Australian Government
Department of Agriculture, Fisheries and Forestry

# Draft risk analysis report for the release of *Puccinia lantanae* for the biological control of *Lantana camara*

February 2026

**Cataloguing data**

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**Acknowledgement of Country**

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

**Stakeholder submissions on draft reports**

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

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

Front cover picture

Lantana blister rust » Manaaki Whenua

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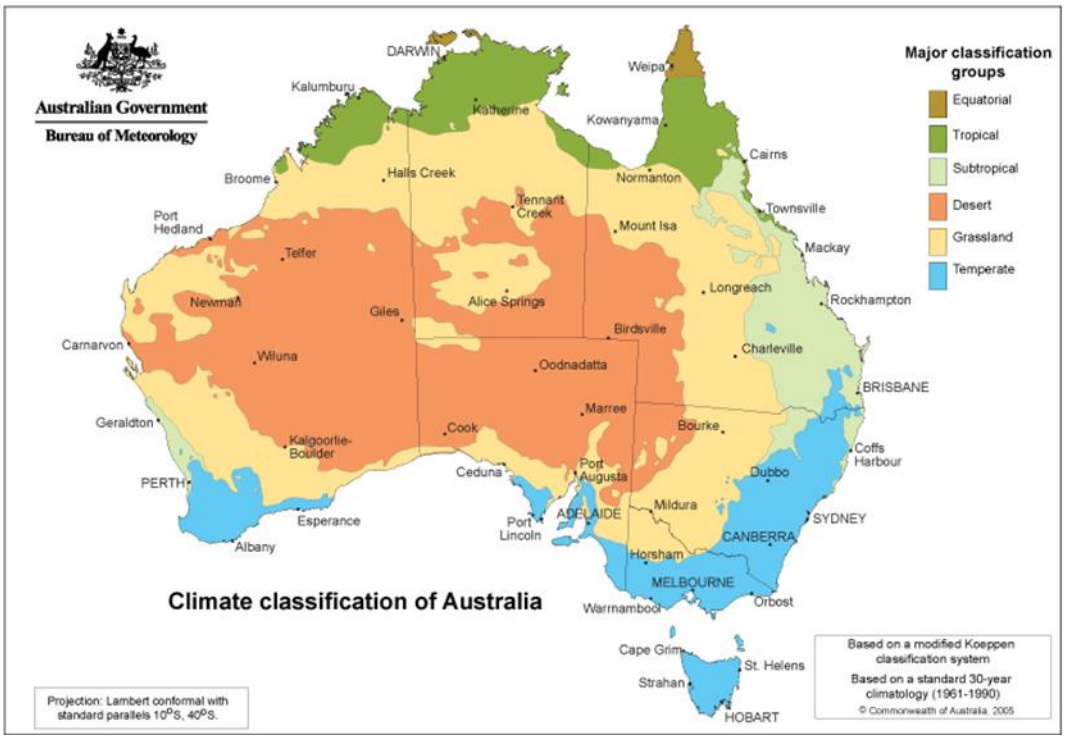


# Summary

The Australian Government Department of Agriculture, Fisheries and Forestry (the department) has prepared this draft report to assess the proposal by the Queensland Department of Primary Industries (QDPI) to release *Puccinia lantanae* for the biological control of *Lantana camara* in Australia.

This draft report proposes that the release of *P. lantanae* should be permitted, subject to standard biosecurity requirements associated with the import and release of exotic biological control agents.

This draft report has determined the overall risk associated with the release of *P. lantanae* to be Negligible. A risk estimate of Negligible achieves Australia's appropriate level of protection (ALOP).

The assessment of risk to non-target plants included consideration of the testing methodology used and the plant species test list, including non-target species tested in described experiments. The biology of *P. lantanae* was also considered.

*Puccinia lantanae* has been satisfactorily demonstrated to be host specific to *L. camara*. There may be some minor off-target disease symptoms expressed on *V. gaudichaudii* and *V. africana*, however it is not anticipated that any infection will cause plant mortality.

This draft report also contains details of the risk assessment process used for consideration of potential off-target effects associated with the proposed release of *P. lantanae*.

The application from QDPI that was provided to the department has been included with this draft report (Attachment 1).

# 1 Introduction

## 1.1 Australia's biosecurity policy framework

Australia's biosecurity policies aim to protect Australia against the risks that may arise from exotic pests entering, establishing and spreading in Australia, thereby threatening Australia's unique flora and fauna, as well as Australia's agricultural industries that are relatively free from serious pests.

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

Successive Australian Governments have maintained a stringent, but not a zero risk, approach to the management of biosecurity risks. This approach is expressed in terms of the ALOP for Australia, which is defined in the *Biosecurity Act 2015* as providing a high level of protection aimed at reducing risk to a very low level, but not to zero.

Australia's risk analyses are undertaken by the department using technical and scientific experts in relevant fields and involve consultation with stakeholders at various stages during the process.

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

Further information about Australia's biosecurity framework is provided in the *Biosecurity Import Risk Analysis Guidelines 2016* located on the department's website at agriculture.gov.au/biosecurity-trade/policy/risk-analysis/guidelines.

# 2 This risk analysis

## 2.1 Background

An application has been submitted by QDPI to release a biological control agent (Attachment 1). The identified biological control agent, *P. lantanae* is a leaf rust pathogen proposed for the biological control of *L. camara* (lantana). The applicant has followed the steps outlined in the Biosecurity Guidelines for the Introduction of Exotic Biological Control Agents for the Control of Weeds and Plant Pests.

*Lantana camara* is a thicket forming perennial shrub that is native to Mexico, Central America, the West Indies, and the northern parts of South America. *Lantana camara* L. *sensu lato* includes the neotropical species, in addition to the hundreds of cultivars and hybrids derived from interbreeding with other *Lantana* species (Attachment 1). The cultivars and hybrids can be distinguished in various ways, including by morphology, physiology and genetics (Attachment 1).

In Australia, lantana is present in NSW, NT, QLD, VIC and WA. It is most widely established as infestations across extensive areas of coastal and subcoastal eastern Australia.

Lantana is a Weed of National Significance (WONS) and is a difficult and costly to control weed of agriculture, livestock, plantation timber and orchards (Attachment 1). It is also a significant environmental weed, posing a threat to natural ecosystems by outcompeting native plant species (Attachment 1). Current control is mostly via mechanical removal, herbicide application and biological control. There is a long history of biological control of lantana in Australia, with 31 insects and one pathogen released with varying success rates (Attachment 1).

*Puccinia lantanae* is a leaf rust pathogen, native to tropical and subtropical regions of the Americas, parts of Africa and Asia. The pathotype (IMI 398849) proposed for release in Australia was discovered and collected from Peru (Attachment 1). Pathotype IMI 398849 has been observed to heavily infect lantana in Peru, the disease expression observed for this pathotype is considered to be much more severe than previously observed symptoms for the species.

*Puccinia lantanae* is an autoecious rust pathogen and is classified as microcyclic. Only two types of spores are produced, basidiospores and teliospores (Attachment 1). The pathotype proposed for release is highly damaging to lantana plants, infecting leaves, petioles and stems, resulting in cankers and stem die-back (Attachment 1).

The pathotype proposed for release will be the same isolate (IMI 398849) used for host specificity testing.

## 2.2 Scope

The scope of this risk analysis is to consider the biosecurity risk that may be associated with the release of an exotic biological control agent into the Australian environment (excluding its external territories). The primary risk associated with a release of this nature is the possibility of unwanted off-target effects on other species already present in Australia. The department assesses the risk under the *Biosecurity Act 2015*.

Plants that are considered weeds are sometimes also considered to have value, for example, for purposes such as ornamental display, traditional medicine, feed for stock, etc. Considerations of the benefits, and therefore any associated concerns about eradication of the target weed species are out of the scope of this analysis.

The department will not commence an assessment to release a biological control agent unless the target has been approved by an appropriate government body. Lantana biological control programs have been operating since 1914, pre-existing the current approval processes. Therefore *L. camara* is considered to be an approved target for biological control.

## 2.3 Associated pests

There are pests that may arrive with an imported exotic biological control agent. Section 9 of the *Biosecurity Act 2015* defines a pest as 'a species, strain or biotype of plant or animal, or a disease agent, that has the potential to cause, either directly or indirectly, harm to: human, animal or plant health; or the environment.' These pests may include, for example, parasitoids, mites or fungi. Should an application to release a biological control agent be approved, these pests will be addressed by existing operational procedures that apply to the importation and final release of the agent. These procedures include detailed examination of imported material, confirmation of identity, and breeding under containment conditions before release. For this reason, associated pests are not further considered in this risk analysis.

## 2.4 Consultation

In September 2025, a preliminary draft of this report was distributed to state and territory departments of primary industry via the Plant Health Committee and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). There were no objections to the proposed recommendation to release *P. lantanae* for the biological control of the weed lantana (*Lantana camara*).

## 2.5 Next Steps

This draft report gives stakeholders the opportunity to comment and 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 informally with stakeholders. The department will revise the draft report as appropriate. The department will then prepare a final report, taking into account stakeholder comments.

The final report will be published on the department's website with a notice advising stakeholders of the release. The department will also notify the applicant and registered stakeholders about the release of the final report. Publication of the final report represents the end of the risk analysis process. If the department approves release of the biological control agent, a letter will be sent to the applicant providing conditions of release.

# 3 Assessment of off-target risks

This section sets out the assessment of off-target risks that could be associated with the release of the biological control agent. Where appropriate, the methods followed those used for pest risk analysis (PRA) by the department which are consistent with the International Standards for Phytosanitary Measures (ISPMs), including ISPM 2: *Framework for pest risk analysis* (FAO 2019a), ISPM 3: *Guidelines for the export, shipment, import and release of biological control agents and other beneficial organisms* (FAO 2017) and ISPM 11: *Pest risk analysis for quarantine pests* (FAO 2019b) and the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement) (WTO 1995). The methodology for a commodity-based PRA is provided in Appendix A.

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 2.1, marked 'very low risk', represents the upper boundary of the ALOP for Australia.

The risk associated with the release of a biological control agent is a combination of the estimates of likelihood of off-target effects and the potential consequences of any off-target effects. A risk estimation matrix (Table 2.1) is used to combine these estimates.

**Table 2.1 Risk estimation matrix.**

| Likelihood of off-target effects | Consequences of off-target effects | | | | | |
|---|---|---|---|---|---|---|
| | 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 |

## 3.1 Stage 1: Initiation

Initiation commences when an applicant provides a submission proposing the release of a biological control agent. The department will not commence an assessment to release a biological control agent unless the target pest in the submission has been approved as a biological control target by an appropriate government body.

The risk analysis area is defined as all of Australia (excluding its external territories), given that once released there will be no control of spread of the agent other than environmental constraints related to the biology of the organism.

## 3.2 Stage 2: Risk assessment

This assessment evaluates the likelihood of off-target effects and the potential economic and environmental consequences of any such effects.

The risk assessment is based primarily on consideration of the information provided by the applicant in the application package, including the results of host specificity testing, and current information in the scientific literature, where this is available. Given that the proposal is for deliberate release, the likelihood of entry, establishment and spread is assumed to be certain, and therefore the assessment relates to the host specificity of the proposed agent.

A likelihood is assigned to the estimate of occurrence of off-target effects. Six descriptors are used: high; moderate; low; very low; extremely low; and negligible. Definitions for these descriptors and their indicative ranges are given in Appendix A, Table A.1.

### 3.2.1 Host specificity testing methodology

The following information regarding host specificity testing has been sourced from the application provided by QDPI (Attachment 1). For further details please refer to the application and its appendices. The methodology is also fully described in Thomas et al (2021).

In order to predict whether any non-target species would be at risk from the candidate agent, host specificity testing was conducted with *P. lantanae* under contained conditions at CABI in the UK. Host specificity testing was carried out on 55 non-target plant species. A total of 24 species were tested from the Verbenaceae family, to which the target weed belongs and 31 species were tested from 14 other families within the order Lamiales.

The host test list was compiled using the phylogenetic centrifugal approach, placing greater emphasis on closely related species to the target weed (Briese 2005). Within this framework representatives were chosen from native, ornamental, naturalised and weedy species.

*Lantana camara* plants used as control plants for host specificity testing were the “Brisbane common pink” variety. Non-target plant species were obtained as seeds or stem cuttings from the Queensland Government, Manaaki Whenua Landcare Research (New Zealand), Agricultural Research Council Plant Protection Research Institute (South Africa) or nurseries in the UK.

*Host specificity tests*

As described in the application (Attachment 1), the purified isolate (IMI 398849) of *P. lantanae* used in all host specificity testing was originally collected from a site in Tamshiyacu, Peru.

Where possible, each test run included four replicate plants. There were two test runs. The target total number of replicates was six for each species, however some plant species had less replicates due to a limited number of available plants. A positive control, using *L. camara* ‘Brisbane common pink’, was included in each test run.

All test plants (including controls) were inoculated in a dew chamber held at 20°C for 48 hours. After 48 hours the inoculum was inspected in order to evaluate the level of sporulation and test plants were also examined to ensure that they were correctly positioned under the inoculum. If during this initial inspection no sporulation of the inoculum had occurred or plants were discovered to be

incorrectly positioned and no symptoms were observed after six weeks, these plants were excluded from the analysis.

Two inoculation methods were used for testing: a qualitative and a quantitative method. The qualitative method was used for all test plants, whereby a large amount of inoculum at differing concentrations was used. The quantitative method was only used for *Verbena africana* and *V. gaudichaudii* and used a more precise dose. Two similar but slightly different quantitative methods were used for the two plant species assessed using this method.

**Qualitative method**

Inoculum containing dense teliospores measuring at least 5 mm² was used to challenge test plants, with multiple pieces of inoculum (minimum of 3) used per plant. Inoculum was either directly placed onto new shoot tips and secured with petroleum jelly or suspended within 1 cm of the meristem. This method ensured basidiospores would be released from the teliospores directly onto susceptible plant parts. In addition, leaves (1-5) with at least 10 x 5 mm² telia were also suspended approximately 10 cm above test plants on a wire rack.

All plants that expressed symptoms due to the challenge from the rust, but showed no telial development, were retained for further observation until leaf senescence. This ensured no latent infection was present.

Where telia did develop on test plant species, the teliospores were used to attempt infection of different plants of the same species as well as susceptible *L. camara* biotypes.

A microscopic analysis, using a leaf clearing technique, was also used to monitor the interaction between the rust and test plant species on which minor symptoms occurred.

**Quantitative method – *Verbena africana***

Test plants were inoculated at four different inoculum concentrations, approximately doubling in number of telia for each concentration used. The diameters of telia for each concentration used were added together, totalling 20 (approximately four telia), 40, 80 and 160 mm (Thomas et al 2021). Each concentration was suspended over individual test plants using the method outlined above. Four replicate plants with a minimum of four young shoots were used and the experiment was repeated twice, resulting in eight different plants tested in total. Numbers of telia were recorded after 40 days.

**Quantitative method – *Verbena gaudichaudii***

The method used was similar to the above quantitative method used for *V. africana*. Four different concentrations were used, however infected 'Brisbane common pink' *L. camara* leaves with known amounts of telia (10, 16, 32 and 80) were used instead of pieces of inoculum. Leaves were suspended above test plants as described above in the qualitative method. Four replicate plants with a minimum of four young shoots were used and the experiment was repeated twice, resulting in eight different plants tested in total. Numbers of telia were recorded after 40 days.

A qualitative scoring system was used to assess the susceptibility of all non-target plant species to *P. lantanae*. Each test plant species was classified using a rating scale (Table 5, Attachment 1). Each

plant species was classified as either: Immune, Resistant, Weakly susceptible, Moderately susceptible or Fully susceptible.

### 3.2.2 Host specificity testing results

During host specificity testing only 'Brisbane common pink' *L. camara* control plants were demonstrated to be fully susceptible to *P. lantanae* pathotype IMI 398849, using the plant response categories outlined in Table 5, Attachment 1. Other lantana flower colour morphotypes tested in additional testing ranged from fully susceptible to resistant (refer to Appendix 1, Attachment 1 for further information).

No non-target plant species were found to be fully susceptible to *P. lantanae*. The majority of non-target plants tested were classified as immune using the rating scale, including all plant species tested outside the Verbenaceae family. Within the Verbenaceae family, four plant species were classified as resistant and a further four were found to range from weakly susceptible to moderately susceptible.

Non-target plant species classified as resistant were, *Citharexylum spinosum*, *Priva meyeri*, *Lantana rugosa* and *Phyla nodiflora*. Microscopic observations of *C. spinosum* revealed no internal development inside the leaf, despite attempted penetration.

*Phyla nodiflora* var. *minor* (syn. *P. canescens*) and *Lippia alba* were both classified as weakly susceptible. For both species, a few telia developed and were observed in lesions on the lower leaf surface. Teliospores produced by both species used to inoculate other plants of the same species did not result in infection, however infection of the control (*L. camara* 'Brisbane common pink') was achieved.

Testing of susceptibility of *Verbena africana* and *V. gaudichaudii* produced variable results, with plants of both species ranging from being resistant to moderately susceptible.

*Verbena africana* showed an atypical response on plants sourced from central Queensland, resulting in a suspected systemic infection, as opposed to the typical leaf infection caused by *P. lantanae*. The variability in reactions of plants of this species were attributed to significant genetic variation between and within populations. Teliospores that developed on *V. africana* plants were viable and infection of *L. camara* plants was achieved, however attempts to infect new *V. africana* plants were unsuccessful.

Similar to *V. africana*, some *V. gaudichaudii* test plant species also developed suspected systemic infections. However, teliospores that developed on *V. gaudichaudii* were unable to infect either *L. camara* or new *V. gaudichaudii* plants.

Due to the variable responses for both *V. africana* and *V. gaudichaudii*, further testing using a quantitative approach was carried out on both species to investigate.

Further testing on *V. africana* demonstrated that the concentration of rust inoculum has a significant effect on the number of telia that develop. The minimum dose of inoculum required for infection was a total diameter of 40 mm. However, increasing amounts of inoculum did not result in a linear relationship, as the concentrations of 40 mm and 160 mm produced the most infection, with a dose of 80 mm inducing lower levels of infection.

Further testing on *V. gaudichaudii* demonstrated that there was generally an increase in infection as inoculum dose was increased. Some variability in results was noted however. A moderate to high dose of inoculum was required to induce infection. Despite some high levels of infection being recorded on individual plants during testing, none of the plants died, and in all cases outgrew the infection and recovered. Telia produced on *V. gaudichaudii* were viable and infection of susceptible *L. camara* plants was achieved, however attempts to infect new *V. gaudichaudii* plants were unsuccessful.

### 3.2.3 Comments on host specificity testing

A total of 55 non-target plant species were tested during host specificity testing, including 24 species from the Verbenaceae family. Representatives were tested from the Lantaneae tribe, to which the target weed belongs, including species from *Lantana* genus, *Aloysia* genus, *Stachytarpheta* genus, *Lippia* genus and *Phyla* genus. Representative species from other closely related tribes within the Verbenaceae family were also tested, including species from the Verbeneae, Citharexyleae and Priveae tribes. The host test list includes a selection of native, ornamental, naturalised and weedy representative species from the most closely related plant taxa to the target species in Australia. By testing these closely related non-target plant species using the methodology described above, in the application (Attachment 1) and Thomas et al. (2021), the applicant is considered to have satisfactorily assessed the likelihood of off-target effects occurring in the Australian environment.

The results of host specificity testing experiments indicate that only the target weed, *L. camara* is fully susceptible to *P. lantanae* pathotype IMI 398849. Although some non-target species were able to be infected during testing, only low numbers of viable teliospores were produced and these were unable to cause infection via re-inoculation on the same species. The *V. gaudichaudii* non-target plants displaying the highest levels of infection were still able to fully recover and outgrow the infection.

Based on host specificity testing results, it is possible that *V. africana* and *V. gaudichaudii* plants growing in close proximity to *L. camara* plants infected with *P. lantanae* may develop some symptoms of infection. However, it is not anticipated that infection will cause plant mortality. Information provided in Attachment 1 also indicates that the more inland distribution of *V. africana* and *V. gaudichaudii* has limited overlap with the primarily coastal/subcoastal distribution of *L. camara* in Australia. In addition, *P. lantanae* is less likely to establish in more inland, elevated areas, as these are not very suitable for the pathogen.

### 3.2.4 Likelihood of off-target effects

The likelihood of off-target effects is estimated on the basis of the outcomes of host specificity testing and other relevant information presented in the application (Attachment 1).

It is anticipated that *L. camara* will be the only plant species that is able to support the complete lifecycle of *P. lantanae* in the Australian environment. It is possible that there may be some localised off-target impacts on *V. africana* and *V. gaudichaudii* where these species are in close contact with the pathogen, however due to the limited overlap of *L. camara* with these species this is not expected to be a common occurrence.

On the basis of the results of host specificity testing reported in this application it is concluded that the likelihood of occurrence of off-target effects in Australia is **Low**.

### 3.2.5 Assessment of potential consequences of off-target effects

The potential consequences of the off-target effects of this biological control agent have been assessed using the same methodology (Appendix A) as used in the import risk analysis process for pests associated with imported fresh produce.

| Criterion | Estimate and rationale |
|---|---|
| **Direct** | |
| Plant life or health | B—Minor significance at the local level<br>Under field conditions it is expected that *P. lantanae* will only complete its lifecycle on *L. camara*. It is anticipated that there may be some off-target impacts on *V. africana* and *V. gaudichaudii* where there is overlap in host range with infected *L. camara*. While some off-target impacts may affect individual plants of these species, it is not expected that plant death will occur and plants affected are likely to outgrow any infection. It is also not expected that either plant species will be able to support the full lifecycle of *P. lantanae*. |
| Other aspects of the environment | A— Indiscernible<br>There is no evidence that the introduction of *P. lantanae* would have any negative effects on any other aspects of the environment.<br>The introduction of *P. lantanae* into the environment has the potential to provide control of lantana, which is likely to have beneficial effects. Lantana is a significant environmental weed. |
| **Indirect** | |
| Eradication, control | A— Indiscernible<br>*Puccinia lantanae* is a biological control agent proposed for the biological control of *L. camara*. There are minimal off-target impacts expected which are unlikely to result in environmental or economic consequences. Therefore, the need for eradication and/or control is not anticipated. |
| Domestic trade | A—Indiscernible<br>*Puccinia lantanae* is a biological control agent proposed for the biological control of *L. camara*, a weed of agricultural and environmental importance. Host specificity testing results indicate that the pathogen is unable to complete its lifecycle on any non-target plant species. Therefore, domestic trade is unlikely to be affected. |
| International trade | A—Indiscernible<br>*Lantana camara* has no known economic benefit either in its native range or other areas where it is established. *Puccinia lantanae* is a biological control agent proposed for the biological control of *L. camara*, an agricultural and environmental weed. No off-target impacts are expected to occur on any plants of significance to international trade. |
| Environmental and non-commercial | A—Indiscernible<br>*Lantana camara* is an introduced weed in Australia. The reduction of this species in the environment is not anticipated to have any negative indirect environmental or non-commercial effects. |

Based on this assessment the potential consequences of off-target effects are assessed as: **Negligible**.

### 3.2.6 Off-target risk estimate

Unrestricted risk is the result of combining the likelihood of off-target effects with the outcome of potential consequences. Off-target effects and consequences are combined using the risk estimation matrix shown in Table 2.1.

| **Risk estimate for *Puccinia lantanae*** | |
|---|---|
| Likelihood of off-target effects | Low |
| Consequences | Negligible |
| Risk | Negligible |

As indicated, the risk estimate for release of *Puccinia lantanae* has been assessed as 'Negligible', which achieves the appropriate level of protection (ALOP) for Australia.

# 4 Draft recommendation on release

The overall risk estimate for release of *P. lantanae* has been assessed as Negligible, which achieves the ALOP for Australia. Therefore, it is proposed to recommend that this biological control agent be permitted to be released, subject to standard import and release conditions to ensure that the released material is free of other organisms.

This draft recommendation is made on the basis of the high level of host specificity demonstrated by *P. lantanae* on *L. camara* and is based on currently available information.

# 5 Attachment 1

'Application to release *Puccinia lantanae* Farl. (Pucciniales: Pucciniaceae) for the biological control of *Lantana camara* L. (Verbenaceae) in Australia'

# Appendix A: Method for pest risk analysis

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

A PRA is 'the process of evaluating biological or other scientific and economic evidence to determine whether an organism is a pest, whether it should be regulated, and the strength of any phytosanitary measures to be taken against it' (FAO 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 11 (FAO 2019b), the PRA process may be initiated as a result of:

- the identification of a pathway that presents a potential pest hazard. For example, international trade is requested for a commodity not previously imported into the country or a commodity from a new area or new country of origin

- the identification of a pest that may require phytosanitary measures. For example, a new pest risk is identified by scientific research, a pest is repeatedly intercepted, a request is made to import an organism, or an organism is identified as a vector of other pests
- the review or revision of a policy. For example, a country's decision is taken to review phytosanitary regulations, requirements or operations or a new treatment or loss of a treatment system, a new process, or new information impacts on an earlier decision.

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

The primary elements in the initiation stage are:

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

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

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

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

## A2 Stage 2: Pest risk assessment

The process for pest risk assessment includes 2 sequential steps:

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

### A2.1 Pest categorisation

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

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

assessed for pests that have potential to enter, establish and spread in the PRA area. Further pest risk assessments are then undertaken for pests that have potential to cause economic consequences, i.e., pests that meet the criteria for a quarantine pest.

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

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

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

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

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

### A2.2.1 Likelihood of entry

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

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

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

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

- likelihood of the pest being associated with the pathway at origin
  - prevalence of the pest in the source area
  - occurrence of the pest in a life-stage that would be associated with the commodity
  - mode of trade (for example, bulk, packed)
  - volume and frequency of movement along each pathway
  - seasonal timing of imports
  - pest management, cultural and commercial procedures applied at the place of origin (for example, application of plant protection products, handling, culling, and grading)

- likelihood of survival of the pest during transport or storage
  - speed and conditions of transport and duration and conditions of storage compared with the duration of the life cycle of the pest
  - vulnerability of the life-stages of the pest during transport or storage
  - prevalence of the pest likely to be associated with a consignment
  - commercial procedures (for example, refrigeration) applied to consignments during transport and storage in the country of origin, and during transport to Australia
- likelihood of pest surviving existing pest management procedures.

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

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

### A2.2.2 Likelihood of establishment

Establishment is defined as the 'perpetuation for the foreseeable future, of a pest within an area after entry' (FAO 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

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

**Table A.1 Nomenclature of likelihoods**

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

### A2.2.5 Combining likelihoods

The likelihood of entry is determined by combining the likelihood that the pest will be imported into the PRA area and the likelihood that the pest will be distributed within the PRA area, using a matrix of rules (Table A.2). This matrix is then used to combine the likelihood of entry and the likelihood of establishment, and the likelihood of entry and establishment is then combined with the likelihood of spread to determine the overall likelihood of entry, establishment and spread.

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

importation x distribution = entry [E] **Low x Moderate = Low**

entry x establishment = [EE] **Low x High = Low**

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

**Table A.2 Matrix of rules for combining likelihoods**

| | High | Moderate | Low | Very Low | Extremely Low | Negligible |
|---|---|---|---|---|---|---|
| High | High | Moderate | Low | Very Low | Extremely Low | Negligible |
| Moderate | – | Low | Low | Very Low | Extremely Low | Negligible |
| Low | – | – | Very Low | Very Low | Extremely Low | Negligible |
| Very Low | – | – | – | Extremely Low | Extremely Low | Negligible |
| Extremely Low | – | – | – | – | Negligible | Negligible |
| Negligible | – | – | – | – | – | Negligible |

**Time and volume of trade**

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

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

ecological facts, for example where a pest or disease may establish in the year of import but spread may take many years.

The use of a one year volume of trade has been taken into account when setting up the matrix that is used to estimate the risk and therefore any policy based on this analysis does not simply apply to one year of trade. Policy decisions that are based on the department's method that uses the estimated volume of one year's trade are consistent with Australia's policy on appropriate level of protection and meet the Australian Government's requirement for ongoing quarantine protection. If there are substantial changes in the volume and nature of the trade in specific commodities then the department will review the risk analysis and, if necessary, provide updated policy advice.

## A2.3 Assessment of potential consequences

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

**Step 1: Assessing direct and indirect impacts**

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

- the life or health of plants and plant products

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

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

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

- eradication and control

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

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

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

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

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

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

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

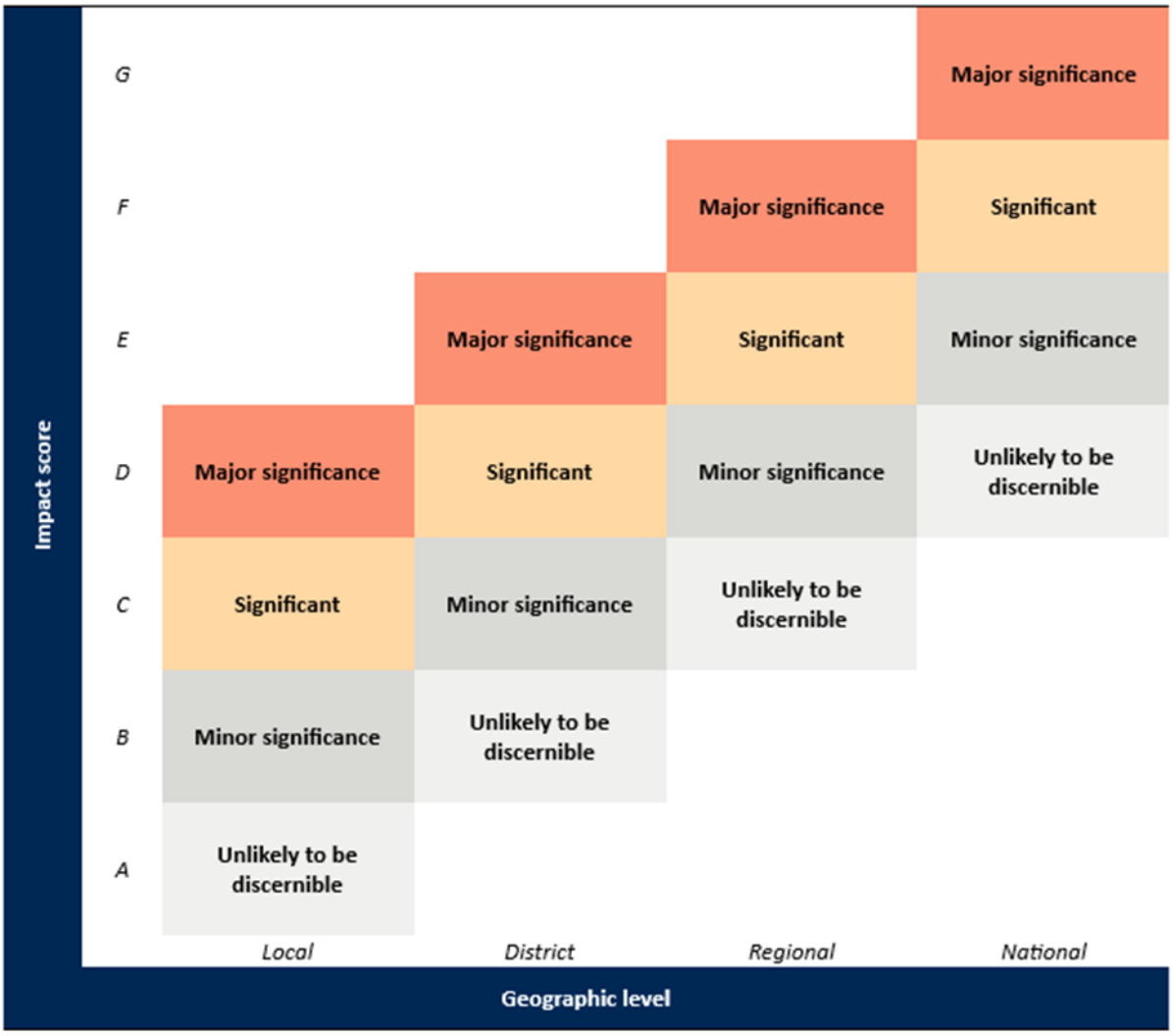
- **Unlikely to be discernible**–pest impact is not usually distinguishable from normal day-to-day variation in the criterion
- **Minor significance**–expected to lead to a minor increase in mortality/morbidity of hosts or a minor decrease in production but not expected to threaten the economic viability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

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

The following are considered during this process:

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

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




For each criterion:

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

**Step 2: Combining direct and indirect impacts**

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

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

| Rule | The impact scores for consequences of direct and indirect criteria | Overall consequence rating |
|---|---|---|
| 1 | Any criterion has an impact of 'G'; or<br>more than one criterion has an impact of 'F'; or<br>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<br>all criteria have an impact of 'E'. | High |
| 3 | One or more criteria have an impact of 'E'; or<br>all criteria have an impact of 'D'. | Moderate |
| 4 | One or more criteria have an impact of 'D'; or<br>all criteria have an impact of 'C'. | Low |
| 5 | One or more criteria have an impact of 'C'; or<br>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<br>all criteria have an impact of 'A'. | Negligible |

## A2.4 Estimation of the unrestricted risk

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

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

**Table A.4 Risk estimation matrix**

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

## A2.5 The appropriate level of protection (ALOP) for Australia

The SPS Agreement defines the concept of an 'appropriate level of sanitary or phytosanitary protection (ALOP)' as the level of protection deemed appropriate by the WTO Member establishing a

sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory.

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

### A2.6 Adoption of outcomes from previous assessments

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

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

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

### A2.7 Application of Group PRAs to this risk analysis

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

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

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

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

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

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

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

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

## A3 Stage 3: Pest risk management

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

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

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

Examples given of measures commonly applied to traded commodities include:

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

# Glossary, acronyms and abbreviations

| Term or abbreviation | Definition |
|---|---|
| ACT | Australian Capital Territory |
| Additional declaration | A statement that is required by an importing country to be entered on a phytosanitary certificate and which provides specific additional information on a consignment in relation to regulated pests or regulated articles (FAO 2024). |
| Appropriate level of protection (ALOP) | The level of protection deemed appropriate by the Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory (WTO 1995). |
| Appropriate level of protection (ALOP) for Australia | The *Biosecurity Act 2015* defines the appropriate level of protection (or ALOP) for Australia as a high level of sanitary and phytosanitary protection aimed at reducing biosecurity risks to very low, but not to zero. |
| Area | An officially defined country, part of a country or all or parts of several countries (FAO 2024). |
| Area of low pest prevalence | An area, whether all of a country, part of a country, or all parts of several countries, as identified by the competent authorities, in which a specific pest is present at low levels and which is subject to effective surveillance or control (FAO 2024). |
| Arthropod | The largest phylum of animals, including the insects, arachnids and crustaceans. |
| Asexual reproduction | The development of a new individual from a single cell or group of cells in the absence of meiosis. |
| Australian territory | Australian territory as referenced in the *Biosecurity Act 2015* refers to Australia, Christmas Island and Cocos (Keeling) Islands and any external Territory to which that provision extends. |
| BA | Biosecurity Advice |
| BICON | Australia's Biosecurity Import Conditions system<br>bicon.agriculture.gov.au/BiconWeb4.0 |
| Biological control agent | A natural enemy, antagonist or competitor, or other organism, used for pest control (FAO 2024). |
| Biosecurity | The prevention of the entry, establishment or spread of unwanted pests and infectious disease agents to protect human, animal or plant health or life, and the environment. |
| Biosecurity import risk analysis (BIRA) | The *Biosecurity Act 2015* defines a BIRA as an evaluation of the level of biosecurity risk associated with particular goods, or a particular class of goods, that may be imported, or proposed to be imported, into Australian territory, including, if necessary, the identification of conditions that must be met to manage the level of biosecurity risk associated with the goods, or the class of goods, to a level that achieves the ALOP for Australia. The risk analysis process is regulated under legislation. |
| Biosecurity measures | The *Biosecurity Act 2015* defines biosecurity measures as measures to manage any of the following: biosecurity risk, the risk of contagion of a listed human disease, the risk of listed human diseases entering, emerging, establishing themselves or spreading in Australian territory, and biosecurity emergencies and human biosecurity emergencies. |
| Biosecurity risk | The *Biosecurity Act 2015* refers to biosecurity risk as the likelihood of a disease or pest entering, establishing or spreading in Australian territory, and the potential for the disease or pest causing harm to human, animal or plant health, the environment, economic or community activities. |
| CABI | Centre for Agriculture and Bioscience International |
| Calyx | A collective term referring to all of the sepals in a flower. |

| Term or abbreviation | Definition |
|---|---|
| Consignment | A quantity of plants, plant products or other articles being moved from one country to another and covered, when required, by a single phytosanitary certificate (a consignment may be composed of one or more commodities or lots) (FAO 2024). |
| Control (of a pest) | Suppression, containment or eradication of a pest population (FAO 2024). |
| Crawler | Intermediate mobile nymph stage of certain arthropods. |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| Endangered area | An area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss (FAO 2024). |
| Endemic | Belonging to, native to, or prevalent in a particular geography, area or environment. |
| Entry (of a pest) | Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO 2024). |
| EP | Existing policy. This denotes that a pest species has previously been assessed in another policy published by the department. |
| Establishment (of a pest) | Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO 2024). |
| FAO | Food and Agriculture Organization of the United Nations |
| Fresh | Living; not dried, deep-frozen or otherwise conserved (FAO 2024). |
| FSANZ | Food Standards Australia New Zealand (foodstandards.gov.au/Pages/default.aspx) and the Australia New Zealand Food Standards Code (foodstandards.gov.au/code/Pages/default.aspx) |
| Fumigation | A method of pest control that completely fills an area with gaseous pesticides to suffocate or poison the pests within. |
| Genus | A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature the genus name is used, either alone or followed by a Latin adjective or epithet, to form the name of a species. |
| Goods | The *Biosecurity Act 2015* defines goods as an animal, a plant (whether moveable or not), a sample or specimen of a disease agent, a pest, mail or any other article, substance or thing (including, but not limited to, any kind of moveable property). |
| Host | An organism that harbours a parasite, mutual partner, or commensal partner, typically providing nourishment and shelter. |
| Host range | Species capable, under natural conditions, of sustaining a specific pest or other organism (FAO 2024). |
| Import permit | Official document authorising importation of a commodity in accordance with specified phytosanitary import requirements (FAO 2024). |
| Infection | The internal 'endophytic' colonisation of a plant, or plant organ, and is generally associated with the development of disease symptoms as the integrity of cells and/or biological processes are disrupted. |
| Infestation (of a commodity) | Presence in a commodity of a living pest of the plant or plant product concerned. Infestation includes infection (FAO 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 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). |

| Term or abbreviation | Definition |
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| 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). |
| Introduction (of a pest) | The entry of a pest resulting in its establishment (FAO 2024). |
| Larva | A juvenile form of animal with indirect development, undergoing metamorphosis (for example, insects or amphibians). |
| Lot | A number of units of a single commodity, identifiable by its homogeneity of composition, origin et cetera, forming part of a consignment (FAO 2024). Within this report a 'lot' refers to a quantity of fruit of a single variety, harvested from a single production site during a single pick and packed at one time. |
| Mature fruit | Commercial maturity is the start of the ripening process. The ripening process will then continue and provide a product that is acceptable to consumers. Maturity assessments include colour, starch, index, soluble solids content, flesh firmness, acidity, and ethylene production rate. |
| National Plant Protection Organization (NPPO) | Official service established by a government to discharge the functions specified by the IPPC (FAO 2024). |
| Non-target species | Also known as off-target species, these are species, either plant or invertebrate, that are not targeted by a biological control agent. |
| NSW | The state of New South Wales in Australia. |
| NT | The Northern Territory of Australia. |
| Nymph | The immature form of some insect species that undergoes incomplete metamorphosis. It is not to be confused with larva, as its overall form is already that of the adult. |
| Official control | The active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests (FAO 2024). |
| Off-target effects | The impact that a biological control agent has on a non-target species. |
| Parasitoid | An insect parasitic only in its immature stages, killing its host in the process of its development, and free living as an adult (FAO 2024). |
| Pathogen | A biological agent that can cause disease to its host. |
| Pathway | Any means that allows the entry or spread of a pest (FAO 2024). |
| 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 free area (PFA) | An area in which a specific pest is absent as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained (FAO 2024). |
| Pest free place of production (PFPP) | Place of production in which a specific pest is absent as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained for a defined period (FAO 2024). |

| Term or abbreviation | Definition |
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| Pest free production site (PFPS) | A production site in which a specific pest is absent, as demonstrated by scientific evidence, and in which, where appropriate, this condition is being officially maintained for a defined period (FAO 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 assessment (for regulated non-quarantine pests) | Evaluation of the probability that a pest in plants for planting affects the intended use of those plants with an economically unacceptable impact (FAO 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 risk management (for regulated non-quarantine pests) | Evaluation and selection of options to reduce the risk that a pest in plants for planting causes an economically unacceptable impact on the intended use of those plants (FAO 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). |
| 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). |
| Polyphagous | Feeding on a relatively large number of hosts from different plant family and/or genera. |
| PRA area | Area in relation to which a pest risk analysis is conducted (FAO 2024). |
| Qld | The state of Queensland in Australia. |
| Quarantine | Official confinement of regulated articles, pests or beneficial organisms for inspection, testing, treatment, observation or research (FAO 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 article (RA) | Any plant, plant product, storage place, packaging, conveyance, container, soil and any other organism, object or material capable of harbouring or spreading pests, deemed to require phytosanitary measures, particularly where international transportation is involved (FAO 2024). |
| Regulated non-quarantine pest | A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is |

| Term or abbreviation | Definition |
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| | therefore regulated within the territory of the importing contracting party (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 analysis | Refers to the technical or scientific process for assessing the level of biosecurity risk associated with the goods, or the class of goods, and if necessary, the identification of conditions that must be met to manage the level of biosecurity risk associated with the goods, or class of goods to a level that achieves the ALOP for Australia. |
| Risk management measure | Conditions that must be met to manage the level of biosecurity risk associated with the goods or the class of goods, to a level that achieves the ALOP for Australia. In this risk analysis, the term 'risk management measure' and 'phytosanitary measure' may be used interchangeably. |
| SA | The state of South Australia. |
| Saprophyte | An organism deriving its nourishment from dead organic matter. |
| Spread (of a pest) | Expansion of the geographical distribution of a pest within an area (FAO 2024). |
| SPS Agreement | WTO Agreement on the Application of Sanitary and Phytosanitary Measures. |
| Stakeholders | Government agencies, individuals, community or industry groups or organizations, whether in Australia or overseas, including the proponent/applicant for a specific proposal, who have an interest in the policy issues. |
| Surveillance | An official process which collects and records data on pest presence or absence by survey, monitoring or other procedures (FAO 2024). |
| Systems approach(es) | The integration of different risk management measures, at least 2 of which act independently, and which cumulatively achieve the appropriate level of protection against regulated pests. |
| Tas. | The state of Tasmania in Australia. |
| Trash | Soil, splinters, twigs, leaves and other plant material, other than fruit as defined in the scope of this risk analysis.<br>For example, stem and leaf material, seeds, soil, animal matter/parts or other extraneous material |
| Treatment (as a phytosanitary measure) | Official procedure for killing, inactivating, removing, rendering infertile or devitalising regulated pests (FAO 2024). |
| Unrestricted risk | Unrestricted risk estimates apply in the absence of risk management measures. |
| Vector | In this report, a vector is an organism that is capable of harbouring and spreading a pest from one host to another. |
| Viable | Alive, able to germinate or capable of growth and/or development. |
| Vic. | The state of Victoria in Australia. |
| WA | The state of Western Australia. |
| WTO | World Trade Organization |

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