaralizadeh & Ghosta 2011), *Bacillus thuringiensis* (Ahmedani, Khaliq & Haque 2007), and *Xylocoris flavipes* (Usta Gebeş & Gözüaçik 2024).
- Adequate susceptibility of khapra beetle adult and larvae to most Iranian isolates of *M. anisopliae* under controlled laboratory conditions was observed, with the efficiency varies considerably according to the fungal isolates and conidial concentrations (Khashaveh, Safaralizadeh & Ghosta 2011). *Metarhizium anisopliae* is present in Australia and is available commercially for use as a bioinsecticide. However, it is uncertain if *M. anisopliae* naturally occurring in Australia will be an effective enemy to control the spread of khapra beetle.
- Ahmedani, Khaliq and Haque (2007) investigated the use of commercial formulations of *B. thuringiensis* to combat khapra beetle infestation in stored wheat. The authors reported that there were highly significant differences among efficacy of different commercial formulations of *B. thuringiensis* against khapra beetle larvae. Impact of strain and subspecies of *B. thuringiensis* on the specificity and toxicity of the pathogen against different insect groups have also been reported (Françoise et al., 1987; Dong et al., 2004, cited in Ahmedani, Khaliq and Haque, 2007). Naturally occurring *B. thuringiensis* is predominately in the active or vegetative form and does not normally contribute significantly to insect mortality (Ahmedani, Khaliq & Haque 2007). *Bacillus thuringiensis* is present in Australia and is available commercially for use as a bioinsecticide. However, *B. thuringiensis* naturally occurring in Australia is not expected to be an effective enemy to control the spread of khapra beetle.
- The warehouse pirate bug (*Xylocoris flavipes*) is a cosmopolitan generalist predator of coleopteran and lepidopteran stored-product pests (Arbogast 1979, cited in Sing & Arbogast 2008). It is reported to be most successfully controls small, externally developing prey, particularly readily accessible eggs and early instars that are neither heavily sclerotized nor overly hirsute (LeCato and Davis 1973; Sing 1997; Sing and Arbogast 2007, cited in Sing & Arbogast 2008). Usta Gebeş and Gozuacik (2024) studied the biology of *X. flavipes* and its prey preference on some warehouse pests, under laboratory conditions at 25±2ºC temperature and 55±10% humidity. The authors concluded that *Ephestia kuehniella* eggs were most preferred by *X. flavipes* because they were smaller and khapra beetle larvae were the least preferred because they contained excessive hair. *Xylocoris flavipes* naturally occurring in Australia is not expected to be an effective enemy to control the spread of khapra beetle.

Khapra beetle has demonstrated the ability to spread quickly once being introduced to a new area.

- In the USA, khapra beetle was first detected in the lower half of California in 1953, and by early 1955 a total of 151 premises had been infested: 121 in 16 California counties, 27 in 5 Arizona counties, and 3 in 2 New Mexico counties (Lindgren, Vincent & Krohne 1955). In addition, 3 infestations were found in part of Mexico just below the California border (Armitage 1958; Lindgren, Vincent & Krohne 1955).

For the reasons outlined, the likelihood that khapra beetle will spread within Australia is assessed as Moderate.

3.4 Overall likelihood of entry, establishment and spread

The overall likelihood of entry, establishment and spread is determined by combining the individual likelihoods of entry, establishment and spread using the matrix of rules in Table A.2 and presented in Table 3.2.

Table 3.2 Overall likelihood of entry, establishment and spread (EES) of khapra beetle

Pathway	Likelihood of			EES
	Entry (E)	Establishment (E)	Spread (S)	
Plant products exported from a target-risk khapra beetle country	High	High	Moderate	**Moderate**
Plant products exported from an other-risk khapra beetle country	Very Low	High	Moderate	**Very Low**

3.5 Potential consequences

The potential consequences of entry, establishment and spread of khapra beetle in Australia have been estimated according to the method described in section A2.3 in Appendix A.

Based on the decision rules described in Table A.3 (Appendix A), that is, where the potential consequences of a pest with respect to a single criterion is rated as 'F', the overall consequences are estimated to be: **High.**

Criterion	Estimate and rationale
Direct	
Life or health of plants and plant products	**E—Significant at the regional level** The direct effect of khapra beetle on the life or health of plants and plant products would be of significance at the regional level. • Khapra beetle is one of the most destructive pests globally for stored products, including stored grains, pulses, nuts, oil seeds, herbs, spices and dry foodstuffs and presents potential threat to global food security (Ahmedani et al. 2007a; Athanassiou, Kavallieratos & Boukouvala 2016; Athanassiou, Phillips & Wakil 2019; Bell & Wilson 1995; Rees & Banks 1998). • Khapra beetle can feed on almost any dried material of plant origin, mostly by its larvae, and can cause significant damage to the products, affecting quality and quantity (Ahmedani et al. 2011; Girish, Kumar & Jain 1975; Rees & Banks 1998). • In bulk commodities, greatest damage tends to occur in the top 30 cm, but damage can also occur at greater depths close to corners and walls of bins (Rees & Banks 1998). • The damage affects quantity by reducing the weight of commodities, for example, about 16% loss to wheat (Girish, Kumar & Jain 1975), a 20% loss to wheat seeds after a storage period of 6 months initially infested with only 10 pairs of khapra beetle larvae (Ahmedani et al. 2011), and up to 70% loss to stored grains through voracious

Criterion	Estimate and rationale
	feeding and heating of grains, caused by large number of larvae gregarizing together (Honey et al. 2017). • In Arizona, USA, Nutting (1984) estimated a weight loss of 20% in sorghum and 30% in barley from two years of heavy infestation in storage conditions. • Australia is one of the major agricultural producing countries. In the financial year of 2023-2024, 52.234 million tonnes of grains, oilseeds and pulses (value at $21.945 billions) were produced in Australia (ABARES 2025). Should khapra beetle become established in Australia, it would pose a major threat to Australia's grain, oilseed and pulse industries due to potential production losses during storage. It would also pose a major threat to other khapra beetle host industries, such as nuts and dried foodstuffs. • The effect of larva feeding on product quality includes the decrease of the contents of protein, gluten, crude fat, sugar, carbohydrates, sedimentation value and germination (Girish, Kumar & Jain 1975; Honey et al. 2017). Heavily infested grain can be turned into a powdery mass (Rees & Banks 1998). • In addition, the presence of khapra beetle can render the food products unfit for human consumption because of the contamination by the cast larval skins, body parts, excreta, and dead adults (Jood, Kapoor & Singh 1996; Stibick 2007). • Stored products contaminated with body parts and barbed hairs of khapra beetle larvae are highly allergenic to humans (Rees 2004; Stibick 2007). The health risks caused by barbed hairs includes skin irritation if touched, gastrointestinal irritation if swallowed (Stibick 2007) and irritating airways and causing asthma when inhaled (Honey et al. 2017).
Other aspects of the environment	**A—Unlikely to be discernible at the local level** The direct effect of khapra beetle on the other aspects of the environment would be unlikely to be discernible at the local level. • There are no known direct consequences of khapra beetle on other aspects of the environment.
Indirect	
Eradication, control	**E—Significant at the regional level** The indirect effect of khapra beetle on eradication and control would be of significance at the regional level. • Eradication program for khapra beetle is both time consuming and expensive. Day & White (2016) comprehensively reviewed the detections and eradications of khapra beetle in Australia and around the world. These authors reported that it took over 13 years (1953 to 1966) to eradicate khapra beetle from the US and part of Mexico with a program costing an equivalent of about US$96-130 million (in 2016-dollar value). This eradication program involved fumigation of over 600 infestation sites and inspection of about 97,000 properties (Day & White 2016). • In Australia, khapra beetle was detected in 2007 in a house in metropolitan Perth, Western Australia. Eradication activities begun immediately, and the house was quarantined and fumigated. This incursion was only declared to be successfully eradicated in 2009 following a two-year trapping surveillance program. The cost for eradication of this single incursion in a single residence was around $200,000 (Day & White 2016). The cost of a widely dispersed khapra beetle incursion in Australia is expected to be significantly greater. • Khapra beetle's cryptic behaviour of crawling to hide in protected locations such as tiny cracks and crevices in grain storage, handling and processing facilities and warehouses makes the beetle difficult to control (Honey et al. 2017; Rees 2004). In addition, unfavourable conditions can trigger khapra beetle larvae to enter diapause, and diapausing larvae have high tolerance to extreme conditions (chemical and non-chemical) (Burges 1959b, 1962b, 1963; Rees & Banks 1998). These can negatively affect the efficacy of eradication measures. • The success of eradication programs can also be impeded by the development of resistance to commonly used fumigant insecticides (Bell & Wilson 1995; Bond 1989).

Criterion	Estimate and rationale
	• In cases where eradication of khapra beetle is considered unlikely to be feasible or not economically justifiable, ongoing pest management would be required to control the pest. • Pest management programs to minimise the impact of khapra beetle in storage facilities, including pesticide applications and monitoring, are likely to be costly and can disrupt normal business activities. Chemical treatments such as methyl bromide fumigation would be required to control khapra beetle in storage, handling and processing facilities and warehouses. • Some khapra beetle populations have developed resistance against phosphine (Ahmad et al. 2013; Ahmedani et al. 2007b; Alam et al. 1999; Bell & Wilson 1995; Borah & Chahal 1979; Riaz, Shakoori & Ali 2016). The introduction of phosphine-resistant populations into Australia would require additional measures to manage these populations. Contact pyrethroid insecticides will give control of adults, but larvae are harder to kill compared to adults, and older larvae are more tolerant than younger larvae (Athanassiou et al. 2015).
Domestic trade	**E—Significant at the regional level** The indirect effect of khapra beetle on domestic trade would be of significance at the regional level. • Australian states and territories have their own domestic biosecurity restrictions for pests of biosecurity concern for their jurisdictions. When an exotic pest is detected in a limited area in Australia, state or territory authorities would likely restrict intra– and/or inter–state movement of affected commodities to prevent the pest's spread. Such a restriction would clearly impact on domestic trade. States and territories that are free from the pest can put specific risk mitigation measures in place to manage the pest, which would increase the costs on domestic trade. • Stringent controls on domestic trade would be required if khapra beetle is present or established in commercial grain handling and storage facilities in Australia. It is expected that these would impose a significant cost on industry. For example, if inter-state trade of wheat is restricted, it would have significant impact on the major wheat producing states, such as Western Australia, New South Wales, South Australia, Victoria and/or Queensland.
International trade	**F—Significant at the national level** The indirect effect of khapra beetle on international trade would be of significance at the national level. • The presence of khapra beetle in commercial grain handling and storage facilities in Australia can result in restrictions or loss of access to overseas markets where this pest is absent. • Khapra beetle is the most important stored product quarantine insect (Athanassiou, Kavallieratos & Boukouvala 2016). Many countries, including Australia's important trading partners, have stringent phytosanitary measures to import the beetle's host commodities. • Australia is a significant exporter of wheat and other grains, nuts, oilseeds, and pulses. For example, in the financial year of 2023-2024, Australia's exported grains, oilseeds and pulses were about $22.828 billion (ABARES 2025). • Many of Australia's trading partners list khapra beetle as their quarantine pest. The presence of khapra beetle in any export consignments may immediately trigger rejection of the consignments and/or suspension of trade. This would have a significant impact on Australia's industries involved and cause significant economic losses. • Several countries have restricted the import of some commodities and/or imposed additional phytosanitary conditions to prevent the introduction of khapra beetle. For example, o in 2012, the USA restricted the importation of commercial and non-commercial shipments of rice, soybeans, chickpeas, and safflower seeds from countries where khapra beetle is known to occur (USDA-APHIS 2012).

Criterion	Estimate and rationale
	○ in 2012, Canada implemented additional phytosanitary certification from khapra beetle affected countries (G/SPS/N/CAN/609). ○ USA and Mexico rejected Pakistan rice export shipments due to the khapra beetle infestation during 2011 to 2014 (Iqbal 2019). ○ Russia introduced emergency measures against imports of rice and nuts from India in 2013 (G/SPS/N/RUS/11), restricted tea imports from Sri Lanka due to khapra beetle infestation in 2017 (Manu 2017) and rejected a rice shipment from Pakistan for the same reason in 2019 (Iqbal 2019).
Non-commercial and the environment	**B—Minor significance at the local level** The indirect effect of khapra beetle on the environmental and non-commercial would be of minor significance at the local level. • The introduction of khapra beetle would result in additional use of chemical insecticides, such as fumigants. The additional use of pesticides could produce some adverse effects to the environment. The required rate of methyl bromide fumigation for khapra beetle is significantly higher than for other stored product pests (Bond 1989). Although methyl bromide can damage the ozone layer if released into the atmosphere and can be harmful to humans and fauna if not used carefully, all uses of methyl bromide are regulated and controlled in Australia.

3.6 Unrestricted risk estimate

Unrestricted risk estimate (URE) is the result of combining the likelihood of entry, establishment and spread with the overall consequences. The likelihood and consequences are combined using the risk estimation matrix shown in Table A.4 (Appendix A).

The URE for khapra beetle associated with plant product pathways is shown in Table 3.3.

Table 3.3 Unrestricted risk estimate of khapra beetle

Pathway	Overall likelihood of EES	Overall consequences	URE
Plant products from a target-risk khapra beetle country	Moderate	High	**High**
Plant products from an other-risk khapra beetle country	Very Low	High	**Low**

The URE for khapra beetle on plant products from a target-risk khapra beetle country is assessed as High, which does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for khapra beetle on this pathway.

The URE for khapra beetle on plant products from an other-risk khapra beetle country is assessed as Low, which does not achieve the ALOP for Australia. Therefore, specific risk management measures are required for khapra beetle on this pathway.

4 Pest risk management

As outlined in Chapter 3, the URE of khapra beetle associated with plant products from either target-risk khapra beetle countries or other-risk countries does not achieve the ALOP for Australia and therefore specific risk management measures are required.

This chapter evaluates existing emergency measures to determine whether they are appropriate and proposes risk management measures that will reduce the risk of khapra beetle associated with the imported plant product pathways to an acceptable level, that is to achieve the ALOP for Australia.

This chapter includes:

- A summary of existing emergency measures for khapra beetle and the factors that are used as the bases for these measures (section 4.1)
- Evaluation of the bases for existing emergency measures (section 4.2)
- Evaluation of excluding some forms of plant products from the emergency measures (section 4.3)
- Evaluation of the required 'freedom from *Trogoderma* species' in the additional declaration on the phytosanitary certificate (section 4.4)
- Evaluation of the existing emergency measures for plant products (section 4.5)
- Proposed risk management measures for khapra beetle (section 4.6)
- Operational systems for the assurance, maintenance, and verification of phytosanitary status (section 4.7)

4.1 Existing emergency measures

Existing emergency measures, the bases used by the department in determining these emergency measures and key terminologies used are described in section 1.2.3.2.

For convenience, a summary of the bases used to determine existing emergency measures is provided in section 4.1.1 and a summary of the existing emergency measures is provided in section 4.1.2.

4.1.1 Summary of the bases used to determine existing emergency measures

The existing emergency measures for khapra beetle are based on:

- The status of khapra beetle in countries of export:
    - 'target-risk khapra beetle countries' are countries where khapra beetle is assessed as being present; and
    - 'other-risk khapra beetle countries' are all countries other than 'target-risk khapra beetle countries'.
- The risk category of imported plant products:
    - 'high-risk plant products' are plant products with scientific reports indicating that they are main hosts, good hosts or preferred hosts for khapra beetle and/or plant product hosts on which the beetle has been intercepted on multiple occasions in international trade; and

- ‘other-risk plant products’ are all plant product hosts (Table 2.1) other than ‘high-risk plant products’ (Table 1.1).

- The mode of arrival into Australia of imported plant products:
  - Non-freight — arrival with passengers including crew (ship or aircraft) as accompanied or unaccompanied baggage, arrival as unaccompanied personal effects (air or sea) or arrival via international mail (air or sea). In this PRA, these modes of arrival are termed ‘non-freight mode of arrival’; and
  - Freight — arrival as high value freight or low value freight (air or sea). In this PRA, these modes of arrival are termed ‘freight mode of arrival’.
- The intended use in Australia of imported plant products:
  - personal use such as for human consumption, planting;
  - commercial use such as for human consumption, processing, planting; and
  - use for research purposes.

4.1.2 Summary of existing emergency measures

The existing emergency measures can be summarised in 7 key measures. It is important to note that these 7 key measures must be read in conjunction with each other and with the list of exclusions (see section 1.2.3.2, Table 1.4).

Measure 1: Not permitted entry for any ‘high-risk plant product’, imported from any country, arriving with passengers including crew (ship or aircraft) either as accompanied or unaccompanied baggage, arriving as unaccompanied personal effects (air or sea), or arriving via international mail (air or sea), for any intended use.

Measure 2: Not permitted entry for any ‘high-risk plant product’, imported from any country, arriving as low value freight (air or sea), for personal use.

Measure 3: Pre-export treatment, followed by pre-export inspection, and phytosanitary certification endorsed with additional declarations for any ‘high-risk plant product’, imported from any ‘target-risk khapra beetle country’, arriving as high value freight or low value freight (air or sea), for any commercial use except for planting. Approved pre-export treatments are listed in Table 1.3.

Measure 4: Pre-export inspection and phytosanitary certification endorsed with additional declaration for any ‘high-risk plant product’, imported from any ‘other-risk khapra beetle country’, arriving as high value freight or low value freight (air or sea), for any commercial use except for planting.

Measure 5: Pre-export inspection and phytosanitary certification endorsed with additional declaration for seed of any ‘high-risk plant product’, imported from any country, arriving as low value freight (air or sea), for planting (commercial use only). Seeds for planting imported through PEQ in Australia are excluded from this measure.

Measure 6: Pre-export inspection and phytosanitary certification endorsed with additional declaration for seed of any ‘high-risk plant product’, imported from any country, arriving as high value freight (air or sea), for planting (except for research purposes). Seeds for planting imported through PEQ in Australia are excluded from this measure.

Measure 7: Pre-export inspection and phytosanitary certification endorsed with additional declaration for any 'other-risk plant product', imported from any country, arriving via any mode of arrival, for any intended use except for research purposes. Seeds for planting imported through PEQ in Australia are excluded from this measure.

4.2 Evaluation of the bases for existing emergency measures

This section evaluates the bases for existing emergency measures, including the status of khapra beetle in exporting countries (section 4.2.1), the risk category of imported plant products (section 4.2.2), the mode of arrival into Australia of imported plant products (section 4.2.3) and the intended use in Australia of imported plant products (section 4.2.4).

4.2.1 Status of khapra beetle in exporting countries

The likelihood of importation for khapra beetle associated with imported plant products is assessed (in section 3.1.1) as 'High' for 'target-risk khapra beetle countries' and as 'Very Low' for 'other-risk khapra beetle countries', indicating that the likelihood of importation is influenced by the status of khapra beetle in the exporting country. This supports the use of the status of khapra beetle in the exporting country, i.e., 'target-risk khapra beetle countries' or 'other-risk khapra beetle countries', as a basis of risk management measures for this pest.

Review of global distribution of khapra beetle

This report includes a review of the global distribution of khapra beetle (see also Appendix C).

Criteria

In determining the status of khapra beetle in a country, the department uses the following criteria:

- **Presence:** There is evidence to indicate the presence of khapra beetle in a country, such as published records, references and notification. The country is classified as a 'target-risk khapra beetle country'.
- **Absence:** The following criteria are used as evidence supporting absence of khapra beetle in a country. Meeting one of these criteria, the country is classified as an 'other-risk khapra beetle country'.
    - No record of khapra beetle being present in the country has been found.
    - Khapra beetle was previously recorded in the country, but information is available to indicate that the pest has been eradicated.
    - Khapra beetle was previously recorded in the country, but the pest has been proved to be absent by subsequent surveys and/or later evidence is available to support the current absence.
    - Records of khapra beetle in the country are for pest intercepted on imported good only.
    - Records of khapra beetle in the country have been demonstrated to be unreliable.

Outcomes

Outcomes of the review include:

- Khapra beetle is present in the 40 countries classified as 'target-risk khapra beetle countries' in the existing emergency measures (Table 1.2).

- There are references suggesting that khapra beetle may be present in 8 additional countries (Appendix C). These countries are Angola, Chad, Guinea, Jordan, Kazakhstan, Tajikistan, Tanzania and Turkmenistan. The department engaged with the NPPO of these countries, seeking clarification on the status of the beetle in the countries and requesting supporting information should the beetle is not or no longer present in the countries. There have been no responses or sufficient information has not been provided to support the 'absence' status from these countries.
- The list of 'target-risk khapra beetle countries' should be revised to include these additional 8 countries. The proposed revised list is presented at Table 4.1.
- All other countries are classified as 'other-risk khapra beetle countries'.

Table 4.1 Proposed revised list of 'target-risk khapra beetle countries'

Target-risk khapra beetle countries	
Afghanistan	Mauritania
Albania	Morocco
Algeria	Myanmar
Angola	Nepal
Bangladesh	Niger
Benin	Nigeria
Burkina Faso	Oman
Chad	Pakistan
Côte d'Ivoire (Ivory Coast)	Qatar
Cyprus	Saudi Arabia
Egypt	Senegal
Ghana	Somalia
Greece	South Sudan
Guinea	Sri Lanka
India	Sudan
Iran, Islamic Republic of	Syrian Arab Republic
Iraq	Tajikistan
Israel	Tanzania, United Republic of
Jordan	Timor-Leste
Kazakhstan	Tunisia
Kuwait	Türkiye
Lebanon	Turkmenistan
Libya	United Arab Emirates
Mali	Yemen

Proposals

This report provides 4 proposals relevant to the status of khapra beetle in the exporting country.

Proposal 1: Using the status of khapra beetle in the exporting country, i.e., 'target-risk khapra beetle countries' or 'other-risk khapra beetle countries', as a basis for risk management measures for khapra beetle is technically justified and should be maintained.

Proposal 2: The current list of 'target-risk khapra beetle countries' be updated to include 8 additional countries as per the proposed revised list of 'target-risk khapra beetle countries' presented at Table 4.1. The department intends to implement this proposed revised list prior to the PRA being finalised. The department will engage with relevant stakeholders prior to the implementation.

Proposal 3: The list of 'target-risk khapra beetle countries' is subject to a review by the department based on evidence. For example, evidence of khapra beetle being present in a 'other-risk khapra beetle country' will trigger a review and the country may be re-classified as a 'target-risk khapra beetle country'. Likewise, evidence of khapra beetle not being present in a 'target-risk khapra beetle country', such as the pest has been eradicated or proved to be no longer present, will trigger a review and the country may be removed from the list of 'target-risk khapra beetle countries'.

Proposal 4: If there is an incursion, outbreak or other changes in the status of khapra beetle in an 'other-risk khapra beetle country', the NPPO of the country must notify the department as soon as possible.

4.2.2 Risk category of imported plant products

As stated in section 2.2.4, all plant products listed in Table 2.1 are considered hosts of khapra beetle as they can be infested by khapra beetle, can harbour the beetle, can act as food source for the beetle, can facilitate the beetle's development and/or can facilitate the completion of the beetle's life cycle.

The unrestricted risk estimate (URE) of khapra beetle associated with all plant product hosts are assessed (in Chapter 3) as not achieving the ALOP for Australia and therefore specific risk management measures are required.

The host species can influence the development rate of khapra beetle (Athanassiou, Kavallieratos & Boukouvala 2016; Borzoui, Naseri & Namin 2015; Golizadeh & Abedi 2017; Majd-Marani et al. 2017, 2018; Seifi, Naseri & Razmjou 2016). Among the plant product hosts of khapra beetle, published literature indicate that some plant products are better hosts for the beetle as they are better food sources, better facilitate the beetle's development and completion of its life cycle and/or better facilitate the beetle's reproduction. For example, *T. granarium* developed higher populations on wheat and triticale and lower populations on barley and maize (Athanassiou, Kavallieratos & Boukouvala 2016). Records of interceptions of khapra beetle in international trade (section 2.4) show that the beetle has been intercepted in association with some plant products more often than other plant products. It is unclear if the interceptions of khapra beetle in international trade are influenced by volumes and patterns of trade in the plant products. To minimise the impact on trade in line with Australia's obligation to the WTO SPS Agreement, the department considers that using published literature on plant products being main hosts, good hosts or preferred hosts and records of interceptions in international trade to classify the risk category of the plant products, i.e., ‘high-risk plant products’ (Table 1.1) or ‘other-risk plant products’, and using these risk categories as the basis for emergency measures is technically justified.

Proposals

This report provides 2 proposals relevant to the risk category of plant products.

Proposal 1: Using the risk category of plant products, i.e., ‘high-risk plant products’ or ‘other-risk plant products’, as a basis for risk management measures for khapra beetle is technically justified and should be maintained.

Proposal 2: The list of ‘high-risk plant products’ is subject to a review by the department based on evidence. For example, evidence of interceptions of khapra beetle in international trade on multiple occasions on an 'other-risk plant product’ will trigger a review and the plant product may be re-classified as a ‘high-risk plant product’.

4.2.3 Mode of arrival into Australia of imported plant products

Goods imported into Australia may arrive via ‘freight modes of arrival’ or ‘non-freight modes of arrival’.

‘Freight modes of arrival’

All goods arriving in Australia as ‘freight mode of arrival’, either as high value freight or low value freight are electronically screened or profiled in the Integrated Cargo System (ICS). The ICS is underpinned by the *Customs Act 1901* and subordinate legislation that defines mandatory roles and responsibilities, and what, when, how and by whom information must be reported. The department uses electronic profiles and screening processes in the ICS to refer goods that may pose biosecurity risk to the department’s biosecurity officers to verify, assess, and manage any associated biosecurity risk.

‘Non-freight modes of arrival’

Goods arriving in Australia via passengers including crew or via international mail are not electronically screened or profiled in the ICS system, making it difficult for the department to prepare for, target and manage goods at risk of khapra beetle infestation. Although goods arriving in Australia as unaccompanied personal effects are screened/profiled in the ICS system, they may be lodged without specifying full details or range of types of goods, which are also difficult to screen and manage goods at risk of khapra beetle infestation.

Also, khapra beetle is known as an effective hitchhiker pest and a difficult pest to treat/kill. Goods arriving in Australia via ‘non-freight modes of arrival’ may not be appropriately packed or sealed, increasing the likelihood of infestation or cross-infestation pre-export or in-transit. The sites at which inspections are conducted on these goods, such as international airports or international mail centres, are not suitable to effectively manage (e.g., contain, treat) khapra beetle should it be detected.

In addition, most plant products arriving in Australia via 'non-freight modes of arrival' are intended for personal use. Plant products imported for personal use pose higher risk of being infested with khapra beetle than those imported for commercial use or for research purposes (see details outlined in section 4.2.4).

Proposal

This report provides 1 proposal relevant to the mode of arrival into Australia of imported plant products.

Proposal 1: Using the mode of arrival into Australia of imported plant products as a basis for risk management measures for khapra beetle is technically justified and should be maintained.

4.2.4 Intended use in Australia of imported plant products

Goods imported into Australia may be for personal use (e.g., consumption, planting), commercial use (e.g., consumption, processing, planting) or use for research purposes.

Personal use vs commercial use

Unlike plant products imported for commercial use, plant products imported for personal use may not have been subjected to commercial quality control processes to manage khapra beetle or other storage pests. In addition, they are not subjected to inspection and certification by the National Plant Protection Organisation (NPPO) of the exporting country prior to export, that they are free from pests of biosecurity concern to Australia or have been produced or treated in accordance with Australia's requirements. It is also not always possible or practical to verify the country from which the plant products are imported. Therefore, it is highly likely that the risk of plant products imported for personal use being infested with khapra beetle is higher than for plant products imported for commercial use.

Use for research purposes

Goods imported for research purposes are typically imported in small volumes and generally require different measures compared to the same goods imported for personal or commercial uses. The measures applied to goods imported for research purposes vary depending on the product type and the type of research. These measures may include restrictions on quantities imported, use in a laboratory which may include biosecurity containment and/or the goods are not permitted for release after the use.

Planting (seed)

It is expected that seeds for planting pose less biosecurity risk of being infested by khapra beetle than grains or other plant products imported for consumption or processing. This is due to the higher market price and more rigorous commercial quality control processes to manage pests, including postharvest procedures and storage. These processes are needed for the intended use of planting.

Proposal

This report provides 1 proposal relevant to the intended use in Australia of imported plant products.

Proposal 1: Using the intended use in Australia of imported plant products as a basis for risk management measures for khapra beetle is technically justified and should be maintained.

4.3 Evaluation of excluding some forms of plant products from existing emergency measures

As stated in section 1.2.3.2, some forms of plant products are excluded from existing emergency measures (see Table 1.4).

ISPM 32 (FAO 2016c) recognises that the method and degree of processing to which a commodity has been subjected before export may have impact on the pest risk associated with the commodity. ISPM 32 states that 'where, due to the method of processing to which commodities moving in international trade have been subjected, the probability of entry of pests has been removed, those commodities should not be regulated' and 'commodities which after processing may still present a pest risk may be subject to appropriate phytosanitary measures'. However, ISPM 32 also recognises that processed commodities may become contaminated with certain pests after processing and states that 'contaminating pests or storage pests that may become associated with the commodity after processing are not considered in the standard'.

In line with ISPM 32, the department recognises that certain forms of processing are effective in removing the risk of khapra beetle from plant products if infested or contaminated prior to processing. As the processed plant products may become infested or contaminated with khapra beetle post-processing, the method and degree of processing alone are not sufficient to manage the risk of this pest.

The department considers that certain forms of processing combined with certain forms of packaging and appropriate standard operating procedures to maintain integrity of the processed products, will reduce the risk of khapra beetle infestation or contamination to an acceptable level, that is to achieve the ALOP for Australia. Appropriate standard operating procedures to maintain integrity of the processed products are required to ensure hygienic conditions throughout the processes from processing through to packaging and storage.

Proposals

This report provides 2 proposals relevant to exclusions for some forms of plant products from existing emergency measures.

Proposal 1: The exclusion of some plant products, which have been subjected to certain forms of processing combined with certain forms of packaging and appropriate standard operating procedures to maintain the integrity of the processed plant products, from the emergency measures is technically justified and should be maintained.

Proposal 2: The exclusion list is subject to a review by the department based on evidence. For example, evidence to support an addition of a plant product to the list or a removal of a plant product from the list will trigger a review and the plant product may be added to- or removed from- the list, respectively.

4.4 Evaluation of the required 'freedom from *Trogoderma* species' in the additional declaration on the phytosanitary certificate

Existing emergency measures for khapra beetle require that prior to export, plant products are inspected by a government official of exporting country and certified as being free from any *Trogoderma* species of biosecurity concern to Australia.

This report considers that the requirement for certifying freedom from *Trogoderma* species of biosecurity concern to Australia is justified due to the risk of misidentification of *T. granarium* as other *Trogoderma* species, and this is supported by the following:

- Apart from khapra beetle (*T. granarium*), several other *Trogoderma* species are also known as storage pests, such as *T. angustum* and *T. inclusum*, and also feed on grains, pulses, nuts, seeds, and other plant products (Hagstrum & Subramanyam 2009; Kemper & Döhring 1963).
- Several other *Trogoderma* species have geographical distribution that overlap with khapra beetle. For example,
  - *T. angustum* is reported from India, Pakistan (Háva & Kadej 2009), Türkiye (Germann, Schneppat & Herger 2014);
  - *T. inclusum* from Algeria, Egypt, India, Iran, Israel, Morocco, Tunisia, Türkiye (Háva 2008a), Iraq (Mawlood & Abdul-Rassoul 2000); Lebanon (Háva 2015b) and Cyprus (Háva & Herrmann 2011);
  - *T. ornatum* from Egypt (Háva 2015b);
  - *T. sternale* from Nigeria (Háva & Herrmann 2023);
  - *T. teukton* from Iran (Háva, Kadej & Herrmann 2014); and
  - *T. versicolor* from Egypt (Abdel-Kawy & Hasaballa 1993), Tunisia, (Mroczkowski 1968), and Türkiye (Özgen & Háva 2018).
- There are a number of species in the genus *Trogoderma* that are difficult to identify and to differentiate from each other (Peacock 1993). Accurate identification of khapra beetle from other *Trogoderma* species requires expertise trained for the purpose (Athanassiou, Phillips & Wakil 2019).
- Khapra beetle spends more than 95% of its life in the larval form and therefore it is more likely to be the life stage encountered at inspections. Larvae can be identified only under a microscope, using few detailed morphological structures after special preparation of specimens, and these resources are not always available at pre-export phytosanitary inspection. Larvae of some *Trogoderma* species are morphologically very similar and can be misidentified or difficult to be distinguished from each other through visual inspection alone. For example, *T. granarium* had previously been misidentified as *T. inclusum* (Sonda 1968) due to the similarity of their larvae (Beal 1960).
- Khapra beetle identification based on adults is considered easier and more reliable than that on larvae. However, identification of adults is also based on very specialised morphological features. Adults can potentially be misidentified because they are often scarce and damaged and need expert dissection for identification (Byrne et al. 2018). In addition, adults are short-lived, and larvae tend to devour bodies of dead adults, further reducing chance of finding adult bodies for identification.

- Misidentification of khapra beetle as other *Trogoderma* species could result in introduction of khapra beetle into Australia.

Table 4.2 Current Australia's list of *Trogoderma* species of biosecurity concern.

Trogoderma species of biosecurity concern to Australia [a]
T. augustrum
T. anthrenoides
T. cavum
T. granarium (khapra beetle)
T. grassmani
T. inclusum
T. longisetosum
T. ornatum
T. serraticorne
T. simplex
T. sinistrum
T. sternale
T. teukton
T. versicolor
T. yunnaeunsis

[a] including all synonyms and subordinate taxa of the species listed

This PRA includes pest categorisation of 16 other *Trogoderma* species that have potential to be associated with plant products (Table B.2 in Appendix B). The pest categorisation identifies that 13 species have the potential to be on the plant product import pathways and meet the definition of a quarantine pest for Australia. Two species, *T. glabrum* and *T. variabile* are not quarantine pests for Australia as they are present in Australia and are not under official control. One species, *T. serraticorne*, although not present in Australia, does not have the potential to be on the plant product import pathways and therefore was not assessed further. As such, the current Australia's list of *Trogoderma* species of biosecurity concern (Table 4.2) should be updated to remove *T. serraticorne*. The proposed revised Australia's list of *Trogoderma* species of biosecurity concern is presented at Table 4.3.

Table 4.3 Proposed updated Australia's list of *Trogoderma* species of biosecurity concern

Trogoderma species of biosecurity concern to Australia [a]
T. augustrum
T. anthrenoides
T. cavum
T. granarium (khapra beetle)
T. grassmani
T. inclusum
T. longisetosum
T. ornatum
T. simplex
T. sinistrum
T. sternale
T. teukton
T. versicolor
T. yunnaeunsis

[a] including all synonyms and subordinate taxa of the species listed

Appendix B also lists *Trogoderma* species that are not recorded from Australia and have not been reported as associated with stored plant products (in Table B.3).

Proposals

This report provides 2 proposals relevant to the required 'freedom from *Trogoderma* species' in the additional declaration on the phytosanitary certificate.

Proposal 1: The requirement of 'freedom from *Trogoderma* species' in the additional declaration on the phytosanitary certificate is technically justified and should be maintained.

Proposal 2: The current Australia's list of *Trogoderma* species of biosecurity concern be updated to remove *T. serraticorne* as per Table 4.3.

Proposal 3: The Australia's list of *Trogoderma* species of biosecurity concern is subject to a review by the department based on evidence. For example, evidence to support an additional *Trogoderma* species being associated with plant products will trigger a review and the species may be added to the list.

4.5 Evaluation of existing emergency measures

The URE is assessed as 'High' for khapra beetle associated with plant products imported from 'target-risk khapra beetle countries' and as 'Low' for khapra beetle associated with plant products imported from 'other-risk khapra beetle countries'. Both UREs do not achieve the ALOP for Australia and therefore specific risk management measures are required. These assessments are detailed in Chapter 3 and summarised in Table 3.4.

As stated in sections 4.1.1, several bases were used by the department when determining emergency measures for khapra beetle, most of which were to minimise trade impacts, where appropriate. The use of these bases for risk management measures for khapra beetle was evaluated in sections 4.2.1-4.2.4 as being technically justified and should be maintained.

This section evaluates the efficacy of each of the 7 existing emergency measures.

4.5.1 <u>Not permitted entry</u> for any 'high-risk plant product', imported from any country, arriving with passengers including crew (ship or aircraft), either as accompanied or unaccompanied baggage, arriving as unaccompanied personal effects (air or sea), or arriving via international mail (air or sea), for any intended use (Measure 1)

As stated in section 4.1.1, arrival of goods into Australia with passengers including crew as accompanied or unaccompanied baggage, arrival as unaccompanied personal effects or arrival via international mail are termed 'non-freight mode of arrival' in this PRA.

As outlined in section 4.2.3, plant products arriving in Australia via any non-freight modes of arrival pose higher risk of being infested with khapra beetle and these modes of arrival limit the ability for the department to profile, target, verify and manage those at risk of khapra beetle infestation.

Due to the reasons outlined, not permitting entry for plant products arriving in Australia through these non-freight modes of arrival is justified.

In order to minimise the impact on trade, <u>not permitted entry</u> for plant products arriving in Australia through these modes of arrival being limited only to 'high-risk plant products' is reasonable. The department acknowledges that the records of interceptions of khapra beetle in international trade could be influenced by volumes and patterns of trade in plant products, that may change over time. Nevertheless, as per Proposal 3 in section 4.2.2, the list of 'high-risk plant products' is subject to review by the department based on evidence. For example, evidence of interceptions of khapra beetle in international trade on multiple occasions on an 'other-risk plant product' will trigger a review and the plant product may be re-classified as a 'high-risk plant product'. Therefore, not permitted entry for plant products arriving in Australia through these 3 modes of arrival be limited only to 'high-risk plant products' is adequate to manage the risk to an acceptable level.

Proposal

The department proposes that:

- Not permitted entry for any 'high-risk plant products', imported from any country, arriving with passengers including crew (ship or aircraft) either as accompanied or unaccompanied baggage, arriving as unaccompanied personal effects (air or sea), or arriving via international mail (air or sea), for any intended use (Measure 1) is technically justified and adequate to manage the biosecurity risk to achieve the ALOP for Australia and should be maintained.

4.5.2 Not permitted entry for any 'high-risk plant product', imported from any country, arriving as low value freight, for any personal use (Measure 2)

As outlined in section 4.2.4, plant products imported for personal use pose high risk of being infested by khapra beetle because they may not have been subjected to commercial quality control processes to manage the pest and are not subjected to any inspection and certification by the NPPO of the exporting country prior to export.

Also, goods imported as low value freight are eligible for self-assessed clearance and do not require full import declaration (FID), which limit the ability for the department to profile, target and manage those at risk of khapra beetle infestation.

Due to the reasons outlined, not permitted entry for plant products arriving in Australia as low value freight for personal use is justified.

Like Measure 1 discussed in section 4.5.1, not permitted entry for plant products arriving in Australia as low value freight for personal use being limited only to 'high-risk plant products' is reasonable and adequate to manage the risk to an acceptable level.

Proposal

The department proposes that:

- Not permitted entry for any 'high-risk plant products', imported from any country, arriving as low value freight, for personal use (Measure 2) is technically justified and adequate to manage the biosecurity risk to achieve the ALOP for Australia and should be maintained.

4.5.3 Pre-export treatment, followed by pre-export inspection, and phytosanitary certification endorsed with additional declaration for any 'high-risk plant product', imported from any 'target-risk khapra beetle country', arriving as high value freight or low value freight (air or sea), for any commercial use except for planting (Measure 3)

Among the imported plant product pathways arriving via 'freight modes of arrival' for commercial use, the risk of khapra beetle infestation is expected to be greatest for 'high-risk plant products' imported from 'target-risk khapra beetle countries'. Khapra beetles are not easily detected through visual inspections alone due to their small size and tendency to hide in places such as in between layers of cardboard or in the seams of bags used for packaging plant products. Therefore, pre-export visual inspection alone is not considered sufficient to provide phytosanitary security to achieve the ALOP for Australia for the imported plant products with greatest risk of khapra beetle infestation, and pre-export treatment is necessary.

Pre-export treatment

Pre-export treatment must:

- use one of the department's approved treatments;
- occur within 21 days of export or sealing of the container; and
- be accompanied by appropriate treatment certification.

Treatments approved by the department

According to existing emergency measures, the department has approved methyl bromide fumigation and heat treatment as these treatments are known to be effective for khapra beetle. Controlled atmosphere treatments involving high carbon dioxide concentration and/or low oxygen concentration have potential for use as phytosanitary measures for khapra beetle. However, due to the lack of sufficient data to support their efficacy, the department has only accepted controlled atmosphere treatments as provisional phytosanitary treatments for khapra beetle. The continuation of controlled atmosphere treatments is subject to confirmation of their effectiveness.

Methyl bromide fumigation

The IPPC recognises the use of fumigation, including methyl bromide fumigation, as phytosanitary measures (FAO 2019d). ISPM 43 (FAO 2019d) provides technical guidance for NPPOs on the application of fumigation as a phytosanitary measure and on the authorisation of treatment providers to conduct fumigation. For example, ISPM 43 states that fumigation is considered to be effective when the specific concentration of fumigant, at the minimum temperature and duration required for the stated efficacy, is achieved in the area of lowest concentration within a fumigation enclosure. Various factors may affect the effectiveness of fumigation and need to be taken into consideration in the treatment processes. Measures to prevent infestation or contamination after fumigation should also be applied (FAO 2019d).

Methyl bromide fumigation has been recognised as an effective treatment for khapra beetle and has been used to successfully eradicate the beetle infestation in warehouse/storage facilities and in plant products (Athanassiou, Phillips & Wakil 2019; Banks 2012; Honey et al. 2017; Khalique et al. 2018; Sonda 1968; Viljoen 1990). Diapausing larvae of khapra beetle exhibit lower sensitivity to fumigation and it is noted that the dosages to meet quarantine requirements are typically very high for khapra beetle (Banks 2012).

The methyl bromide fumigation treatment approved by the department for khapra beetle is 80 g/m^3 for 48 hrs at 21°C conducted in accordance with the department's Methyl Bromide Fumigation Methodology. The requirements for methyl bromide fumigation treatment set out by the department are consistent with ISPM 43 guidelines.

Heat treatment

The IPPC recognises the use of temperature treatments, including heat treatment, as phytosanitary measures (FAO 2018). ISPM 42 (FAO 2018) provides guidance on how temperature treatments may be used as phytosanitary measures, including guidance on the main operational requirements for the application of temperature treatment to achieve pest mortality at a specified efficacy. For example, ISPM 42 states that phytosanitary treatments based on temperature are considered to be effective when the specific temperature–time combination required for the stated efficacy to be achieved is attained. Dry heat treatment is used primarily for commodities with low moisture content that should not be exposed to moisture. Systems for treatment delivery should be designed, used and monitored to ensure that treatments are properly conducted, and commodities are protected from infestation and contamination after treatment (FAO 2018).

Heat treatment has been recognised as an effective treatment for khapra beetle (Battu, Bains & Atwal 1975; Wilches et al. 2016, 2019; Wright, Sinclair & Annis 2002).

The heat treatment approved by the department for khapra beetle is ≥ 60°C (measured at the core of the goods) for a minimum of 120 minutes, conducted in accordance with the department's Heat Treatment Methodology. The requirements for heat treatments set out by the department are consistent with ISPM 42 guidelines.

Controlled atmosphere treatment

Controlled atmosphere treatment is a type of modified atmosphere treatment (FAO 2021). Controlled atmosphere treatments involve altering gas concentrations in ambient air, by increasing the carbon dioxide (CO_2) content (hypercarbia) or reducing the oxygen (O_2) content (hypoxia or anoxia), or both, of the treatment environment to create and maintain an atmosphere lethal to target pests (FAO 2021).

The IPPC recognises the use of controlled atmosphere treatments as phytosanitary measures (FAO 2021). ISPM No. 44 (FAO 2021) provides guidance on the application of modified atmosphere treatments as phytosanitary measures, including authorisation, monitoring and auditing of treatment providers. For example, ISPM 44 states that modified atmosphere treatments are conducted in an enclosure (e.g., vacuum chamber, freight container, warehouse, cargo ship hold, packaging) and the lethal condition of the atmosphere should be achieved and maintained throughout the enclosure for a specified length of time as required by the treatment schedule. Various factors within the enclosure, including packing of the commodity, can influence the efficacy of modified atmosphere treatments. Systems should be designed, used and monitored to ensure that treatments are properly conducted, and commodities are protected from infestation and contamination after treatment (FAO 2021).

ISPM 44 also states that modified atmosphere treatments can be used in conjunction with modification of other parameters such as temperature and humidity (factors that affect respiration of target pests) to ensure the achievement of the required efficacy of modified atmosphere treatments.

Annis (1987) reviewed information and data on controlled atmospheres as a method of killing insects in stored grain, stated that considerable investigations have been made on the use of controlled atmosphere as a means of insect control in stored grains, both in the laboratory and in the field. Increased CO_2 concentration will cause an increase in respiration (Jay 1971). The mortality of pests at high CO_2 concentrations is primarily caused by desiccation due to the opening of spiracles (Nicolas & Sillans 1989). Low O_2 will cause insect feeding and acoustic activity to be reduced or stopped but these may resume post treatment. Sufficiently low level of O_2 for sufficiently long duration can cause insect mortality (Nicolas & Sillans 1989). However, to date, controlled atmosphere treatments have not been recognised as effective treatments for khapra beetle. Therefore, controlled atmosphere treatments have been accepted by the department only as provisional treatments for Khapra beetle.

The following controlled atmosphere treatments conducted in accordance with the department's Controlled Atmosphere Treatment Methodology are accepted by the department as provisional treatments for khapra beetle. The requirements for controlled atmosphere treatments set out by the department are consistent with ISPM 44 guidelines.

For all the following controlled atmosphere treatments, all temperature readings (enclosure and core of the product) and gas concentrations must meet or exceed the parameters of the treatment schedule throughout the entire exposure period.

1. **High-CO_2 atmosphere at atmospheric pressure**

   ≥ 80% CO_2 concentration at ≥ 25°C at atmospheric pressure for a minimum duration of 28 consecutive days

2. **High-CO_2 atmosphere at high pressure**

   ≥ 95% CO_2 concentration at ≥ 20°C at ≥ 30 bars for a minimum duration of 3 consecutive hours

   OR

   ≥ 95% CO_2 concentration, at ≥ 20°C at ≥ 20 bars for a minimum duration of 5 consecutive hours

3. **Low O_2 atmosphere (with N_2 balance) at atmospheric pressure**

   ≤1% O_2 concentration at ≥ 25°C at atmospheric pressure for a minimum duration of 22 consecutive days

   OR

   ≤1% O_2 concentration at ≥28°C at atmospheric pressure for a minimum duration of 12 consecutive days.

To date, the use of controlled atmosphere treatments for khapra beetle have been very minimal and insufficient to confirm their efficacy.

Pre-export inspection and phytosanitary certification endorsed with additional declaration

Following pre-export treatment, the treated goods must undergo a pre-export phytosanitary inspection by the NPPO of the exporting country and be accompanied by a phytosanitary certificate endorsed with the required additional declaration.

The currently required additional declaration is:

"Following treatment, representative samples were inspected and found free from all live species of *Trogoderma*."

In line with ISPM 23 (FAO 2019c), pre-export inspection of a consignment is to confirm compliance with the phytosanitary import requirements and, where a pre-export treatment is required, to verify that the required treatment has been applied and there is no indication of a treatment failure.

In line with ISPM 12 (FAO 2022), a phytosanitary certificate is issued to attest that goods in a consignment meet the phytosanitary import requirements and are in conformity with the certifying statement. The required additional declaration is to provide specific additional information on a consignment in relation to regulated pests.

ISPM 42, ISPM 43 and ISPM 44 all state that inspection should be carried out by the NPPO of the exporting country to determine compliance with phytosanitary import requirements. Where live non-target pests are found after the respective treatment, the NPPO should consider if their survival indicates a treatment failure for the targeted pest and whether additional phytosanitary measures may be necessary.

Khapra beetle is known to be more difficult to kill compared to most other *Trogoderma* species as well as most other insect pests. The presence of any live insects in any treated goods is an indication of a treatment failure and/or occurrence of pest infestation post treatment. The latter indicates that the phytosanitary status of the treated good was not maintained. Both treatment failure and pest infestation post treatment pose biosecurity risk of khapra beetle and/or other exotic pests being introduced in Australia. Therefore, the required additional declaration for the inspection of the treated goods should be:

"Following treatment, representative samples were inspected and found free from all live insects, including *Trogoderma* spp."

Proposals

The department proposes that:

- <u>Pre-export treatment, followed by pre-export inspection and phytosanitary certification endorsed with additional declaration</u> for any 'high-risk plant products', imported from any 'target-risk khapra beetle countries', arriving as high value freight or low value freight (air or sea), for any commercial use except for planting (Measure 3) is technically justified and adequate to manage the biosecurity risk to achieve the ALOP for Australia and should be maintained.
- The additional declaration for the inspection of the treated goods should be revised to:

'Following treatment, representative samples were inspected and found free from all live insects, including *Trogoderma* spp.'

- The use of methyl bromide fumigation and heat treatments as approved phytosanitary treatments for khapra beetle is appropriate and should be maintained.
- At this stage, controlled atmosphere treatments cannot be approved as phytosanitary treatments for khapra beetle, pending availability of data to demonstrate their efficacy. These treatments will continue to be accepted as provisional treatments and are subject to a review by the department based on evidence. For example, evidence to support that of the treatments are not effective or practical for khapra beetle will trigger a review by the department and the treatments may no longer be accepted as provisional treatments for the beetle.

4.5.4 Pre-export inspection and phytosanitary certification endorsed with additional declaration for any 'high-risk plant product', imported from any 'other-risk khapra beetle country', arriving as high value freight or low value freight (air or sea), for any commercial use except for planting (Measure 4)

Pre-export inspection

As outlined in section 3.1.1, although khapra beetle is currently not known to be present in 'other-risk khapra beetle countries', khapra beetle has been occasionally intercepted on plant products from these countries. It is likely that most of these interceptions occur as a result of contamination from infested sea containers used to transport the plant products. However, there is also a possibility that there may be a lag period before incursions of khapra beetle in new countries are recognised.

Therefore, pre-export inspection to verify that consignments are free from khapra beetle is technically justified and adequate to manage the risk to an acceptable level.

Phytosanitary certification endorsed with additional declaration

In line with ISPM 12, a phytosanitary certificate, issued by the exporting country's NPPO, endorsed with the following additional declaration is required to attest that goods in a consignment meets the phytosanitary import requirements and are in conformity with the certifying statement.

"Representative samples were inspected and found free from evidence of any species of *Trogoderma* (whether live, dead or exuviae) in Australia's list of *Trogoderma* species of biosecurity concern".

Justification for the required '*Trogoderma* species of biosecurity concern' instead of '*Trogoderma granarium*' in the additional declaration are outlined in section 4.4.

Proposal

The department proposes that:

- Pre-export inspection and phytosanitary certification endorsed with the additional declaration for any 'high-risk plant products', imported from any 'other-risk khapra beetle countries', arriving as high value freight or low value freight (air or sea), for any commercial use except for planting (Measure 4) is technically justified and adequate to manage the biosecurity risk to achieve the ALOP for Australia and should be maintained.

4.5.5 Pre-export inspection and phytosanitary certification endorsed with additional declaration for seed of any 'high-risk plant product', imported from any country, arriving as low value freight (air or sea), for planting (commercial use only) (Measure 5)

It is important to note that Measure 5 is applicable to seed for planting as commercial use only. Justification for not permitting entry for any 'high-risk plant product', imported from any country, arriving as low value freight (air or sea), for any personal use (including planting) is outlined in section 4.5.2. Evaluation of excluding any plant products, including seed for planting, imported for research purposes from any emergency measures for khapra beetle, except for Measure 1, is outlined in section 4.5.8.

Pre-export inspection

As outlined in section 4.2.4, it is expected that seeds for planting pose less risk of being contaminated or infested with khapra beetle compared to grains or plant products imported for other intended use due to the more rigorous commercial quality control processes to manage pests needed for the intended use of planting and market price. Therefore, pre-export inspection to verify that consignments of any seed of 'high-risk plant products' imported for planting are free from khapra beetle regardless of the status of khapra beetle in the country where the seed consignments are imported from is justified and adequate to manage the risk to an acceptable level.

Phytosanitary certification endorsed with additional declaration

In line with ISPM 12, a phytosanitary certificate, issued by the exporting country's NPPO, endorsed with the following additional declaration is required to attest that goods in a consignment meets the phytosanitary import requirements and are in conformity with the certifying statement.

> "Representative samples were inspected and found free from evidence of any species of *Trogoderma* (whether live, dead or exuviae) in Australia's list of *Trogoderma* species of biosecurity concern."

Justification for the required '*Trogoderma* species of biosecurity concern' instead of '*Trogoderma granarium*' in the additional declaration is outlined in section 4.4.

Pelleted or coated seed

According to existing emergency measures, pelleted or coated seeds may be certified by a government official of the exporting country based on the inspection of a bare seed sample of an identified seed lot. Where no bare seed is available, an importer may apply for an import permit. The importer will be required to submit necessary information to support their application for the department to assess whether the biosecurity risk can be managed to an acceptable level without a phytosanitary certificate.

The department considers that existing emergency measures for pelleted or coated seed are appropriate due to the absence of information to support that pelleting or coating processes applied to seed remove the risk of khapra beetle if associated with the seed.

Exclusion

According to existing emergency measures, seeds for planting that are imported for disease screening in post-entry quarantine (PEQ) in Australia, either in the Australian government PEQ or in the Approved Arrangement operating under a process management system with the department, are excluded from Measure 5.

Seeds for planting imported through PEQ are required to be verified that they are free from pests of biosecurity concern to Australia prior to being grown in PEQ, which is in contained environments, for disease screening. These conditions will adequately manage the risk of khapra beetle should it be present on the imported seeds. Therefore, the exclusion of seeds for planting imported through PEQ from this measure is appropriate.

Proposals

The department proposes that:

- Pre-export inspection and phytosanitary certification endorsed with the additional declaration for seed of any 'high-risk plant product', imported from any country, arriving as low value freight (air or sea), for planting (commercial use only) (Measure 5) is technically justified and adequate to manage the biosecurity risk to achieve the ALOP for Australia and should be maintained.
- Should information become available to support that pelleting or coating processes applied to seed remove the risk of khapra beetle if associated with the seed, the department will review the information and may remove or modify the measures for pelleted or coated seed as appropriate.
- The exclusion of seeds for planting imported through post entry quarantine in Australia from Measure 5 is appropriate and should be maintained.

4.5.6 Pre-export inspection and phytosanitary certification endorsed with additional declaration for seed of any 'high-risk plant product', imported from any country, arriving as high value freight (air or sea), for planting (except for research purposes) (Measure 6)

It is important to note that Measure 6 is not applicable to seed for planting for research purposes. Evaluation of excluding any plant products, including seed for planting, imported for research purposes from any emergency measures for khapra beetle, except for Measure 1, is outlined in section 4.5.8.

Pre-export inspection and phytosanitary certification endorsed with additional declaration

Similar to Measure 5 (section 4.5.5), pre-export inspection and phytosanitary certification endorsed with additional declaration to verify that consignments of any seed of 'high-risk plant products' imported for planting are free from khapra beetle regardless of the status of khapra beetle in the country where the seed consignments are imported from is justified and adequate to manage the risk to an acceptable level.

Pelleted or coated seed

Similar to Measure 5 (section 4.5.5), the department considers that existing emergency measures for pelleted or coated seed are appropriate due to the absence of information to support that pelleting or coating processes applied to seed remove the risk of khapra beetle if associated with the seed.

Exclusion

Seeds for planting that are imported through PEQ in Australia, either in the Australian government PEQ or in the Approved Arrangement operating under a process management system with the department, are excluded from Measure 6.

Justification for excluding seed for planting imported through PEQ in Australia from Measure 6 is the same as that for Measure 5 (outlined in section 4.5.5).

Proposals

The department proposes that:

- Pre-export inspection and phytosanitary certification endorsed with the additional declaration for seed of any 'high-risk plant product', imported from any country, arriving as high value freight (air or sea), for planting (except for research purposes) (Measure 6) is technically justified and adequate to manage the risk to achieve the ALOP for Australia and should be maintained.
- Should information become available to support that pelleting or coating processes applied to seed remove the risk of khapra beetle if associated with the seed, the department will review the information and may remove or modify the measures for pelleted or coated seed as appropriate. The exclusion of seeds for planting imported through PEQ in Australia from Measure 6 is appropriate and should be maintained.

4.5.7 Pre-export inspection and phytosanitary certification endorsed with additional declaration for any 'other-risk plant product', imported from any country, arriving via any mode of arrival, for any intended use, except for research purposes (Measure 7)

It is important to note that Measure 7 is not applicable to 'other-risk plant products' imported for research purposes. Evaluation of excluding any plant products, including seed for planting, imported for research purposes from any emergency measures for khapra beetle, except for Measure 1, is outlined in section 4.5.8.

Pre-export inspection and phytosanitary certification endorsed with additional declaration

As outlined in section 4.2.2, to minimise the impact on trade in line with Australia's obligation to the WTO SPS Agreement, applying less stringent measures for 'other-risk plant products' than 'high-risk plant products' is technically justified. Therefore, the required pre-export inspection and phytosanitary certification endorsed with additional declaration for 'other-risk plant products' regardless of the khapra beetle status in the exporting country, the mode of arrival into Australia or the intended use in Australia (except for research purposes) is justified and adequate to manage the risk to an acceptable level.

Pelleted or coated seed

Similar to Measure 5 (section 4.5.5), the department considers that existing emergency measures for pelleted or coated seed are appropriate due to the absence of information to support that pelleting or coating processes applied to seed remove the risk of khapra beetle if associated with the seed.

Exclusion

Seeds for planting that are imported through PEQ in Australia, either in the Australian government PEQ or in the Approved Arrangement operating under a process management system with the department, are excluded from Measure 7.

Justification for excluding seed for planting imported through PEQ in Australia from Measure 7 is the same as that for Measure 5 (outlined in section 4.5.5).

Proposals

The department proposes that:

- Pre-export inspection and phytosanitary certification endorsed with additional declaration for 'other-risk plant products', imported from any country, arriving through any mode of arrival, for any intended use, except for research purposes (Measure 7) is technically justified and adequate to manage the risk to achieve the ALOP for Australia and should remain in place.
- Should information become available to support that pelleting or coating processes applied to seed remove the risk of khapra beetle if associated with the seed, the department will review the information and may remove or modify the measures for pelleted or coated seed as appropriate.
- The exclusion of seeds for planting imported through post entry quarantine in Australia from this measure is appropriate and should be maintained.

4.5.8 Exclusion of plant products imported for research purposes

Apart from Measure 1, other existing emergency measures are not applicable to plant products imported for research purposes.

As outlined in section 4.2.4, measures applied to goods imported for research purposes vary depending on the product type and the type of research. Measures such as use in a laboratory which may include biosecurity containment and/or not permitted for release after the use are expected to address the risk of exposure of any pests, including khapra beetle, that may be associated with the goods to the environment in Australia. However, these measures are not required for all goods imported for research purposes. As such, this draft report proposes that specific risk management measures be applied to plant products imported for research purposes to ensure the consistent management of the risk to achieve the ALOP for Australia.

Proposal:

The department proposes that:

- High-risk plant products and other-risk plant products, including seed for planting, imported from any country for research purposes are subject to one of the following risk management measures:
    - use only in biosecurity containment (Approved Arrangement class 5)
    - pre-export inspection and phytosanitary certification endorsed with additional declaration, OR

- apply for an import permit. The department will assess the risk associated with the product type and type of research and impose import requirements on the import permit that will manage the risk of khapra beetle to achieve the ALOP for Australia.

4.6 Proposed risk management measures

4.6.1 Bases used to determine risk management measures

This draft report proposes that the four bases used to determine emergency measures are also applied to the proposed risk management measures outlined in section 4.6.4. The four bases are:

- Status of khapra beetle in the exporting country, i.e., ‘target-risk khapra beetle countries’ (Table 4.1) or ‘other-risk khapra beetle countries’
  - The list of ‘target-risk khapra beetle countries’ (Table 4.1) is subject to a review by the department based on evidence. For example, evidence of khapra beetle being present in an ‘other-risk khapra beetle country’ will trigger a review and the country may be re-classified as a ‘target-risk khapra beetle country’. Likewise, evidence of khapra beetle not being present in a 'target-risk khapra beetle country', such as the pest has been eradicated or proved to be no longer present, will trigger a review and the country may be removed from the list of ‘target-risk khapra beetle countries’.
  - If there is an incursion, outbreak or other changes in the status of khapra beetle in an ‘other-risk khapra beetle country’, the NPPO of the country must notify the department as soon as possible.
- Risk category of imported plant products, i.e., ‘high-risk plant products’ (Table 1.1) or ‘other-risk plant products’
  - The list of ‘high-risk plant products’ (Table 1.1) is subject to a review by the department based on evidence. For example, evidence of interceptions of khapra beetle in international trade on multiple occasions on an 'other-risk plant product’ will trigger a review and the plant product may be re-classified as a ‘high-risk plant product’.
- Mode of arrival into Australia of imported plant products, i.e., ‘freight modes of arrival’ (low-value freight or high-value freight) or ‘non-freight modes of arrival’
- Intended use in Australia of imported plant products, i.e., ‘personal use’ (e.g., human consumption, planting), ‘commercial use’ (e.g., human consumption, processing, planting) or ‘for research purposes’.

4.6.2 Excluding some forms of plant products from the measures

This draft report proposes that some forms of plant products that are excluded from emergency measures are also excluded from the proposed risk management measures.

- Plant products listed in Table 1.4 are excluded from the proposed risk management measures outlined in section 4.6.4.
  - The list of plant products excluded from emergency measures (Table 1.4) is subject to a review by the department based on evidence. For example, evidence to support an addition of a plant product to the list or a removal of a plant product from the list will trigger a review and the plant product may be added to- or removed from- the list, respectively.

4.6.3 Required ‘freedom from *Trogoderma* species’

This draft report proposes that specifying freedom from any *Trogoderma* species of biosecurity concern to Australia is required for the relevant proposed risk management measures.

- Specifying freedom from any *Trogoderma* species of biosecurity concern to Australia (Table 4.3) in the additional declaration on the phytosanitary certificate is required for the proposed risk management measures 4-7 outlined in section 4.6.4.
  - The list of *Trogoderma* species of biosecurity concern' (Table 4.3) is subject to a review by the department based on evidence. For example, evidence to support an additional *Trogoderma* species being associated with plant products will trigger a review and the species may be added to the 'Australia's list of *Trogoderma* species of biosecurity concern'.

4.6.4 Proposed risk management measures as ongoing risk management measures for khapra beetle

This draft report proposes that all the 7 existing emergency measures (Measure 1 to Measure 7) be maintained and 1 measure (Measure 8) be added as ongoing risk management measures for khapra beetle associated with imported plant product pathways.

It is important to note that these proposed 8 ongoing risk management measures must be read in conjunction with each other and with the list of exclusions (Table 1.4).

Measure 1: <u>Not permitted entry</u> for any 'high-risk plant product', imported from any country, arriving with passengers including crew (ship or aircraft) either as accompanied or unaccompanied baggage, arriving as unaccompanied personal effects (air or sea), or arriving via international mail (air or sea), for any intended use.

Measure 2: <u>Not permitted entry</u> for any 'high-risk plant product', imported from any country, arriving as low value freight (air or sea), for personal use.

Measure 3: <u>Pre-export treatment, followed by pre-export inspection, and phytosanitary certification endorsed with additional declarations</u> for any 'high-risk plant product', imported from any 'target-risk khapra beetle country', arriving as high value freight or low value freight (air or sea), for any commercial use except for planting.

Approved and provisionally approved pre-export treatments are listed in Table 1.5. This draft report proposes that:

- methyl bromide fumigation and heat treatments are approved as ongoing phytosanitary treatments for khapra beetle
- controlled atmosphere treatments continue to be accepted as provisional treatments and are subject to a review by the department based on evidence. For example, evidence to support that of the treatments are not effective or practical for khapra beetle will trigger a review and the treatments may no longer be accepted as provisional treatments for the beetle.

Following pre-export treatment, the treated goods must undergo a pre-export phytosanitary inspection by the NPPO of the exporting country and be accompanied by a phytosanitary certificate endorsed with the required additional declaration:

> "Following treatment, representative samples were inspected and found free from any live insects, including *Trogoderma* spp."

Measure 4: Pre-export inspection and phytosanitary certification endorsed with additional declaration for any 'high-risk plant product', imported from any 'other-risk khapra beetle country', arriving as high value freight or low value freight (air or sea), for any commercial use except for planting.

The required additional declaration on the phytosanitary certificate is:

> "Representative samples were inspected and found free from evidence of any species of *Trogoderma* (whether live, dead or exuviae) in Australia's list of *Trogoderma* species of biosecurity concern."

Measure 5: Pre-export inspection and phytosanitary certification endorsed with additional declaration for seed of any 'high-risk plant product', imported from any country, arriving as low value freight (air or sea), for planting (commercial use only). Seeds for planting imported through PEQ in Australia are excluded from this measure.

The required additional declaration on the phytosanitary certificate is:

> "Representative samples were inspected and found free from evidence of any species of *Trogoderma* (whether live, dead or exuviae) in Australia's list of *Trogoderma* species of biosecurity concern."

Pelleted or coated seeds may be certified by a government official of the exporting country based on the inspection of a bare seed sample of an identified seed lot. Where no bare seed is available, an importer may apply for an import permit. The importer will be required to submit necessary information to support their application for the department to assess whether the biosecurity risk can be managed to an acceptable level without a phytosanitary certificate. Should information become available to support that pelleting or coating processes applied to seed remove the risk of khapra beetle if associated with the seed, the department will review the information and may remove or modify the measures for pelleted or coated seed as appropriate.

Measure 6: Pre-export inspection and phytosanitary certification endorsed with additional declaration for seed of any 'high-risk plant product', imported from any country, arriving as high value freight (air or sea), for planting (except for research purposes). Seeds for planting imported through PEQ in Australia are excluded from this measure.

The required additional declaration on the phytosanitary certificate is:

> "Representative samples were inspected and found free from evidence of any species of *Trogoderma* (whether live, dead or exuviae) in Australia's list of *Trogoderma* species of biosecurity concern."

Pelleted or coated seeds may be certified by a government official of the exporting country based on the inspection of a bare seed sample of an identified seed lot. Where no bare seed is available, an importer may apply for an import permit. The importer will be required to submit necessary information to support their application for the department to assess whether the biosecurity risk can be managed to an acceptable level without a phytosanitary certificate. Should information become available to support that pelleting or coating processes applied to seed remove the risk of khapra beetle if associated with the seed, the department will review the information and may remove or modify the measures for pelleted or coated seed as appropriate.

Measure 7: Pre-export inspection and phytosanitary certification endorsed with additional declaration for any 'other-risk plant product', imported from any country, arriving via any mode of arrival, for any intended use except for research purposes. Seeds for planting imported through PEQ in Australia are excluded from this measure.

The required additional declaration on the phytosanitary certificate is:

> "Representative samples were inspected and found free from evidence of any species of *Trogoderma* (whether live, dead or exuviae) in Australia's list of *Trogoderma* species of biosecurity concern."

Pelleted or coated seeds may be certified by a government official of the exporting country based on the inspection of a bare seed sample of an identified seed lot. Where no bare seed is available, an importer may apply for an import permit. The importer will be required to submit necessary information to support their application for the department to assess whether the biosecurity risk can be managed to an acceptable level without a phytosanitary certificate. Should information become available to support that pelleting or coating processes applied to seed remove the risk of khapra beetle if associated with the seed, the department will review the information and may remove or modify the measures for pelleted or coated seed as appropriate.

Measure 8: Biosecurity containment (Approved Arrangement class 5), pre-export inspection and phytosanitary certification endorsed with additional declaration, OR apply for an import permit for high-risk plant products and other-risk plant products, including seed for planting, imported from any country for research purposes.

4.6.5 Consideration of alternative measures

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

4.7 Operational systems for the assurance, maintenance, and verification of phytosanitary status

A system of operational procedures is necessary to ensure that proposed specific risk management measures (Section 4.6) are effectively applied, the phytosanitary status of the plant products is maintained, and these can be verified.

4.7.1 Packaging and labelling

The objective of these procedures is to ensure that the packaging and labelling is sufficient to ensure consignment integrity is maintained from packing to export, including during storage and transport and to enable consignments to be reconciled against documentation.

- All packaging used for export of plant products to Australia, including outer bags and external cartons, must be new, clean and free from biosecurity risk material.
- Packaged goods must be labelled with consignment specific information. Labelling must be accurate and detailed enough to enable reconciliation of the consignment against phytosanitary certification. Labelling should include a consignment description and identifiers (e.g. botanical name, batch numbers etc) to allow traceability.
- For consignments requiring pre-export treatment, the exporting NPPO must verify that the packaging of the goods at the time of treatment complied with the department's packaging guidelines to ensure effective treatment penetration, described further in Section 4.7.2.
- If non-compliance with any of the requirements listed in previous dot points is identified, the exporting NPPO must not issue a phytosanitary certificate until corrective actions have been applied.

4.7.2 Pre-export treatment and treatment certification

The objective of these procedures is to ensure that pre-export treatments for khapra beetle (where required) are effectively applied in accordance with Australia's import requirements.

Where pre-export treatment is required, the exporting NPPO must ensure the following:

- Treatment must be applied using one of the department-approved treatments, as specified in Section 4.6, and in accordance with the relevant treatment methodologies, treatment schedules and packaging requirements (https://www.agriculture.gov.au/biosecurity-trade/import/arrival/treatments/treatments-fumigants).
- Treated goods must be exported within 21 days from completion of treatment OR sealed within a shipping container within 21 days, to minimise the risk of re-infestation post-treatment. Shipping and consignment documentation, and treatment certification must be supplied to verify dates of treatment and export.
- Treatment certificates must comply with the templates provided to verify compliance with treatment requirements (https://www.agriculture.gov.au/biosecurity-trade/import/arrival/treatments/treatments-fumigants#daff-page-main).
- For treatment providers that are listed as 'suspended', 'under review' or 'withdrawn' on the department's List of Treatment Providers OR those listed as 'unacceptable' or 'under review' on the List of Unregistered Treatment Providers (https://www.agriculture.gov.au/biosecurity-trade/import/before/prepare/treatment-outside-australia/pre-border-biosecurity-treatment-providers), treatments must be conducted under the supervision of the exporting NPPO. This is required to provide oversight and assurance in treatments undertaken by treatment providers who are recognised as non-compliant under a department pre-border treatment provider scheme. Supervision of treatment must be certified with an additional declaration on the phytosanitary certificate to enable verification of adherence to Australia's requirements.
- In countries participating in a government-to-government arrangement such as the Australian Fumigation Accreditation Scheme (AFAS), the exporting NPPO, in collaboration with the department, must verify treatment provider's compliance with Australia's treatment methodologies, treatment related import conditions, and treatment schedules in line with the paragraphs and schedules in the arrangement. The key mechanisms include:
  - Verifying that treatments for export to Australia are conducted by AFAS-registered providers.

  - Maintaining an up-to-date list of registered providers, including their accreditation status and operational details.
  - Maintaining procedures for assessing, accrediting, training and auditing fumigators to ensure compliance with AFAS standards.
  - Conducting compliance management activities, such as annual audits, for each registered provider, as well as Joint System Reviews (JSR) to enhance training and compliance management capacity. Maintaining records related to accreditation and personnel, registration, auditing and compliance activities.
  - Managing non-compliance, including taking immediate action to change registration status subject to investigations and corrective actions being undertaken, and promptly notifying the department.
  - Managing the re-instatement of providers on completion of corrective actions, in conjunction with the department.
  - Overseeing the accurate and timely submission of treatment documentation by registered providers to the department's portal (where required).
  - Engaging in department-led capacity building activities to improve the regulatory capability of the exporting NPPO, increasing their capacity to detect and manage non-compliance.

To strengthen assurance and oversight in the effective application of pre-export treatment for khapra beetle, the department intends to require that all treatment providers be registered and approved under one of the Australian pre-border biosecurity treatment provider schemes. These schemes include the Australian Fumigation Accreditation Scheme (AFAS) or AusTreat (government-to-industry scheme). It is anticipated that this requirement will be in effect by 2027.

The department administers AusTreat to ensure effective risk management through rigorous treatment provider registration, ongoing compliance monitoring, and robust mechanisms for non-compliance enforcement.

The accreditation process is designed to provide the department assurance that providers have suitable systems in place to ensure compliance with the department's treatment requirements. The key activities by the department include:

- Administering registration assessment of treatment providers to evaluate their capacity to complete effective treatments through assessment of equipment, personnel, facilities, and procedures.
- Conducting knowledge assessments during registration or in response to non-compliance, requiring additional trainings as appropriate.
- Approving only providers who meet these criteria.

The monitoring and compliance management process ensures ongoing conformance with biosecurity requirements and accountability for non-compliance. Key activities by the department include:

- Reviewing submitted treatment documentation to verify compliance and treatment efficacy. Treatment providers are required to upload all treatment certificates, record of treatment and data into the treatment certificate portal, within 14 days of treatment. Through this portal, the department identifies non-compliance prior to consignment arrival, allowing appropriate time for risk management interventions and for industry to make alternative arrangements for the goods.

- Conducting re-accreditation every three years, including routine audit and site inspections, to ensure ongoing adherence to Australia's treatment requirements.
- Enforcing non-compliance measures, suspending accreditation for non-compliant providers and requiring corrective actions (e.g. training or system improvements) before re-instatement.
- Implementing capacity building controls to improve the technical capacity of treatment providers, increasing their capacity to detect and manage non-compliance.

4.7.3 Pre-export inspection and phytosanitary certification by the exporting NPPO

The objective of these procedures is to ensure that Australia's import requirements have been met.

Pre-export inspection

- Pre-export visual inspections must be conducted by the exporting NPPO in accordance with ISPM 23: Guidelines for inspection (FAO 2019).
- Sampling for inspection must be in accordance with ISPM 31: Methodologies for sampling of consignments. (FAO 2016). Goods must be sampled for inspection to provide a 95% confidence level that infestations of more than 0.5% would be detected.
- For untreated consignments, inspections must target *Trogoderma* species listed on the Australia's list of *Trogoderma* species of biosecurity concern. Inspection protocols must be capable of detecting all life stages of *Trogoderma* species, including larval exuviae, across all packaging types and product forms.
- For treated consignments, the NPPO must verify that treatments comply with Australia's requirements, including reconciling treatment documentation against the consignment and ensuring compliance with all requirements in Section 4.7.2.

  Following verification of treatment documentation, the NPPO must conduct a post-treatment inspection to confirm freedom from *Trogoderma* species and any other live arthropod pest.

  If any live insect is detected, the consignment is considered to have failed the inspection. This is because the presence of live insects could indicate a treatment failure and/or re-infestation post-treatment. The exporting NPPO must apply remedial action to manage the biosecurity risk. Remedial action may include withdraw of the consignment from export to Australia OR re-treatment and re-inspection. The source of the pest infestation should also be investigated and corrective actions applied to avoid future failure.

- NPPO's must retain inspection records and ensure traceability of findings to support certification and enable verification by Australia.

Phytosanitary certification

- Phytosanitary certificate for export (or re-export – see also section 4.7.4) must be issued by the exporting NPPO for each consignment, following verification of documentation and pre-export inspection.

- Phytosanitary certificate must comply with ISPM 12 Guidelines for phytosanitary certificate (FAO 2022), Australia's minimum documentary and import declaration requirements policy, and requirements described in Section 4.6. Notably:
  - description of consignment (including place of origin), with sufficient information to reconcile the consignment.
  - relevant additional declarations as described in BICON, depending on phytosanitary measures required for the goods.
  - details of disinfestation treatments (where applicable).
- For treated consignments, the certificate must include an additional declaration to record the post-treatment inspection outcomes and confirm the absence of any live insects, including *Trogoderma* species. Additional declarations are also required to verify that treatment was completed as per the relevant methodology and endorse treatment certificate and describe packaging at the time of treatment.
- For untreated consignments, an additional declaration is required to confirm the absence of *Trogoderma* species of biosecurity concern to Australia.

4.7.4 Requirements for re-export situations

The country of export is generally considered to be the country where goods were originally grown, processed and stored. In cases where goods are re-exported through another country, the NPPO of the re-exporting country must issue a phytosanitary certificate (for export or re-export) that confirms compliance with Australia's biosecurity requirements. The certificate must declare the country of origin and identify any locations where the goods were stored or repacked, as these may present a risk of exposure to khapra beetle.

If treatment was conducted in the country of origin, the NPPO of the re-exporting country may issue a re-export phytosanitary certificate provided certain conditions are met. In accordance with ISPM 12 Section 6.1, these conditions include: the consignment has not been exposed to re-infestation or contamination by pests regulated by Australia, the consignment meets Australia's phytosanitary import requirements, and the original phytosanitary certificate from the country of origin is available.

If treatment is required, but was not conducted in the country of origin, the NPPO of the re-exporting country must apply appropriate phytosanitary actions, including treatment and post-treatment inspection, to comply with Australia's requirements, in accordance with ISPM 12 Section 6.2. This must be documented on a phytosanitary certificate for re-export or for export (if the conditions for issuing a re-export certificate cannot be met). In applying treatment, the re-exporting country must ensure that the packaging of the goods is suitable to ensure effective treatment.

For in-transit scenarios, the NPPO of the re-exporting country must confirm that the consignment remained sealed and was not exposed to infestation risks during transit or storage.

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

The objectives of this proposed procedure are to ensure that:

- Consignments comply with Australian import requirements to ensure freedom from:

- any evidence of *Trogoderma* species of biosecurity concern (live, dead, or exuviae), for untreated consignments.
- any evidence of any live insects, including *Trogoderma* species, for treated consignments.

- Consignments are as described on the phytosanitary certificate
- Biosecurity integrity has been maintained.

On arrival in Australia, the department will:

- Examine original documentation to verify that the consignment is as described on the phytosanitary certificate, that required phytosanitary actions have been undertaken and certified correctly.
- Inspect consignments to verify that the biosecurity status of the goods meets Australia's import requirements. The department will verify the packaging (and where applicable verify that the type of packaging was suitable for treatment), labelling and security of consignments, and inspect for quarantine pests, related articles and biosecurity risk material.
- A random sample will be taken per consignment. When inspecting the consignment, the department will apply a sampling method suitable for the commodity.

The department will evaluate the suitability of onshore intervention schemes for managing khapra beetle risks in imported plant products on a case-by-case basis. This assessment will consider factors, such as:

- The extent to which the onshore intervention scheme verifies that critical control measures have been applied in accordance with requirements.
- The impact of the scheme on ability to monitor and detect the presence of khapra beetle in plant commodities.
- The nature of the goods and their associated khapra beetle risk status, and the country of origin or export, to determine the feasibility and appropriateness of applying an intervention scheme.
- The reliability of pre-export controls to assure effective risk-management prior to import.
- The compliance history of the importer or exporter, including past adherence to biosecurity requirements, to support confidence in reduced onshore intervention.

4.7.6 Remedial actions for non-compliance

The objective of remedial actions for non-compliant consignments is to ensure that:

- Any actionable detection or infestation of khapra beetle is effectively mitigated through the appropriate remedial measures.
- Non-compliance with import requirements, including documentation or treatment failures, is addressed appropriately.

Consignments that fail to meet Australia's import conditions for khapra beetle will be subject to remedial actions. Export is recommended as the primary remedial measure to mitigate the potential risks associated with managing goods infested (or potentially infested) with khapra beetle, including the potential spread during handling, storage or transport pending alternative onshore measures, such as treatment.

The department may consider alternative remedial actions on a case-by-case basis, guided by a risk-assessment.

4.7.7 Monitoring and reporting of pest interceptions and non-compliance

The objective of these procedures is to verify the effectiveness of offshore phytosanitary measures applied to manage khapra beetle risks.

These procedures form part of the department's ongoing verification framework and contributes to continuous improvement of import requirements through evidence-based risk management. Activities include:

- The department will undertake routine monitoring and analysis of pest interception data and non-compliance to identify potential non-compliance with the import requirements, potential gaps in offshore phytosanitary systems or security, or emerging risks along the export pathway.
- Data on pest interception and non-compliance may be used to trigger a review by the department, including the review of the bases used to determine phytosanitary measures, the phytosanitary measures, and the operational procedures for the assurance, maintenance and verification of phytosanitary status.
- Where repeated or significant pest detections occur, the department may initiate investigations, notify the relevant NPPO, report non-compliance under international obligations, and apply appropriate regulatory actions.

4.8 Review of policy

The department reserves the right to review the import policy as deemed necessary. This may include if there is information to suggest that a phytosanitary measure proposed for khapra beetle is no longer effective, or where alternative risk management options become available.

5 Conclusion

The IPPC and the SPS Agreement requires emergency phytosanitary measures against the introduction of new pests to be technically justified. The department undertook this PRA (Part 1) to meet Australia's obligations under this convention and agreement by reviewing Australia's existing emergency measures to manage biosecurity risks of khapra beetle (*Trogoderma granarium*) associated with imported plant product pathways entering Australia.

This PRA has been conducted in accordance with Australia's method for pest risk analysis (Appendix A), which is consistent with the ISPMs, including ISPM No. 2 (FAO 2019a) and ISPM No. 11 (FAO 2019b), and the WTO-SPS Agreement (WTO 1995).

In conclusion, this draft report proposes a range of biosecurity requirements outlined in sections 4.6 and 4.7 in Chapter 4 for the imported plant product pathways to mitigate biosecurity risks of khapra beetle associated with these pathways to achieve the ALOP for Australia.

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

All plant products within the scope of this draft report 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 managing khapra beetle associated with imported plant products. The import conditions will be communicated on BICON.

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 No. 2: *Framework for pest risk analysis* (FAO 2019a) and ISPM No. 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 2024). A pest is 'any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products' (FAO 2024). 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 2024).

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 2024).

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 2024). 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 No. 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 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) and
- further pest risk assessment, which includes evaluation of the likelihood 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 No. 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 No. 11 (FAO 2019b), 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 No. 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 through identified pathways, 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 2024). 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 2024). 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

Estimates of likelihood were assigned to each step of entry, establishment and spread. Six qualitative likelihood descriptors are used: High; Moderate; Low; Very Low; Extremely Low; and Negligible. Definitions for these descriptors and their indicative ranges are given in Table A.1. The indicative ranges are only provided to illustrate the boundaries of the descriptors and are not used beyond this purpose in qualitative PRAs. These indicative ranges provide guidance to the risk analyst and promote consistency between different pest risk assessments.

Table A.1 Nomenclature of likelihoods

Likelihood	Descriptive definition	Indicative range
High	The event would be very likely to occur	0.7 < to ≤ 1
Moderate	The event would occur with an even likelihood	0.3 < to ≤ 0.7
Low	The event would be unlikely to occur	0.05 < to ≤ 0.3
Very low	The event would be very unlikely to occur	0.001 < to ≤ 0.05
Extremely low	The event would be extremely unlikely to occur	0.000001 < to ≤ 0.001

Negligible	The event would almost certainly not occur	0 < to ≤ 0.000001

A2.2.5 Combining likelihoods

The likelihood of entry was determined by combining the likelihood that khapra beetle will be imported into Australia and the likelihood that khapra beetle will be distributed within Australia in a viable status and subsequently transfer to a suitable host in Australia, 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 then the likelihood of entry and establishment is 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 ~~is~~ 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 considered. The consideration of the likelihood of entry, establishment and spread and subsequent consequences considers 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 considered when setting up the matrix that is used to estimate the risk and therefore any policy based on this analysis does not simply apply to one year of trade. Policy decisions that are based on the department's method that uses the estimated volume of one year's trade are consistent with Australia's policy on appropriate level of protection and meet the Australian Government's requirement for ongoing quarantine protection. If there are substantial changes in the volume and nature of the trade in specific commodities then the department will review the risk analysis and, if necessary, provide updated policy advice.

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

A2.3 Assessment of potential economic consequences

The department used a 2-step process to estimate the potential consequences of entry, establishment and spread of khapra beetle in Australia. 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 pest impacts

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

- the life or health of plants and plant products.

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

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

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

- eradication and control

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

- domestic trade

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

- international trade

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

- non-commercial and environment

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

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

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

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

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

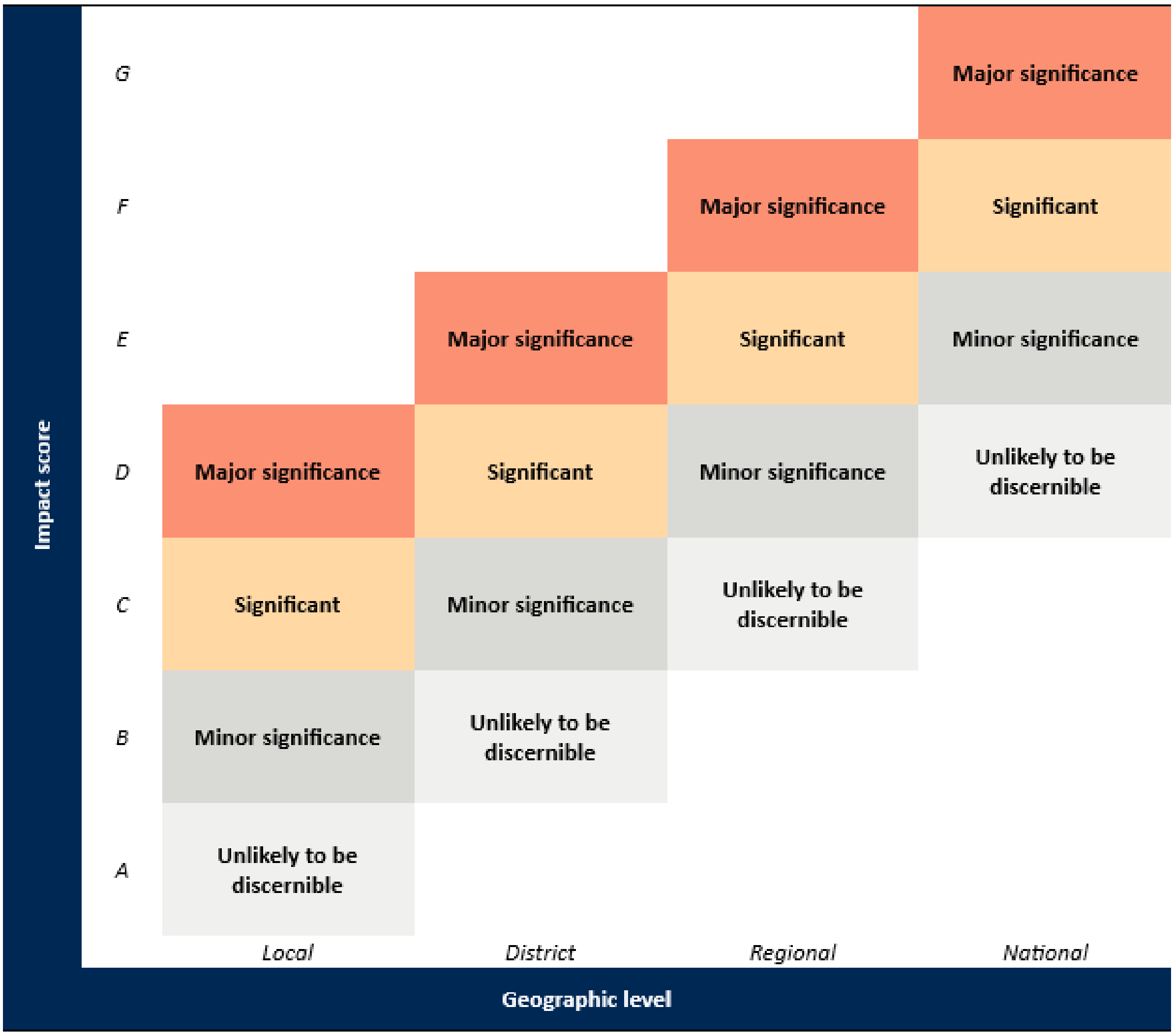
Each individual direct or indirect impact is given an impact score (A–G) using the decision rules in Figure A.1. This is done by determining which of the shaded cells with bold font in Figure A.1 correspond to the level and magnitude of the particular impact.

The following are considered during this process:

- At each geographic level below 'National', an impact more serious than 'Minor significance' is considered at least 'Minor significance' at the level above. For example, a 'Significant' impact at the state or territory level is considered equivalent to at least a 'Minor significance' impact at the national level.
- If the impact of a pest at a given level is in multiple states or territories, districts or regions or local areas, it is considered to represent at least the same magnitude of impact at the next highest geographic level. For example, a 'Minor significance' impact in multiple states or territories represents a 'Minor significance' impact at the national level.

- The geographic distribution of an impact does not necessarily determine the impact. For example, an outbreak could occur on one orchard/farm, but the impact could potentially still be considered at a state or national level.

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



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

Step 2: Combining direct and indirect pest 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 Appropriate Level of Protection (acceptable level of risk)

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.

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 No. (FAO 2019b) provides details on the identification and selection of appropriate risk management options and notes that the choice of measures should be based on their effectiveness in reducing the likelihood of entry of the pest.

Examples given of measures commonly applied to traded commodities include:

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

Appendix B: Pest categorisation of *Trogoderma* species

This appendix provides pest categorisation of khapra beetle (*Trogoderma granarium*) (Table B.1) and other *Trogoderma* species that are associated with stored plant products (Table B.2). It also lists *Trogoderma* species that are not recorded from Australia and have not been reported as associated with stored plant products (Table B.3).

B1 Pest categorisation of *Trogoderma granarium*

Table B.1 Pest categorisation of *Trogoderma granarium*

Pest	Country or region where the species is reported	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			
Trogoderma granarium Everts, 1898 Khapra beetle	Various countries in Africa, Americas, Asia and Europe (Háva 2015b). See also Appendix C	No Pest eradicated (Day & White 2016) and pest intercepted only (Athanassiou, Phillips & Wakil 2019)	Yes *Trogoderma granarium* infests a wide spectrum of commodities (Athanassiou, Kavallieratos & Boukouvala 2016; Hagstrum et al. 2013). Numerous interceptions of *T. granarium* in imported plant products by Australia and other countries (discussed in section 2.4) demonstrates the potential for this species to be imported into Australia through imported plant product pathways.	Yes *Trogoderma granarium* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	Yes Plant product hosts of *T. granarium* are widely available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma granarium* is a well-recognised storage pest (Ahmedani et al. 2007a; Athanassiou, Kavallieratos & Boukouvala 2016; Eliopoulos 2013; Hagstrum et al. 2013). Australia is one of the major agricultural producing countries. In the financial year of 2023-2024, 52.234 million tonnes of grains, oilseeds and pulses (value at $21.945 billions) were produced in Australia (ABARES 2025). Should khapra beetle become established in Australia, it would pose a major threat to Australia's	Yes

Pest	Country or region where the species is reported	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			
						grain, oilseed and pulse industries due to potential production losses during storage. It would also pose a major threat to other khapra beetle host industries, such as nuts and dried foodstuffs.	

B2 Pest categorisation of other *Trogoderma* species with potential association with stored plant products

Pest categorisation for other *Trogoderma* species is undertaken to determine the quarantine status for Australia of the species associated with stored plant products. This is to justify Australia's requirement for exporting countries' NPPOs to certify freedom from all *Trogoderma* species of biosecurity concern to Australia, as explained in Chapter 4.

Table B.2 Pest categorisation of other *Trogoderma* species that are associated with stored plant products

Pest	Country or region where the species is reported (a)	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Quarantine pest
			Potential for importation	Potential for distribution			
Trogoderma angustum (Solier, 1849)	Europe, U.S.A., Argentina, Chile, Peru, India, Pakistan and Thailand (Háva 2015b)	No records found	Yes This species is associated with and feeds on a wide range of stored plant products (Kemper & Döhring 1963) and thus has the potential to be imported with infested plant products.	Yes *Trogoderma angustum* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma angustum* is an economically important pest (Wilches et al. 2016).	Yes

Pest	Country or region where the species is reported (a)	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Quarantine pest
			Potential for importation	Potential for distribution			
				transportation and transit, in storage and processing facilities, and through waste disposal in Australia.			
Trogoderma anthrenoides (Sharp 1902)	Europe, Americas, Asia and Pacifics (Háva 2015b)	No records found	Yes This species is associated with stored plant products (Beal 1960; Hagstrum & Subramanyam 2009) and thus has the potential to be imported with infested plant products. *Trogoderma anthrenoides* was intercepted in the USA in plant products from Nicaragua and Venezuela (Beal 1960).	Yes *Trogoderma anthrenoides* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma anthrenoides* is an economically important pest (Wilches et al. 2016).	Yes
Trogoderma cavum Beal, 1982	Bolivia (Beal 1982) and the USA (Háva & Herrmann 2021).	No records found	Yes This species is associated with stored rice (Beal 1982) and thus has the potential to be imported with infested rice and potentially other plant products. *Trogoderma cavum* was intercepted in rice from	Yes *Trogoderma cavum* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma cavum* infests stored rice (Beal 1982).	Yes

Pest	Country or region where the species is reported (a)	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Quarantine pest
			Potential for importation	**Potential for distribution**			
			Boliva to USA in 1980 (Beal 1982).	coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.			
Trogoderma glabrum (Herbst, 1783)	Europe, Asia and Americas (Háva 2015b)	Yes (Rees 2004)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	**No**
Trogoderma grassmani (Beal, 1954)	USA and Mexico (Háva 2015b)	No records found	Yes This species is associated with stored plant products (Hagstrum & Subramanyam 2009) and thus has the potential to be imported with infested plant products. *Trogoderma grassmani* was intercepted on vegetable seed from the USA in New Zealand (Ward 1965).	Yes *Trogoderma grassmani* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma grassmani* is an economically important pest (Wilches et al. 2016).	Yes
Trogoderma inclusum LeConte, 1854	Europe, Africa, North America, Peru, Asia and New Zealand (Háva 2015b)	No (Ślipiński, Szitó & Zhou 2023)	Yes This species is associated with stored plant products (Hagstrum & Subramanyam 2009) and	Yes *Trogoderma inclusum* arriving with imported plant products is already associated with its hosts	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are	Yes *Trogoderma inclusum* is an economically important pest (Wilches et al. 2016)	Yes

Pest	Country or region where the species is reported (a)	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Quarantine pest
			Potential for importation	Potential for distribution			
			thus has the potential to be imported with infested plant products. *Trogoderma inclusum* was intercepted in a shipment of dried distillers' grains and soluble shipment from the USA in Vietnam (Phillips, Pfannenstiel & Hagstrum 2018).	and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	available in various parts of Australia for the species' establishment and spread.	and has also been shown to be almost as a serious pest as *T. granarium* (Harney 1992).	
Trogoderma longisetosum Chao & Lee, 1966	Europe and Asia (Háva 2015b)	No records found	Yes This species is associated with stored plant products (Hagstrum & Subramanyam 2009; Stejskal, Kučerová & Háva 2005) and thus has the potential to be imported with infested plant products. *Trogoderma longisetosum* was intercepted on peanuts from China in Czech Republic (Stejskal, Kučerová & Háva 2005).	Yes *Trogoderma longisetosum* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma longisetosum* is a stored product pest in China (FAO 2016b).	Yes

Pest	Country or region where the species is reported (a)	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Quarantine pest
			Potential for importation	Potential for distribution			
Trogoderma ornatum (Say, 1825)	Africa, Asia, and Americas (Háva 2015b)	No records found	Yes This species is associated with stored plant products (Hagstrum & Subramanyam 2009) and thus has the potential to be imported with infested plant products.	Yes *Trogoderma ornatum* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma ornatum* is an economically important pest (Wilches et al. 2016).	Yes
Trogoderma serraticorne (Fabricius, 1792) Note: Hava (2016) proposed that *Trogoderma anthrenoides* is a junior synonym of *T. serraticorne* but did not provide sufficient evidence to support the proposal. Hence, this report considers *T. serraticorne* and *T. anthrenoides* as 2 separate species.	Americas (Háva 2015b)	No records found	No No reports of *T. serraticorne* being a pest of stored plant products or being intercepted on plant products could be found.	Assessment not required	Assessment not required	Assessment not required	Assessment not required

Pest	Country or region where the species is reported (a)	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Quarantine pest
			Potential for importation	Potential for distribution			
Trogoderma simplex Jayne, 1882	Canada, USA, Mexico, Russia and South Korea (Háva 2015b)	No records found	Yes This species is associated with stored plant products (Hagstrum & Subramanyam 2009) and thus has the potential to be imported with infested plant products.	Yes *Trogoderma simplex* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma simplex* is an economically important pest (Wilches et al. 2016).	Yes
Trogoderma sinistrum Fall, 1926	Canada and USA (Háva 2015b)	No records found	Yes This species is associated with granaries and grain bins (Hagstrum & Subramanyam 2009) and thus has the potential to be imported with infested plant products.	Yes *Trogoderma sinistrum* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma sinistrum* is a stored product pest (Hagstrum & Subramanyam 2009).	Yes

Pest	Country or region where the species is reported (a)	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Quarantine pest
			Potential for importation	Potential for distribution			
				through waste disposal in Australia.			
Trogoderma sternale Jayne, 1882	Europe, North America and Japan (Háva 2015b)	No records found	Yes This species is associated with stored plant products (Hagstrum & Subramanyam 2009) and thus has the potential to be imported with infested plant products.	Yes *Trogoderma sternale* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma sternale* is an economically important pest (Wilches et al. 2016).	Yes
Trogoderma teukton Beal, 1956	Azerbaijan, USA and Asia (Háva 2015b)	No records found	Yes This species is associated with stored maize and wheat (Beal 1960) and thus has the potential to be imported with infested plant products.	Yes *Trogoderma teukton* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma teukton* has been shown to be almost as a serious pest as *T. granarium* (Harney 1992).	Yes

Pest	Country or region where the species is reported (a)	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Quarantine pest
			Potential for importation	Potential for distribution			
				transportation and transit, in storage and processing facilities, and through waste disposal in Australia.			
Trogoderma variabile Ballion, 1878	Europe, Americas, Asia and New Zealand (Háva 2015b)	Yes (Rees, Starick & Wright 2003)	Assessment not required	Assessment not required	Assessment not required	Assessment not required	**No**
Trogoderma versicolor (Creutzer, 1799)	Europe, North America and Asia (Háva 2015b)	No records found	Yes This species is associated with stored plant products (Hagstrum & Subramanyam 2009) and thus has the potential to be imported with infested plant products.	Yes *Trogoderma versicolor* arriving with imported plant products is already associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	Yes Plant product hosts of this species are readily available in Australia. Suitable conditions are available in various parts of Australia for the species' establishment and spread.	Yes *Trogoderma versicolor* is an economically important pest (Wilches et al. 2016).	Yes
Trogoderma yunnaeunsis Zhang & Liu, 1986	China (Háva 2015b)	No records found	Yes This species is associated with stored corn, maize and other grains (Beal	Yes *Trogoderma yunnaeunsis* arriving with imported plant products is already	Yes Plant product hosts of this species are readily available in Australia.	Yes *Trogoderma yunnaeunsis* is a stored grain pest in	Yes

Pest	Country or region where the species is reported (a)	Present within Australia	Potential to enter on pathway		Potential for establishment and spread	Potential for economic consequences	Quarantine pest
			Potential for importation	Potential for distribution			
			2005; Zhang, Liu & Jing 1999), and thus has the potential to be imported with infested plant products.	associated with its hosts and would be able to continue feeding on the imported plant products. In addition, it may also reach a new host when imported plant products coming into contact with the plant product hosts in Australia during transportation and transit, in storage and processing facilities, and through waste disposal in Australia.	Suitable conditions are available in various parts of Australia for the species' establishment and spread.	China (Zhang, Liu & Jing 1999)	

(a): The information provided was not intended to be exhaustive and thus species may have been reported from other country or region not included in the table.

B3 List of *Trogoderma* species that have not been reported as associated with stored plant products

Table B.3 lists *Trogoderma* species that, to date, are not recorded from Australia and have not been reported as associated with stored plant products. If evidence is found to indicate any of these species to be associated with stored plant products, pest categorisation is to be conducted on the species.

Table B.3 List of *Trogoderma* species not recorded from Australia and have not been reported as associated with stored plant products

Species	Country or region where the species is reported (a)
Trogoderma ainu Perkovsky, Háva & Zaitsev 2021	Russia (Perkovsky, Háva & Zaitsev 2021)
Trogoderma albonotatum Reiche in Mulsant & Rey, 1868	France (Háva 2015b)
Trogoderma antennale Broun, 1893	New Zealand (Háva 2015b)
Trogoderma arcanum Zhantiev, 2002	Georgia (Háva 2015b)
Trogoderma argentina Pic, 1906	Argentina (Háva 2016)
Trogoderma aritae Háva & Garcia-Ochaeta 2021	Honduras (Háva & García-Ochaeta 2021)
Trogoderma asperatum Fauvel, 1903	New Caledonia (Háva 2014b)

Species	**Country or region where the species is reported (a)**
Trogoderma aspericolle Casey, 1900	Mexico (Háva 2015b) and USA (Háva & Herrmann 2021)
Trogoderma atrum RA Philippi & F Philippi, 1864	Chile (Háva & Kadej 2009)
Trogoderma bactrianum Zhantiev 1970	Tajikistan and Turkmenistan (Háva 2008a) and Iraq (Mawlood & Abdul-Rassoul 2000)
Trogoderma baeri Pic 1915	Argentina (Háva 2016)
Trogoderma ballfinchae Beal, 1954	Mexico, (Háva 2015b) and USA (Háva & Herrmann 2021)
Trogoderma banari Háva & Trýzna, 2022	Madagascar (Háva & Trýzna 2022)
Trogoderma beali Mroczkowski, 1968	Costa Rica (Háva & García-Ochaeta 2021)
Trogoderma bicinctum Reitter, 1881	French West Indies, Greater and Lesser Antilles and probably Guadeloupe (Háva & Kadej 2006)
Trogoderma bonari Háva & Trýzna 2022	Madagascar (Háva & Trýzna 2022)
Trogoderma burgai Herrmann & Háva 2017	Peru (Herrmann & Háva 2017)
Trogoderma caboverdiana Kalik, 1986	Cape Verde Island (Háva 2015b)
Trogoderma caledonica Háva 2014	New Caledonia (Háva 2014b) and Norfolk Island (Háva & Kadej 2015)
Trogoderma caneparii Háva 2016	Madagascar (Háva 2018)
Trogoderma celatum Sharp, 1902	Mexico (Háva 2014d)
Trogoderma chileanum Háva & Kadej, 2009	Chile (Háva & Kadej 2009)
Trogoderma constantini Háva & Kadej, 2009	Chile (Háva & Kadej 2009)
Trogoderma cordillerae Háva & Solervicens, 2012	Chile (Háva & Solervicens 2012)
Trogoderma davidsoni Háva & Kadej, 2006	Dominican Republic (Háva & Kadej 2006)
Trogoderma denticorne (Normand, 1936)	Tunisia (Háva 2015b)
Trogoderma deserti Beal, 1954	USA (Beal 1960)
Trogoderma diioriori Háva, 2017	Argentina (Háva 2017)
Trogoderma dominicana Háva & Kadej, 2006	Dominican Republic (Háva & Kadej 2006)
Trogoderma ecuadorensis Herrmann & Háva, 2012	Ecuador (Herrmann & Háva 2013)
Trogoderma emeishanum Háva, 2022	China (Háva 2022)

Species	Country or region where the species is reported (a)
Trogoderma fantastica Háva & Kadej, 2006	Dominican Republic (Háva & Kadej 2006)
Trogoderma fasciferum Blatchley, 1914	USA (Háva & Herrmann 2021)
Trogoderma fasciolata Fairmaire, 1897	Madagascar (Kadej & Háva 2015)
Trogoderma friendmani Herrmann & Háva, 2012	Madagascar (Herrmann & Háva 2010)
Trogoderma gigantea Zhongping, Háva & Yongzhi, 2017	China (Zhongping, Háva & Yongzhi 2017)
Trogoderma gounellei Pic, 1915	Brazil (Háva 2006c)
Trogoderma granulatum Broun, 1886	New Zealand (Háva 2019; Kuschel 1990)
Trogoderma halsteadi Veer & Rao, 1994	India (Veer & Rao 1994) and Thailand (Háva 2015b)
Trogoderma horaki Háva, 2013	Madagascar (Háva 2013b)
Trogoderma housei Háva, 2014	Madagascar (Háva 2014a)
Trogoderma impressiceps (Pic, 1915)	Madagascar (Háva 2009)
Trogoderma insulare Chevrolat, 1863	Barbados, Cuba, Puerto Rico (Peck 2016), Panama (Háva 2015b), West Indies and France (Hagstrum & Subramanyam 2009)
Trogoderma irroratum Reitter, 1881	Iraq (Mawlood & Abdul-Rassoul 2000) and Egypt (Háva 2015b)
Trogoderma kalki Háva 2006	Brazil (Háva 2006c)
Trogoderma koenigi Pic, 1954	China (Zhongping, Háva & Yongzhi 2017)
Trogoderma krejciki Háva, 2011	Uruguay (Háva 2011b)
Trogoderma larvalis Háva, et al. 2006	Baltic region (Alekseev 2013; Háva, Prokop & Herrmann 2006)
Trogoderma latenotata Pic, 1915	Argentina (Háva 2016)
Trogoderma lescheni Háva, 2014	New Caledonia (Háva 2014b) and Norfolk Island (Háva & Kadej 2015)
Trogoderma madecassum Pic, 1924	Madagascar (Háva 2009)
Trogoderma maderae Beal, 1954	USA (Háva 2015b)
Trogoderma maestum Broun, 1880	New Zealand (Háva 2019)
Trogoderma mauricepici Háva, 2003	South Africa (Háva 2006b)

Species	Country or region where the species is reported (a)
Trogoderma megatomoides Reitter, 1881	Austria, Czechoslovakia, Hungary, Holland, France, England, Germany and Mexico (Mroczkowski 1968), Sweden, and Belarus (Tamutis, Tamutė & Ferenca 2011) Algeria, Iran, Finland and Poland (Bury & Mazepa 2014)
Trogoderma mexicanum Reitter, 1881	Mexico (Háva 2015b), Canada and USA (Biggs, Herrmann & Cognato 2022)
Trogoderma millei Háva, 2013	New Caledonia (Háva 2014b) and Norfolk Island (Háva & Kadej 2015)
Trogoderma mongolicum Zhantiev, 1973	Mongolia (Háva 2006a)
Trogoderma newzealandicum Háva, 2019	New Zealand (Háva 2019)
Trogoderma nitens Arrow, 1915	Brazil (Háva 2006c)
Trogoderma novaki Háva, 2010	Chile (Háva 2010)
Trogoderma nubleana Háva & Kadej, 2009	Chile (Háva & Kadej 2009)
Trogoderma obscurum Pic ,1936	Brazil and Chile (Háva & Solervicens 2012)
Trogoderma octaedron Peyerimhoff, 1943	The Sahara (Háva 2015b)
Trogoderma okumurai Beal, 1964	USA (Háva & Herrmann 2021)
Trogoderma paralia Beal, 1945	USA (Háva & Herrmann 2021)
Trogoderma parasambiranum Háva, 2009	Madagascar (Háva 2018)
Trogoderma pectinicornis Reitter, 1881	Argentina (Háva 2016) and Brazil (Háva 2006c)
Trogoderma plagifera Casey, 1916	USA (Háva 2015b)
Trogoderma primum Jayne, 1882	Mexico (Háva 2015a) and USA (Háva & Herrmann 2021)
Trogoderma punctatum Broun, 1914	New Zealand (Háva 2019)
Trogoderma puncticolle Broun, 1914	New Zealand (Háva 2015b)
Trogoderma quadrifasciatum Broun, 1893	New Zealand (Háva 2019)
Trogoderma quinquefasciatum Jacquelin du Val, 1859	Algeria, Europe, Iran, Mexico, (Háva 2015b)
Trogoderma rubiginosum Solier 1849	Chile (Háva & Kadej 2009)
Trogoderma ruficolle Reitter, 1881	Argentina and Brazil (Háva 2016)
Trogoderma rufonotatum Pic, 1942	Peru (Háva 2006b, 2008b)

Species	Country or region where the species is reported (a)
Trogoderma rufopictum Arrow, 1915	South Africa (Háva & Herrmann 2008)
Trogoderma sahondrae Háva & Baňař, 2017	Madagascar (Háva & Baňař 2017)
Trogoderma sambrianum Háva, 2004	Madagascar (Háva 2009)
Trogoderma santiagoi Háva & Kadej, 2009	Chile (Háva & Kadej 2009)
Trogoderma sceliphronum Háva, 2016	Argentina (Háva 2016)
Trogoderma schawalleri Háva, 2007	Israel, Jordan, and Palestine (Háva 2007a)
Trogoderma schmorli Reitter, 1881	Brazil (Háva 2006c)
Trogoderma seminigrum Pic, 1915	Madagascar (Háva 2009)
Trogoderma serrigerum Sharp, 1877	New Zealand (Háva 2019)
Trogoderma sharpi Háva & Matsumoto, 2021	Madagascar (Háva & Matsumoto 2021)
Trogoderma signatum Sharp, 1877	New Zealand (Háva 2019)
Trogoderma sinense Pic, 1927	China (Háva 2015b)
Trogoderma sonjirii Háva, 2019	New Zealand (Háva 2019)
Trogoderma stachi Mroczkowski, 1958	Brazil (Háva 2006c)
Trogoderma subrotundatum Reitter, 1881	Brazil (Háva 2006c)
Trogoderma subtile Reitter, 1881	Chile (Háva & Kadej 2009)
Trogoderma taomasinum Háva, 2009	Madagascar (Háva 2009)
Trogoderma thoracicum Reitter, 1881	Brazil (Háva 2006c)
Trogoderma trifasciatum Háva, 2009	Madagascar (Háva 2009)
Trogoderma tryznai Háva & Matsumoto, 2021	Madagascar (Háva & Matsumoto 2021)
Trogoderma turienzoi Háva, 2016	Argentina (Háva 2016)
Trogoderma unifasciatum Pic, 1942	India (Háva 2006b; Veer & Rao 1994)
Trogoderma valparaisoum sp. nov	Chile (Háva 2022)
Trogoderma variegatum Solier, 1849	Chile (Háva & Kadej 2009)

Species	**Country or region where the species is reported (a)**
Trogoderma varium Matsumura & Yokoyama, 1928 (synonym: *Trogoderma laticiorne* Chao & Lee 1966)	Japan (Sonda 1968)
Trogoderma vicinum Solier 1849	Chile (Háva & Kadej 2009)
Trogoderma vulneratum Fauvel, 1903	New Caledonia (Háva 2014b),
Trogoderma westerduijni Háva & Herrmann, 2007	Peru (Háva & Herrmann 2007) and Ecuador (Herrmann & Háva 2013)
Trogoderma wolfgangi Háva & Herrmann, 2008	Madagascar (Háva & Herrmann 2008)
Trogoderma zahradniki Háva, 2019	New Zealand (Háva 2019)
Trogoderma zhantivei Háva & Matsumoto, 2021	Madagascar (Háva & Matsumoto 2021)

(a): The information provided was not intended to be exhaustive and thus species may have been reported from other country or region not included in the table.

Appendix C: Review of global distribution of *Trogoderma granarium*

Khapra beetle (*Trogoderma granarium*) was first reported as a pest in India in 1894 (Singh et al. 2017). Athanassiou, Phillips & Wakil (2019) reviewed the geographical distribution of *T. granarium* and indicated that the pest had spread to and briefly established in countries of all continents prior to the 1960s but was eradicated from or is no longer present in many of these countries. Earlier articles, Banks (1977), and French and Venette (2005), listed the country status of presence or absence of *T. granarium*. The National Plant Protection Organisation (NPPO) of some countries/regions, such as USDA-APHIS (2022) and EPPO (2025), also maintain a list of khapra beetle countries. CABI (2025) provides updated information on the global distribution of *T. granarium* on an ongoing basis. Additionally, an internet website maintained by David Hagstrum (2025) titled 'Regulatory Control of Khapra Beetle' provides a world distribution list of *T. granarium.*

The department reviewed these publications and databases and considers that, although they are very helpful, the presence or absence status of *T. granarium* for some countries documented may not be accurate and/or have not been updated with subsequent information. Some publications or databases heavily rely on information provided in CABI and EPPO at the time for the global distribution of *T. granarium.* Also, CABI often cites EPPO as the evidence but some EPPO's assessments appear to be based on outdated information. Due to the reasons outlined, this PRA includes a review of global distribution of *T. granarium*.

This appendix presents the criteria used in assessing the status of *T. granarium* for a country (Table C.1) and the outcomes of the assessments (Table C.2).

Table C.1 Criteria for determining the status of *Trogoderma granarium* for a country

Category	Criteria
Present	• Evidence of pest being present – there are references, such as published literature and/or notification, to indicate the presence of *T. granarium*
Absent	• Absent: pest not recorded No record of *T. granarium* being present in the country has been found. • Absent: pest records invalid Pest records indicate the presence of a pest, but the conclusion is reached that the records are invalid or no longer valid. Records of *T. granarium* in the country are for pest being intercepted on imported goods only. • Absent: pest eradicated Pest records indicate that the pest was present in the past. Information is available to indicate that pest eradication measures were implemented and were successful. Surveillance confirms continued absence. • Absent: pest no longer present Pest records indicate that the pest was present in the past, but surveillance indicates that the pest is no longer present. There were records of *T. granarium* in the country, but the country's NPPO has provided evidence in support of the current absence.

Table C.2 Global distribution of *Trogoderma granarium*

Country	Status	Criteria
Afghanistan	Present	Evidence of pest being present (Banks 1977; CABI 2025; EPPO 2025; Háva & Kadej 2014; USDA-APHIS 2022).
Albania	Present	Evidence of pest being present (CABI 2025; Paparisto et al. 2012).
Algeria	Present	Evidence of pest being present (Bounechada, Fenni & Benia 2011; CABI 2025; EPPO 2025; USDA-APHIS 2022).
American Samoa	Absent	No record found.
Angola	Present	Háva, Lackner & Mazancová (2013) reported *T. granarium* in Angola. No further information is available to indicate that the pest is not or no longer present in the country.
Argentina	Absent	No record found.
Armenia	Absent	No record found.
Australia	Absent	Pest eradicated (Day & White 2016) and pest intercepted only (Athanassiou, Phillips & Wakil 2019).
Austria	Absent	Pest intercepted only (Athanassiou, Phillips & Wakil 2019; EPPO 2011).
Azerbaijan	Absent	No record found.
Bahamas	Absent	No record found.
Bahrain	Absent	Reports of pest being absent (Banks 1977; Myers & Hagstrum 2012).
Bangladesh	Present	Evidence of pest being present (Ahmed et al. 2015; CABI 2025; EPPO 2025; Mukul, Khan & Uddin 2020; USDA-APHIS 2022).
Belarus	Absent	No record found.
Belgium	Absent	Pest no longer present (Athanassiou, Phillips & Wakil 2019).
Belize	Absent	No records found
Benin	Present	Evidence of pest being present (Obadofin, Joda & Oluitan 2013)
Bhutan	Absent	No record found.
Bolivia	Absent	No record found.
Bosnia and Herzegovina	Absent	No record found.
Botswana	Absent	No record found.
Brazil	Absent	No record found.
Brunei	Absent	No record found.

Bulgaria, the Republic of	Absent	Pest no longer present confirmed by survey (Bulgaria NPPO, 2025).
Burkina Faso	Present	Evidence of pest being present (Deuse 1970) as Upper Volta, (CABI 2025; EPPO 2025; USDA-APHIS 2022; Waongo et al. 2015).
Burundi	Absent	No record found.
Cambodia	Absent	No record found.
Cameroon	Absent	No record found.
Canada	Absent	No record found.
Central African Republic	Absent	No record found.
Chad	Present	The beetle was reported as present in Chad by Deuse (1970). No further information is available to indicate that the pest is not or no longer present in the country.
Chile	Absent	No record found.
China	Absent	Zhao et al. (2021) reported that *T. granarium* is a frequently intercepted quarantine species in China.
Colombia	Absent	No record found.
Comoros	Absent	No record found.
Congo	Absent	No record found.
Cook Island	Absent	No record found.
Costa Rica	Absent	No record found.
Côte d’Ivoire (Ivory Coast)	Present	Evidence of pest being present (Deuse 1970; WDIV-TV 2012).
Croatia	Absent	No record found.
Cuba	Absent	No record found.
Cyprus	Present	Evidence of pest being present (Banks 1977; Batchelor 2000; CABI 2025; Demetriou et al. 2023; EPPO 2025; USDA-APHIS 2022).
Czech	Absent	No record found.
Democratic Republic of Congo	Absent	No record found.
Denmark	Absent	No record found.
Djibouti	Absent	No record found.
Dominican Republic	Absent	No record found.
Ecuador	Absent	No record found.

Egypt	Present	Evidence of pest being present (CABI 2025; Derbalah 2012; El razik et al. 2016; EPPO 2025; Lindgren, Vincent & Krohne 1955; Mahbob & Mahmoud 2013; Mokbel, Hussain & Zinhoum 2020; USDA-APHIS 2022; Younes et al. 2011).
El-Salvador	Absent	No record found.
Equatorial Guinea	Absent	No record found.
Eritrea	Absent	No record found.
Estonia	Absent	No record found.
Eswatini	Absent	No record found.
Ethiopia	Absent	Pest no longer present. The absence of *Trogoderma granarium* in Ethiopia is confirmed by several surveys of plant products – stored maize (Fufa et al. 2021; Sori & Ayana 2012), stored sorghum (Mendesil et al. 2007), traditional pit grain storage systems (Shiferaw 2018), stored wheat (Kalsa et al. 2019), stored faba beans (Endshaw & Hiruy 2020), other stored grains (Tadesse & Ali 2021) and cereal grains and oilseeds (Berhe et al. 2022).
Fiji	Absent	No record found.
Finland	Absent	No record found.
France	Absent	No record found.
French Guiana	Absent	No record found.
French Polynesia	Absent	No record found.
Gabon	Absent	No record found.
Gambia	Absent	No record found.
Georgia	Absent	No record found.
Germany	Absent	Pest eradicated (Athanassiou, Phillips & Wakil 2019).
Ghana	Present	Evidence of pest being present (Golob, Tran & Andan 2001).
Greece	Present	Evidence of pest being present (CABI 2025; Kavallieratos et al. 2017a; Papanikolaou et al. 2019).
Guatemala	Absent	No record found.
Guinea	Present	Deuse (1970) reported *T. granarium* in Guinea. The author noted that *T. granarium* had been endemic in Mali and Niger, the countries that export millet and peanut to Guinea, and commented that these countries were the likely source of outbreaks observed in Guinea. No further information is available to indicate that the pest is not or no longer present in the country.
Guinea Bissau (Republic)	Absent	No record found.

Guyana	Absent	No record found.
Honduras	Absent	No record found.
Hong Kong	Absent	No record found.
Hungary	Absent	Pest eradicated (Athanassiou, Phillips & Wakil 2019; EPPO 1999a)
India	Present	Evidence of pest being present (CABI 2025; EPPO 2025; Kulkarni et al. 2015; Yadav et al. 2018).
Indonesia	Absent	Pest no longer present (IPPC 2009).
Iran	Present	Evidence of pest being present (Forghani & Maroof 2015) and has been reported in wheat (Borzoui, Naseri & Namin 2015; Naseri & Borzoui 2016), barley (Mardani-Talaee et al. 2017; Seifi, Naseri & Razmjou 2016) and rice (CABI 2025; EPPO 2025; Mardani-Talaee et al. 2017; USDA-APHIS 2022).
Iraq	Present	Evidence of pest being present (Al-Saffar & Razzaq 2022; Mawlood & Abdul-Rassoul 2000; Mhemed 2011). Multiple authors reported damage to wheat in Iraq (Al-Iraqi, Dallal-Bashi & Al-Safar 2015; CABI 2025; EPPO 2025; Mhemed 2007, 2011; Shaaban, Minati & Shaban 2021; USDA-APHIS 2022).
Ireland	Absent	Pest no longer present (Athanassiou, Phillips & Wakil 2019).
Israel	Present	Evidence of pest being present (CABI 2025; EPPO 2025; Háva, Pavlíček & Chikatunov 2007; USDA-APHIS 2022).
Italy	Absent	Pest no longer present confirmed by survey (Italy NPPO, 2025).
Jamaica	Absent	No record found.
Japan	Absent	Pest eradicated (Athanassiou, Phillips & Wakil 2019; Sonda 1968).
Jordan	Present	Evidence of pest being present (Al Antary & Thalji 2017).
Kazakhstan	Present	Sokolov (2006) reported the first detection of *T. granarium* in malt of a brewing plant in Kazakhstan in 1987. It was later detected 11 times across various climatic regions of Kazakhstan, linked to importation of infested barley malt. No further information is available to indicate that the pest is not or no longer present in the country.
Kenya	Absent	Pest no longer present (Athanassiou et al. 2015).
Kiribati	Absent	No record found.
Kuwait	Present	Evidence of pest being present (Amr 2021; CBP 2019; Háva 2012, 2013a; Háva & Herrmann 2014; USDA-APHIS 2022).
Kyrgyzstan	Absent	No record found.
Laos	Absent	No record found.
Latvia	Absent	No record found.

Lebanon	Present	Evidence of pest being present (CABI 2025; EPPO 2025; French & Venette 2005; USDA-APHIS 2022).
Lesotho	Absent	No record found.
Liberia	Absent	Pest record unreliable. Háva (2000) reported presence of *T. granarium* in Liberia based on examination of specimens deposited at Expertisebureau Binnendijk-Bree, Netherlands. These specimens were collected in 1959 on Cocoa bean, from Liberia. This information alone is not considered sufficient evidence for the pest presence in Liberia. There is no other report on the presence of *T. granarium* in Liberia.
Libya	Present	Evidence of pest being present (CABI 2025; EPPO 2025; Mohamed & Shaurub 2010; USDA-APHIS 2022).
Lithuania	Absent	No record found. Absence confirmed by survey (Ostrauskas & Taluntytë 2004).
Luxembourg	Absent	No record found.
Macedonia	Absent	No record found.
Madagascar	Absent	Pest record unreliable. *Trogoderma granarium* was recorded in Madagascar in Lindgren, Vincent & Krohne (1955), Herrmann & Háva (2010) citing EPPO (2007), Rafarasoa et al. (2015), and CABI (2025) citing Rafarasoa et al. (2015). These records are considered unreliable because: Lindgren, Vincent & Krohne (1955) did not provide the basis for listing Madagascar for distribution of *T. granarium.* EPPO (2007), the reference cited by Herrmann & Háva (2010) for Madagascar has been corrected and later EPPO Global database such as EPPO (2025) no longer lists *T. granarium* for Madagascar. Háva and coauthors' later publications no longer include *T. granarium* for Madagascar (Háva 2013b, 2014a; Háva & Baňař 2017; Háva & Matsumoto 2021; Háva & Trýzna 2022). Rafarasoa et al. (2015) cited by CABI (2025) for *T. granarium* in Madagascar is considered unreliable because this pest is a well-known storage pest and would be unlikely to be collected in the rice field as reported by Rafarasoa et al. (2015).
Malawi	Absent	Pest no longer present (Viljoen 1990).
Malaysia	Absent	Pest eradicated (Sivapragasam 2007).
Maldives	Absent	No record found.
Mali	Present	Evidence of pest being present (Ajayi & Ratnadass 1998; CABI 2025; Deuse 1970 ; EPPO 2025; Ratnadass et al. 1994; USDA-APHIS 2022).
Malta	Absent	No record found.
Martinique	Absent	No record found.
Mauritania	Present	Evidence of pest being present (CABI 2025; Deuse 1970; EPPO 2025; USDA-APHIS 2022).
Mauritius	Absent	No record found.

Mexico	Absent	Pest eradicated (Barak 1989; Myers & Hagstrum 2012).
Moldova	Absent	No record found.
Monaco	Absent	No record found.
Mongolia	Absent	No record found.
Morocco	Present	Evidence of pest being present (CABI 2025; EPPO 2025; Saba & Laborius 1976; USDA-APHIS 2022).
Mozambique	Absent	No record found.
Myanmar	Present	Evidence of pest being present (CABI 2025; EPPO 2025; USDA-APHIS 2022).
Namibia	Absent	Pest no longer present (Viljoen 1990).
Nauru	Absent	No record found.
Nepal	Present	Evidence of pest being present (CABI 2025; EPPO 2025; Thapa 2000; Yubak Dhoj 2002, 2006).
Netherland	Absent	No record found.
New Caledonia	Absent	No record found.
New Zealand	Absent	No record found.
Nicaragua	Absent	No record found.
Niger	Present	Evidence of pest being present (Baoua et al. 2015; CABI 2025; Deuse 1970; EPPO 2025; USDA-APHIS 2022).
Nigeria	Present	Evidence of pest being present (Abdullahi & Dandago 2021; Asawalam & Onu 2014; Babarinde, Babarinde & Olasesan 2010; Chimoya & Abdullahi 2011; Degri & Zainab 2013; Gambari et al. 2021; Mailafiya et al. 2014a; Mailafiya et al. 2014b; USDA-APHIS, 2022; CABI 2025; EPPO 2025; Musa, Dike & Onu 2009).
North Korea	Absent	No record found.
Norway	Absent	Pest record unreliable. CABI (2025) lists *Trogoderma granarium* as being present in Norway (introduced in 1960) and cites Seebens et al. (2017) as the basis. However, Seebens et al. (2017) did not mention either *Trogoderma granarium* or khapra beetle.
Oman	Present	Evidence of pest being present (Háva 2007b, 2011a, 2012, 2013a; Háva & Herrmann 2014; USDA-APHIS 2022)
Pakistan	Present	Evidence of pest being present (Ahmedani et al. 2007a; Arain, Ahmad & Naeem-Ullah 2015; CABI 2025; EPPO 2025; Honey et al. 2017; Hussain et al. 2019).
Palau	Absent	No record found.
Panama	Absent	No record found.

Papua New Guinea	Absent	No record found.
Paraguay	Absent	No record found.
Peru	Absent	Pest record unreliable. Háva & Herrmann (2007) listed *Trogoderma granarium* as present in Peru but did not cite any specific reference/s to support the listing, although 3 references were consulted: Blackwelder (1945), Mroczkowski (1968) and Hava (2003). These references have been re-examined and none of them mentioned the presence of *T. granarium* in Peru.
Philippines	Absent	Pest record unreliable (Athanassiou et al. 2015).
Poland	Absent	No record found.
Portugal	Absent	No record found.
Puerto Rico	Absent	No record found.
Qatar	Present	Evidence of pest being present (CABI 2025; Háva 2011a, 2012, 2013a; Háva & Pierre 2008; USDA-APHIS 2022).
Romania	Absent	No record found.
Russia	Absent	Pest no longer present (EPPO 2025).
Rwanda	Absent	No record found.
Samoa	Absent	No record found.
Saudi Arabia	Present	Evidence of pest being present (Al-Moajel 2004; Aldryhim & Adam 1992; CABI 2025; EPPO 2025; Háva 2011a, 2012, 2013a; Rostom 1993; USDA-APHIS 2022).
Senegal	Present	Evidence of pest being present (CABI 2025; Deuse 1970; EPPO 2025; Háva 2021; Háva & Coache 2020; USDA-APHIS 2022).
Serbia and Montenegro	Absent	Pest record unreliable (EPPO 2025).
Seychelles	Absent	No record found.
Sierra Leone	Absent	Pest record unreliable. Hall (1955) reported *T. granarium* in stored palm kernels at a private store in Freetown. CABI (2025) indicated *T. granarium* as 'absent, formerly present' for Sierra Leone, citing EPPO (2025) as the reference. EPPO (2025) stated 'Current pest situation evaluated by EPPO on the basis of information dated 1978: Absent, pest no longer present'. Since there is no other report on the presence of *T. granarium* in Sierra Leone apart from Hall (1955), which is about 7 decades ago, the later report of EPPO evaluation of 'Absent, pest no longer present' could be used as a basis.
Singapore	Absent	No record found.

Slovakia	Absent	No record found.
Slovenia	Absent	No record found.
Solomon Island	Absent	No record found.
Somalia	Present	Evidence of pest being present (Abukar, Burgio & Tremblay 1986; ASCLME 2012; CABI 2025; EPPO 2025; USDA-APHIS 2022).
South Africa	Absent	Pest eradicated (Athanassiou et al. 2015; Viljoen 1990).
South Korea	Absent	Pest no longer present (APQA 2020).
South Sudan	Present	Evidence of pest being present (Háva 2014c; USDA-APHIS 2022).
Spain	Absent	Pest no longer present (Castañé et al. 2020; Riudavets et al. 2018).
Sri Lanka	Present	Evidence of pest being present (CABI 2025; EPPO 2025; Lindgren, Vincent & Krohne 1955; USDA-APHIS 2022).
Sudan	Present	Evidence of pest being present (Badawy & Hassan 1964; CABI 2025; EPPO 2025; Kabbashi & Hassan 2014; Satti & Elamin 2012; Seifelnasr 1992; USDA-APHIS 2022).
Suriname	Absent	No record found.
Sweden	Absent	No record found.
Switzerland	Absent	Pest no longer present (Chittaro & Sanchez 2019).
Syria	Present	Evidence of pest being present (CABI 2025; EPPO 2025; Ghanem et al. 2013; Ghanem & Shamma 2007; Mansour 2016; USDA-APHIS 2022).
Taiwan	Absent	Pest no longer present (Athanassiou, Phillips & Wakil 2019; Yao et al. 2016).
Tajikistan	Present	Sokolov (2006) reported the detection of *T. granarium* in facilities handling imported plant products in Tajikistan in 1987-1988. No further information is available to indicate that the pest is not or no longer present in the country.
Tanzania	Present	Evidence of pest being present (Makundi, Massawe & Laswai 2006; Swaine & Mutter 1961).
Thailand	Absent	Pest record unreliable (Athanassiou et al. 2015).
Timore-Leste	Present	Evidence of pest being present (DAFF unpublished).
Togo	Absent	No record found.
Tonga	Absent	No record found.
Trinidad and Tobago	Absent	No record found.
Tunisia	Present	Evidence of pest being present (CABI 2025; EPPO 2025; Saidana et al. 2010; USDA-APHIS 2022).

Türkiye	Present	Evidence of pest being present (Bulak et al. 2013; CABI 2025; EPPO 2025; Mutlu et al. 2019; Özberk et al. 2017; Özgen & Háva 2018; Tezcan et al. 2004; USDA-APHIS 2022).
Turkmenistan	Present	Sokolov (2006) reported the first detection of *T. granarium* in 1986 and further detections in facilities handling imported plant products in Turkmenistan in 1987-1988. These detections were linked to importation of infested fodder and maize wheat. No further information is available to indicate that the pest is not or no longer present in the country.
Uganda	Absent	No record found.
Ukraine	Absent	No record found.
United Arab Emirates (UAE)	Present	Evidence of pest being present (Háva 2007b, 2011a, 2012, 2013a; Háva & Herrmann 2014; USDA-APHIS 2022).
United Kingdom	Absent	Pest no longer present (Athanassiou et al. 2015).
Uruguay	Absent	Pest no longer present (Ministerio de Ganadería 2020).
USA	Absent	Pest eradicated (Athanassiou et al. 2015).
Uzbekistan	Absent	Confirmed by survey (Uzbekistan NPPO, 2025).
Vanuatu	Absent	No record found.
Venezuela	Absent	Pest no longer present (Athanassiou et al. 2015; EPPO 1999b).
Vietnam	Absent	Pest absent confirmed by Vietnam NPPO (PPD 2020).
Yemen	Present	Evidence of pest being present (CABI 2025; EPPO 2025; Háva 2007b, 2011a, 2012, 2013a; Háva & Herrmann 2014).
Zambia	Absent	Pest no longer present (Viljoen 1990).
Zimbabwe	Absent	Pest no longer present (Viljoen 1990).

Appendix D: Stakeholder notification

This appendix provides a summarised chronology of notifications on emergency measures for khapra beetle associated with plant products. Few information on emergency measures for khapra beetle associated with sea containers is listed here where it was included within the same notification as that associated with plant products.

4 Aug 2020 Australia notified trading partners its intention to implement emergency measures to high-risk plant products that are hosts of khapra beetle (*T. granarium*) to safeguard Australia against the entry, establishment and spread of this pest (G/SPS/N/AUS/502/).

The high-risk plant products (in various raw and physically-processed forms for any end use) include Rice (*Oryza sativa*); Chickpeas (*Cicer arietinum*); Cucurbit seed (*Cucurbita* spp.); Cumin seed (*Cuminum cyminum*); Safflower seed (*Carthamus tinctorius*); Bean seed (*Phaseolus* spp.); Soybean (*Glycine max*); Mung beans, cowpeas (*Vigna* spp.); Lentils (*Lens culinaris*); Wheat (*Triticum aestivum*); Coriander seed (*Coriandrum sativum*); Celery seed (*Apium graveolens*); Peanuts (*Arachis hypogaea*); Dried peppers (*Capsicum* spp.); Faba bean (*Vicia faba*); Pigeon Pea (*Cajanus cajan*); Peas (*Pisum sativum*); Fennel seed (*Foeniculum* spp.).

Commercially manufactured goods that are thermally processed, and packaged such as retorted, blanched, roasted, fried, boiled, puffed, malted, or pasteurised goods, fresh vegetables, and commercially manufactured frozen food and frozen plant products or oils derived from vegetables or seed are excepted from these measures.

28 Aug 2020 Australia notified trading partners of the commencement of Phase 1 of the emergency measures from 3 September 2020 (G/SPS/N/AUS/502/Add.1).

High-risk plant products (in various raw and processed forms for any end use) will not be permitted entry from any country into Australia within unaccompanied personal effects (UPEs), or within low value air and sea freight (lodged through self-assessed clearance (SAC)), but excluding goods imported as commercial trade samples or for research purposes.

Failure to comply with the emergency measures will result in export or destruction of the goods upon arrival in Australia. High-risk plant products within UPEs or imported as low value air and sea freight (SAC) that have not been inspected and released prior to 3 September 2020 will not be permitted entry into Australia. High-risk plant products found in consignments on inspection will be re-exported or destroyed.

7 Oct 2020 Australia notified trading partners of Phase 2 of the emergency measures from 15 October 2020 (G/SPS/N/AUS/502/Add.2).

High-risk plant products (in various raw and processed forms for any end use) will not be permitted entry from any country into Australia within baggage carried by international travellers; or–mail articles (including items posted using Express Mail Service).

Failure to comply with the emergency measures will result in destruction of the goods upon arrival in Australia.

20 Nov 2020	Australia notified trading partners that in response to the recent and increasing hitchhiker risk of khapra beetle in sea containers, Australia determined that management of sea containers was now an immediate priority for addressing khapra beetle risk (G/SPS/N/AUS/502/Add.3). Accordingly, Australia now planned to implement new measures for sea containers (Phase 6) ahead of proposed changes for plant products and seeds for sowing (Phases 3–5). A revised schedule of the implementation of the phases is below. **Phase 1:** Ban on high-risk plant products within unaccompanied personal effects and low value freight–commenced 3 September 2020 (G/SPS/N/AUS/502/Add.1). **Phase 2:** Ban on high-risk plant products within accompanied baggage or via international travellers or mail articles–commenced 15 October (G/SPS/N/AUS/502/Add.2). **Phase 3:** Revised phytosanitary certification and new offshore treatment requirements for high-risk plant products arriving via commercial pathways–expected to commence in mid-late 2021 (G/SPS/N/AUS/502/Add.3). **Phase 4:** Revised phytosanitary certification and new offshore treatment requirements for other risk plant products arriving via all import pathways –expected to commence in mid-late 2021 (G/SPS/N/AUS/502/Add.3). **Phase 5:** Introduction of phytosanitary certification for all seeds for sowing – expected to commence in mid-late 2021 (G/SPS/N/AUS/502/Add.3). **Phase 6:** Revised measures for sea containers–expected to commence in early 2021 (G/SPS/N/AUS/502/Add.3).
10 Dec 2020	Australia notified trading partners that from 16 December 2020, Australia's list of khapra beetle risk countries will be updated to the following list: Afghanistan; Albania; Algeria; Bangladesh; Benin; Burkina Faso; Côte d'Ivoire; Cyprus; Egypt; Ghana; Greece; India; Iran; Iraq; Israel; Kuwait, Lebanon; Libya; Mali; Mauritania; Morocco; Myanmar; Nepal; Niger; Nigeria; Oman; Pakistan; Qatar; Saudi Arabia; Senegal; Somalia; South Sudan; Sri Lanka; Sudan; Syria; Timor-Leste; Tunisia; Türkiye; United Arab Emirates and Yemen (G/SPS/N/AUS/502/Add.4). FCL consignments of seeds, grains and dried plant products imported from khapra beetle-risk country must be accompanied by a phytosanitary certificate with the following additional declaration: 'The plant product(s) were inspected and found free from khapra beetle (*T. granarium*)'. Countries not listed as a khapra beetle-risk country must be accompanied by a phytosanitary certificate.
18 May 2021	Australia informed trading partners of a revised implementation schedule for emergency measures (G/SPS/N/AUS/502/Add.10). **Phase 1**: Ban on high-risk plant products within unaccompanied personal effects and low value freight for personal use–commenced 3 September 2020 (G/SPS/N/AUS/502/Add.1). **Phase 2**: Ban on high-risk plant products within accompanied baggage or via international travellers or mail articles–commenced 15 October 2020 (G/SPS/N/AUS/502/Add.2).

	Phase 3: Revised phytosanitary certification and new offshore treatment requirements for high-risk plant products via all commercial pathways–expected to commence in August 2021. Australia informed the trading partners that heat treatment or methyl bromide fumigation may not be feasible for some goods imported under Phase 3. As such, the department is considering alternative treatment options for goods impacted by Phase 3. **Phase 4**: Revised phytosanitary certification and new offshore treatment requirements for other risk plant products–progression of this work is on hold. **Phase 5**: Phytosanitary certification requirements for all seeds for sowing–progression of this work is on hold. **Phase 6A**: Measures for target risk sea containers (FCL/FCX) packed with high-risk plant products in a khapra beetle-risk country–commenced 12 April 2021 (G/SPS/N/AUS/502/Add.9). Measures for target risk sea containers (FCL/FXL) that are packed with all types of goods in a khapra beetle target risk country and unpacked in a rural grain growing area of Australia–will commence on 12 July 2021. **Phase 6B:** Measures for high-risk sea containers—expected to commence in late 2021.
3 Aug 2021	Australia informed trading partners of provisional alternative treatment options for high-risk plant products (G/SPS/N/AUS/502/Add.12). **Phase 3** of the emergency measures (high-risk plant products arriving via all commercial air and sea pathways) will commence in September 2021. The measures include mandatory offshore treatment of high-risk plant products exported from a khapra beetle-risk country. Approved treatment options (heat treatment and methyl bromide fumigation) are not feasible for some products; therefore, the department has considered modified atmosphere treatments as an alternative treatment option.
3 Aug 2021	Australia informed trading partners of an exclusion list of high-risk plant products, which is relevant to khapra beetle emergency measures under Phases 1 to 3 and Phase 6A (high-risk goods packed in a khapra beetle-risk country) (G/SPS/N/AUS/502/Add.13). The following plant products exported on or after 2 August 2021 are no longer considered high-risk: o Commercially prepared and packaged goods that have been thermally processed so that the nature of the material has been transformed from their original raw form. o Goods that are commercially milled or ground to a powder, meal or flakes and packaged in bags less than 25 kg. Note: these goods do not require mandatory treatment from khapra beetle risk-countries, but commercial consignments will require a phytosanitary certificate verifying freedom from khapra beetle.

- Breakfast cereals, instant cereal beverage mixes, couscous meal mixes and snack foods that are commercially prepared and retail packaged*****.
- Bakery and bread mixes (including whole seeds) that are commercially prepared and retail packaged*****.
- Commercially prepared and packaged herbal teas, with or without seeds (including loose leaf and tea bags).

***** An imported good is considered retail packaged if it has been commercially prepared and packaged overseas and is in a final state that requires no further processing, packaging, or labelling prior to sale or use in Australia.

Note: The exclusion list for other risk plant products has also been updated. However, this list only applies to Phase 4 of the emergency measures which has been placed on hold. The exclusions list has been updated on our website: https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/plant/khapra-beetle/urgent-actions

23 Aug 2021 Australia informed trading partners of new import conditions to apply to high-risk plant products exported on or after 30 September 2021 (**Phase 3**). Import conditions will differ depending on the country of export (G/SPS/N/AUS/502/Add.14). The new import conditions do not apply to seeds for sowing and goods that are imported for research purposes coming as low value freight (less than AUD$1,000).

These enhanced import conditions for high-risk khapra beetle products are in addition to measures introduced for sea containers in April 2021.

- **High risk plant products from 'target-risk khapra beetle countries'** via all commercial air and sea pathways will require mandatory offshore treatment with an approved treatment option (methyl bromide fumigation, heat treatment or modified atmosphere) inspected by a government official of the exporting country. In addition to a treatment certificate, the goods must be treated within 21 days of export and be accompanied by a phytosanitary certificate certifying treatment requirements have been met and that the goods are free from all live species of *Trogoderma*.
- Modified atmosphere treatments are a provisional option only. As such, an import permit is required. The goods must have an import permit before they arrive in Australia.
- **High risk plant products from 'other-risk khapra beetle countries'** via all commercial air and sea pathways will require inspection by a government official of the exporting country and certified as free from evidence of any species of *Trogoderma* that are of concern to Australia (the list of *Trogoderma* species of concern can be found via https://www.agriculture.gov.au/biosecurity-trade/policy/legislation/list-trogoderma-species)

Failure to comply with these requirements may result in the export of the sea container and/or goods upon arrival in Australia.

In addition, the department updated the definition of high-risk plant products list on Australia's urgent actions website to exclude goods that are commercially processed to a powder, meal or flakes and packaged in bags less than or equal to 25 kgs (such as cereal flours like semolina, wheat flour, chilli flakes and ground spices). This list can

	be viewed via: https://www.agriculture.gov.au/pests-diseases-weeds/plant/khapra-beetle/high-risk-plant-products#definition-of-highrisk-plant-products.
19 Nov 2021	Australia informed the trading partners of the commencement of Phase 4 and Phase 5 of the khapra beetle emergency measures from early 2022 and extension of Phase 6A of the measures (sea containers) from late 2021 (G/SPS/N/AUS/502/Add.15). **Phase 4 (Other risk-goods from all countries)** will introduce revised phytosanitary certification requirements for other-risk plant products exported from all countries. These goods must be accompanied by a phytosanitary certificate issued by the exporting country with the additional declaration: 'Representative samples were inspected and found free from evidence of any species of *Trogoderma* (whether live, dead or exuviae) in Australia's list of *Trogoderma* species of biosecurity concern'. **Phase 5 (seed for sowing from all countries)** will introduce phytosanitary certification requirements for seeds for sowing exported from all countries and arriving via all arrival modes. These goods must be accompanied by a phytosanitary certificate issued by the exporting country with the additional declaration: 'Representative samples were inspected and found free from evidence of any species of *Trogoderma* (whether live, dead or exuviae) in Australia's list of Trogoderma species of biosecurity concern'. Failure to comply with the above requirements may result in the export of the goods and/or the sea container on-arrival in Australia. We will consider transitional arrangements to accommodate consignments in-transit closer to the implementation. If the products will be packed into an FCL/FCX in a target-risk khapra beetle country and will be unpacked in a regional grain growing area of Australia, the sea container itself will need to be treated. **Sea containers destined for unpack in nut growing areas (packed in 'target-risk khapra beetle countries'):** from 15 December 2021 FCL/FCX packed with all goods in a khapra beetle-risk country and destined for unpack in nut growing areas will be subject to mandatory off-shore treatment.
7 Feb 2022	Australia informed the trading partners of the commencement of Phase 4 and Phase 5 of the khapra beetle emergency measures from 28 April 2022 (G/SPS/N/AUS/502/Add.16). **Phase 4:** Other risk-goods from any country must be accompanied by a phytosanitary certificate with the additional declaration: *'Representative samples were inspected and found free from evidence of any species of Trogoderma (whether live, dead or exuviae) in Australia's list of Trogoderma species of biosecurity concern'* **Phase 5:** Seed for sowing from any country for all arrival modes must be accompanied by a phytosanitary certificate with the additional declaration: *'Representative samples were inspected and found free from evidence of any species of Trogoderma (whether live, dead or exuviae) in Australia's list of Trogoderma species of biosecurity concern'.*

	If other-risk plant products are packed into a sea container with high-risk plant products in a khapra beetle-risk country, all goods may be treated and certified using an approved option for high-risk plant products. If the products will be packed into an FCL/FXL in a target-risk khapra beetle country and will be unpacked in a rural khapra beetle risk area of Australia, the sea container will need to be treated.
26 April 2022	Australia informed trading partners (G/SPS/N/AUS/502/Add.17) that other-risk plant products and seeds for sowing from any country must be: • inspected offshore by a government official of exporting country; and • certified as being free from any listed species of *Trogoderma* (whether live, dead or exuviae) in Australia's list of *Trogoderma* species of biosecurity concern.
8 July 2022	Australia notified trading partners (G/SPS/N/AUS/502/Add.18) of the commencement of a pest risk analysis (PRA) for khapra beetle. The PRA will assess the risks posed by khapra beetle through various import pathways, evaluate the efficacy of existing measures, and determine scientifically justified ongoing phytosanitary measures. Australia invited trading partners to provide information, with supporting evidence, on the status of khapra beetle in their countries to support the PRA process. Information and supporting evidence on pest status should be consistent with *ISPM 8: Determination of pest status in an area.*
7 April 2025	Australia notified trading partners (G/SPS/N/AUS/502/Add.19) of changes to its emergency measures for khapra beetle, effective from 28 May 2025. These changes revised the pre-border treatment and phytosanitary certification requirements for high-risk plant products and certain Full Container Load (FCL) or Full Container Consolidated (FCX) sea containers packed in and exported from khapra beetle target-risk countries. The changes include: • Revised phytosanitary certificate declarations for gas permeability, requiring the statement "The goods were fumigated/treated in gas permeable packaging" or "The goods were fumigated/treated prior to being sealed in gas impermeable packaging" for methyl bromide fumigation or controlled atmosphere treatments. • Mandatory supervision by the exporting country's National Plant Protection Organisation (NPPO) for treatments by providers on Australia's registered list as Suspended, Under Review, or Withdrawn, or unregistered providers listed as Unacceptable or Under Review (unregistered), with a new declaration confirming NPPO oversight • Removal of the fourth concentration sampling tube requirement for methyl bromide fumigation of sea containers, aligning with standard practices stipulated in Australia's methyl bromide fumigation methodology, requiring a minimum of three tube. A transitional period will be provided to facilitate compliance, during which treatments meeting the previous requirements will be accepted. The end dates for

	this transitional period will be published on the department's webpage. Failure to comply with the updated requirements after the transitional period may result in export or destruction of goods and/or sea containers upon arrival in Australia.
13 May 2025	Australia re-notified trading partners (G/SPS/N/AUS/502/Add.20) of the changes notified in Addendum 19, concerning upcoming changes to requirements for pre-border khapra beetle treatments and phytosanitary certification. Australia also invited trading partners to attend a virtual information session held on 15 May 2025, to outline the key changes, expected impacts and compliance requirements.
4 Aug 2025	Australia notified trading partners of the amendment to Australia's list of Trogoderma species of biosecurity concern (G/SPS/N/AUS/502/Add.21). Three species have been added to the list: *Trogoderma serraticorne*, *Trogoderma teukton* and *Trogoderma yunnaeunsis*.
26 Aug 2025	Australia notified trading partners (G/SPS/N/AUS/502/Add.22) that the PRA will now be conducted in two parts: Part 1 will focus on the plant product pathway, and Part 2 on the sea container pathway. This does not alter the overall purpose or scope of the PRA. The objective remains to assess the biosecurity risks posed by khapra beetle, to evaluate the current emergency measures and to recommend effective and appropriate ongoing phytosanitary measures. Existing emergency measures will stay in place until the PRA is finalised, and any recommended ongoing phytosanitary measures are implemented. Australia adopts this 2-part approach because: • The biosecurity risks and emergency measures differ between the two pathways; • Risk assessments, evaluation of existing emergency measures, and proposed ongoing risk management need to be conducted separately for each pathway; and • Australia and the International Plant Protection Convention have several initiatives underway targeting sea container biosecurity risks, which will influence the analysis for that pathway.

Glossary, acronyms, and abbreviations

Term or abbreviation	Definition
Additional declaration	A statement that is required by an importing country to be entered on a phytosanitary certificate and which provides specific additional information on a consignment in relation to regulated pests or regulated articles (FAO 2024).
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).
APHIS	Animal and Plant Health Inspection Services
Appropriate level of protection (ALOP) for Australia	The *Biosecurity Act 2015* defines the appropriate level of protection (or ALOP) for Australia as a high level of sanitary and phytosanitary protection aimed at reducing biosecurity risks to very low, but not to zero.
Australian territory	Australian territory as referenced in the *Biosecurity Act 2015* refers to Australia, Christmas Island and Cocos (Keeling) Islands and any external Territory to which that provision extends.
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 risk	The *Biosecurity Act 2015* refers to biosecurity risk as the likelihood of a disease or pest entering, establishing, or spreading in Australian territory, and the potential for the disease or pest causing harm to human, animal or plant health, the environment, economic or community activities.
Consignment	A quantity of plants, plant products or other articles being moved from one country to another and covered, when required, by a single phytosanitary certificate (a consignment may be composed of one or more commodities or lots) (FAO 2024).
Control (of a pest)	Suppression, containment, or eradication of a pest population (FAO 2024).
(the) department	The Australian Government Department of Agriculture, Fisheries and Forestry
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 2024).
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO 2024).
FAO	Food and Agriculture Organization of the United Nations
Freight mode of arrival	(for the purpose of this PRA) Mode of arrival of goods into Australia as high value freight or low value freight (air or sea), except for arrival as unaccompanied personal effects
Fresh	Living; not dried, deep-frozen or otherwise conserved (FAO 2024).
Fumigant	A gaseous chemical that easily diffuses and disperses in air and is toxic to the target organism.
Fumigation	A method of pest control that completely fills an area with gaseous pesticides to suffocate or poison the pests within.
Genus	A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature the genus name is used, either alone or followed by a Latin adjective or epithet, to form the name of a species.
Goods	The *Biosecurity Act 2015* defines goods as an animal, a plant (whether moveable or not), a sample or specimen of a disease agent, a pest, mail or any other article, substance, or thing (including, but not limited to, any kind of moveable property).

Term or abbreviation	Definition
High-risk plant product	(for the purpose of this PRA) Plant products known to be main hosts, good hosts or preferred hosts for khapra beetle and/or plant product hosts on which the beetle has been intercepted on multiple occasions in international trade
High-value freight	(for the purpose of this PRA) Goods valued above $1,000, arriving in Australia via air or sea freight
Host	An organism that harbours a parasite, mutual partner, or commensal partner, typically providing nourishment and shelter.
Import permit	Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2024).
Infestation (of a commodity)	Presence in a commodity of a living pest of the plant or plant product concerned. Infestation includes infection (FAO 2024).
Inspection	Official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (FAO 2024).
Intended use	Declared purpose for which plants, plant products, or other regulated articles are imported, produced, or used (FAO 2024).
Interception (of a pest)	The detection of a pest during inspection or testing of an imported consignment (FAO 2024).
International Plant Protection Convention (IPPC)	The IPPC is an international plant health agreement, established in 1952, that aims to protect cultivated and wild plants by preventing the introduction and spread of pests. The IPPC provides an international framework for plant protection that includes developing International Standards for Phytosanitary Measures (ISPMs) for safeguarding plant resources.
International Standard for Phytosanitary Measures (ISPM)	An international standard adopted by the Conference of the Food and Agriculture Organization, the Interim Commission on Phytosanitary Measures, or the Commission on Phytosanitary Measures, established under the IPPC (FAO 2024).
International trade	(for the purpose of this PRA) Movement of goods across international border, via all modes of arrival and either for commercial use or non-commercial use
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO 2024).
IPPC	International Plant Protection Convention
ISPMs	International Standard for Phytosanitary Measures
Larvae	A juvenile form of animal with indirect development, undergoing metamorphosis (for example, insects or amphibians).
Low-value freight	(for the purpose of this PRA) Goods valued at or below $1,000, arriving in Australia via air or sea freight
Methyl bromide	A colourless, odorless biocide used to fumigate a wide range of commodities
National Plant Protection Organization (NPPO)	Official service established by a government to discharge the functions specified by the IPPC (FAO 2024).
Non-freight mode of arrival	(for the purpose of this PRA) Mode of arrival of goods into Australia with passengers including crew (ship or aircraft) as accompanied or unaccompanied baggage, arrival as unaccompanied personal effects (air or sea), or arrival via international mail (air or sea)
NPPO	National Plant Protection Organization
Other-risk khapra beetle country	(for the purpose of this PRA) All countries other than ‘target-risk khapra beetle countries’
Other-risk plant product	(for the purpose of this PRA) All plant products that are hosts of khapra beetle other than high-risk plant products
Pathway	Any means that allows the entry or spread of a pest (FAO 2024).

Term or abbreviation	Definition
Pest	Any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products (FAO 2024).
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 2024).
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 2024).
Pest risk assessment (for quarantine pests)	Evaluation of the probability of the introduction and spread of a pest and of the magnitude of the associated potential economic consequences (FAO 2024).
Pest risk management (for quarantine pests)	Evaluation and selection of options to reduce the risk of introduction and spread of a pest (FAO 2024).
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 2024).
Phosphine	Flammable gas generated from either aluminium phosphide or magnesium phosphide and used to treat stored product commodities
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 2024).
Phytosanitary certification	Use of phytosanitary procedures leading to the issue of a phytosanitary certificate (FAO 2024).
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 2024). In this risk analysis the term 'phytosanitary measure' and 'risk management measure' may be used interchangeably.
Phytosanitary procedure	Any official method for implementing phytosanitary measures including the performance of inspections, tests, surveillance, or treatments in connection with regulated pests (FAO 2024).
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 2024).
PRA	Pest risk analysis
PRA area	Area in relation to which a pest risk analysis is conducted (FAO 2024).
Quarantine	Official confinement of regulated articles, pests or beneficial organisms for inspection, testing, treatment, observation, or research (FAO 2024).
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 2024).
Regulated pest	A quarantine pest or a regulated non-quarantine pest (FAO 2024).
Restricted risk	Restricted risk is the risk estimate when risk management measures are applied.
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.
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO 2024).
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 which collects and records data on pest presence or absence by survey, monitoring, or other procedures (FAO 2024).
Target-risk khapra beetle country	(for the purpose of this PRA) Countries where khapra beetle is assessed as being present
Treatment (as a phytosanitary measure)	Official procedure for killing, inactivating, removing, rendering infertile or devitalising regulated pests (FAO 2024).
US-CBP	United States Customs and Border Protection
USDA	United States Department of Agriculture
Viable	Alive, able to germinate or capable of growth and/or development.
WTO	World Trade Organization
WTO-SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures

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