BIOSECURITY PLAN FOR THE ONION INDUSTRY

October 2018, Version 3.1

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Endorsement

The *Biosecurity Plan for the Onion Industry* (Version 3.0) was formally endorsed by the Onion industry (through Onions Australia) in November 2017, and all state and territory governments (through the Plant Health Committee) in October 2018. The Australian Government endorses the document without prejudice for the purposes of industry's planning needs and meeting the Department's obligations under Clause 13 of the EPPRD. In providing this endorsement the Department notes page 61 of the Plan which states: "This Document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling). This is a broader view of potential risk than the IRA conducted by the Department of Agriculture, Water and the Environment which focus only on specific regulated import pathways."

Reporting suspect pests

Any unusual plant pest should be reported immediately to the relevant state/territory agriculture department through the Exotic Plant Pest Hotline (1800 084 881). Early reporting enhances the chance of effective control and eradication.

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List of acronyms

ACPPO	Australian Chief Plant Protection Office
APVMA	Australian Pesticides and Veterinary Medicines Authority
AS/NZS	Australian Standard/New Zealand Standard
BICON	Australian Biosecurity Import Conditions Database
BIG	Biosecurity Implementation Group
BP	Biosecurity Plan
BOLT	Biosecurity On-Line Training
CCEPP	Consultative Committee on Emergency Plant Pests
CPHM	State Chief Plant Health Manager
DAF Qld	Department of Agriculture and Fisheries, Queensland
DAWE	Department of Agriculture, Water and the Environment
DPI NSW	Department of Primary Industries, New South Wales
DJPR	Department of Jobs, Precincts and Regions, Victoria
DPIR NT	Department of Primary Industry and Resources, Northern Territory
DPIPWE	Department of Primary Industries, Parks, Water and Environment, Tasmania
DPIRD	Department of Primary Industries and Regional Development, WA
EPP	Emergency Plant Pest
EPPO	European and Mediterranean Plant Protection Organization
EPPRD	Emergency Plant Pest Response Deed
FAO	Food and Agriculture Organization of the United Nations
HACCP	Hazard Analysis Critical Control Point
HPP	High Priority Pest
ICA	Interstate Certification Assurance
IGAB	Intergovernmental Agreement on Biosecurity
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IRA	Import Risk Analysis
ISPM	International Standards for Phytosanitary Measures
MICoR	Manual of Importing Country Requirements
NAQS	Northern Australian Quarantine Strategy
NDP	National Diagnostic Protocol
NGIA	Nursery and Garden Industry Australia

NMG	National Management Group
NPBDN	National Plant Biosecurity Diagnostic Network
NPBRDE IC	National Plant Biosecurity Research, Development and Extension Strategy. Implementation Committee
NPBS	National Plant Biosecurity Strategy
NSW	New South Wales
NT	Northern Territory
ORC	Owner Reimbursement Costs
PaDIL	Pest and Disease Image Library
PHA	Plant Health Australia
PHC	Plant Health Committee
PIC	Property Identification Code
PIRSA	Primary Industries and Regions South Australia
QA	Quality Assurance
QLD	Queensland
RDC	Research and Development Corporation
RD&E	Research, Development and Extension
SA	South Australia
SARDI	South Australian Research and Development Institute
SDQMA	Sub-Committee for Domestic Quarantine and Market Access
SNPHS	Sub-Committee for Plant Health Surveillance
SPHD	Subcommittee on Plant Health Diagnostic
SPS	Sanitary and Phytosanitary
TEG	Technical Expert Group
TST	Threat Summary Table
Vic	Victoria
WA	Western Australia
WA DPIRD	Western Australia Department of Primary Industries and Regional Development
WTO	World Trade Organization

Definitions

The definition of a plant pest used in this document are insects, mites, snails, nematodes or pathogens (diseases) that have the potential to adversely affect food, fibre, ornamental crops,

bees and stored products, as well as environmental flora and fauna. Exotic pests are those not currently present in Australia. Endemic pests are those established within Australia.

EXECUTIVE SUMMARY

Executive Summary

To ensure its future viability and sustainability, it is important that the Australian onion industry, represented by Onions Australia as the peak industry body, minimises the risks posed by exotic pests and responds effectively to plant pest threats. This plan is a framework to coordinate biosecurity activities and investment for Australia's onion industry. It provides a mechanism for industry, governments and stakeholders to better prepare for and respond to, incursions of pests that could have significant impacts on the onion industry. It identifies and prioritises exotic plant pests (not currently present in Australia) and established pests of biosecurity concern, and focus on future biosecurity challenges.

The Biosecurity Plan for the Onion Industry was developed in consultation with the Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG), which consisted of plant health and biosecurity experts and industry representatives. These groups were coordinated by Plant Health Australia (PHA) and included representatives from Onions Australia, relevant state and territory agriculture agencies and PHA.

The development of Threat Summary Tables (TSTs), constituting a list of more than 113 exotic plant pests and the potential biosecurity threat that they represent to the Australian onion industry was key to the industry biosecurity planning process. Each pest on the list was given an overall risk rating based on four criteria; entry, establishment, spread potential, and economic impact. In this biosecurity plan, established pests of biosecurity significance for the onion industry were also identified (Table 2) as good biosecurity practice is beneficial for the ongoing management and surveillance for these pests.

The Biosecurity Plan for the Onion Industry also details current mitigation and surveillance activities being undertaken and identifies contingency plans, fact sheets and diagnostic protocols that have been developed for pests relevant to the onion industry (Table 5). This enables identification of gaps and prioritises specific actions, as listed in the Biosecurity Implementation Table (Table 4). The development of this table will increase the onion industry's biosecurity preparedness and response capability by outlining specific areas of action which could be undertaken through a government and industry partnership.

This biosecurity plan is principally designed for decision makers. It provides the onion industry and government with a mechanism to identify exotic plant pests as well as to address the strengths and weaknesses in relation to the onion industry's current biosecurity position. It is

envisaged that annual reviews of this BP will be undertaken with another formal review conducted in 5 years.

The biosecurity plan is a document outlining the commitment to the partnership between the onion industry and government to improve biosecurity for the onion industry and is supported by the industry biosecurity statement (Page 47).

SIGNIFICANT BIOSECURITY THREATS

Document overview

Biosecurity for the Australian onion industry focuses on five key areas to identify the components to be implemented through the life of the biosecurity plan 2017-2022. These five areas are outlined in the sections below.

High priority exotic pests, established pests and weeds of biosecurity significance

A key outcome of this biosecurity plan is the identification of the exotic high priority pests, established pests and weeds of biosecurity significance for the Australian onion industry (Page 18). This section includes:

- the High Priority Pests (HPPs), are the most significant exotic threats affecting the onion industry as identified through a prioritisation process.
- the established pests of biosecurity significance, which have been identified in consultation with industry
- the established weeds of biosecurity significance, as identified by industry and government.

The exotic HPP list, established pests and weeds of biosecurity significance will allow industry and government to better prioritise preparedness activities and will assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers, development of surveillance programs, diagnostic protocols as well as development of pest-specific mitigation activity.

Implementing biosecurity for the Australian Onion Industry 2017-2022

This section (Page 28) includes the biosecurity implementation plan and a gap analysis of the current level of preparedness for HPPs of the onion industry. The Biosecurity Implementation Group (BIG), comprised of both industry and government representatives, developed the implementation plan that sets out shared biosecurity goals and objectives over the next five years. It is intended that the biosecurity implementation plan is revisited by the Biosecurity Reference Panel regularly over the next five years to maintain its relevance.

Threat identification and pest risk assessments

Guidelines are provided for the identification and ranking of biosecurity threats through a process of qualitative risk assessment. The primary goal is to coordinate identification of exotic pest threats that could impact productivity, or marketability. This plan strengthens risk assessment work already being done both interstate and overseas. All exotic onion biosecurity threats considered in the biosecurity plan are detailed in threat summary tables (TST; Appendix 2). From the prioritisation process undertaken in the TST, pests with an overall high rating were identified as a HPP (Table 1) Established pests and weeds of biosecurity significance are also listed.

Risk mitigation and preparedness

This section provides a summary of activities to mitigate the impact of pest threats on the Australian onion industry, along with a set of guidelines for managing risk at all operational levels. Many pre-emptive practices can be adopted by plant industries and government agencies to reduce risks. The major themes covered include:

- Barrier quarantine
- Surveillance
- Training
- Awareness
- Farm biosecurity
- Reporting of suspect pests

A summary of pest-specific information and preparedness documents, such as fact sheets, contingency plans and diagnostic protocols are also described to outline activities industry has undertaken to prepare for an exotic pest incursion. Information for industry on how to align preparedness activities with R,D&E, such as researching IPM strategies, resistance breeding and chemical control is also provided.

Response management

Provides a summary of the processes in place to respond to Emergency Plant Pest (EPP)[1] incursions that would affect the Australian onion industry. Areas covered in this section include the Emergency Plant Pest Response Deed (EPPRD), PLANTPLAN (outlines the generic

[1] Refer to the PHA website for details of what an EPP is **http://www.planthealthaustralia.com.au/biosecurity/emergency-plant-pests/**

approach to response management under the EPPRD), categorisation of pests under the EPPRD, industry specific response procedures and industry communication.

Pests and Weeds of Biosecurity Significance Overview

A key component of this biosecurity plan is to identify the exotic and established pests and weeds of biosecurity significance to the Australian onion industry. This section provides information on the High Priority Pest list, the established pests of biosecurity significance and the established weeds of biosecurity significance to the onion industry. These pest lists, provide the Australian onion industry, governments and other stakeholders with the information needed to prioritise resources for biosecurity risk management.

Onion industry high priority exotic pests

Table 1 provides an overview of the top ranked threats to the onion industry for invertebrates, and pathogens and nematodes respectively. Further details on each pest along with the basis for the likelihood ratings are provided in the threat summary tables (Appendix 2). Assessments may change given more detailed research, and the priority list will be formally reviewed along with the Biosecurity Plan on an annual basis through the biosecurity reference panel. An explanation of the method used for calculating the overall risk can be found on the PHA website[2].

Table 1. *Onion industry high priority pest threat list*

Common name (Scientific name)	Host(s)	Affected plant part	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
INVERTEBRATES								
DIPTERA (Flies and midges)								
Onion fly *(Delia antiqua)*	Onion, shallot, Japanese bunching onion or Welsh onion, leek, garlic and chives	Bulb, foliage, roots, seedlings	Palearctic Asia, Americas, Europe	HIGH	MEDIUM	HIGH	HIGH	**HIGH**
Bean fly *(Delia florilega)*	Onion, leek, garlic, Brassicaceae, tomato, potato and corn	Bulbs, seedlings	North America, Western Europe and the Mediterranean region, Russia, Central and eastern Asia	HIGH	MEDIUM	HIGH	HIGH	**HIGH**

[2] Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

Common name (Scientific name)	Host(s)	Affected plant part	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Vegetable leafminer *(Liriomyza sativae)*	Polyphagous, wide range of vegetable and flower crops including eggplant, onion, beans, celery, peas, potato and tomato	Leaves	Much of Asia, Africa, and the Americas. Indonesia (Java), PNG, Vanuatu, Torres Strait (nominally part of Qld – Far northern biosecurity zone 1)	HIGH	HIGH	MEDIUM	HIGH	**HIGH**
THYSANOPTERA (Thrips)								
Onion thrips (*Thrips tabaci* (exotic strains/biotypes))	Wide host range including onion, garlic, leek, shallot, horseradish, daisy, cotton and cucurbits	Foliage, bulbs, flowers	Africa, Asia, Central and Southern America. Limited distribution in North America[3]	HIGH	HIGH	HIGH	HIGH	**HIGH**
PATHOGENS								
BACTERIA								
Xanthomonas leaf blight (*Xanthomonas axonopodis* pv. *allii*)	Onion, garlic, leek, chives, shallot and Welsh onion	Foliage	Americas, parts of Asia, Southern Africa.	HIGH	MEDIUM	HIGH	HIGH	**HIGH**
FUNGI								
Leaf rot and neck rot of onion (*Botrytis squamosa* (syn.*Sclerotinia squamosa*))	Onion, Japanese bunching onion, Welsh onion, leek and garlic	Foliage	Widespread distribution	HIGH	MEDIUM	HIGH	HIGH	**HIGH**
Leaf blotch (*Cladosporium allii* (syn. *Heterosporium allii)*)	Onion, shallot, chive, garlic and leek	Foliage	Parts of Europe and Northern America.	MEDIUM	HIGH	HIGH	HIGH	**HIGH**

[3] Onion thrips, including the biotypes which are exotic to Australia, have a wide global distribution.

Common name (Scientific name)	Host(s)	Affected plant part	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Rust of garlic and chives (*Puccinia allii* ("Koike's race"))[4]	*Allium* spp.	Foliage	USA	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**[5]
Rust of chives (*Puccinia mixta*)[6]	Chives	Foliage	Europe	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**[7]
Rust of leek (*Puccinia porri*)[8]	*Allium* spp. including leek, wild leek and spring onion	Foliage	Widespread, including New Zealand	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**[9]
Onion smut (*Urocystis cepulae)*	Onion, spring onion, leek and garlic	Whole plant	Every continent except Australia. (Eradicated from Australia October 2017)	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
NEMATODES								
Root knot nematode *(Meloidogyne enterolobii* (syn. *Meloidogyne mayaguensis))*	Polyphagous including herbaceous and woody plants. The principal hosts are bean, coffee, cotton, eggplant, guava, papaya, pepper, potato, soybean, sweetpotato, tobacco, tomato, watermelon[10]	Roots	Africa, Asia, Central and Southern America. Limited distribution in North America.	MEDIUM	HIGH	HIGH	HIGH	**HIGH**

[4] McTaggart, A.R., Shivas, R.G., Doungsa-ard, C. et al. Australasian Plant Pathol. (2016) 45: 581

[5] These ratings assume that the onion crop is not proximal to a garlic, spring onion or shallot crop. Proximity to these crops will considerably increase the risk of these rusts to onion crops.

[6] McTaggart, A.R., Shivas, R.G., Doungsa-ard, C. et al. Australasian Plant Pathol. (2016) 45: 581

[7] These ratings assume that the onion crop is not proximal to a garlic, spring onion or shallot crop. Proximity to these crops will considerably increase the risk of these rusts to onion crops.

[8] McTaggart, A.R., Shivas, R.G., Doungsa-ard, C. et al. Australasian Plant Pathol. (2016) 45: 581

[9] These ratings assume that the onion crop is not proximal to a garlic, spring onion or shallot crop. Proximity to these crops will considerably increase the risk of these rusts to onion crops.

[10] https://gd.eppo.int/download/doc/704_ds_MELGMY_en.pdf

Established pests of biosecurity significance

Introduction

This section identifies established pests of biosecurity significance for the onion industry in Australia. By identifying and prioritising established pests which onion producers already have to manage, mechanisms can be put in place to better align industry and government resources and provide a stronger base for biosecurity risk management for the onion industry.

Identification of established pests of significance will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers, surveillance coordinators, diagnosticians and development of pest-specific mitigation activity.

Threat identification

Information on established pests of the onion industry described in this document came from a combination of:

- past records
- existing industry protection plans
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment.

Prioritising pest threats

Although established pests listed in this plan (Table 2) had to meet the criteria listed below for establishment, spread and economic impact, these pests did not undergo a formal pest risk assessment. These pests were considered in an effort to prioritise investment.

Spread: The natural spread of the pest to most production areas is largely unhindered and assisted spread within Australia is also difficult to manage. There may be state or territory specific regulations in place to prevent the pest spreading.

Establishment: The pest has the potential to survive and become established throughout most or all of the range of hosts. Distribution is not limited by environment conditions that prevail in Australia. Based upon its current distribution in Australia, and known conditions of survival, it is likely to survive in Australia in the majority of regions where the host is grown.

Economic Impact: There are severe impacts on production including host mortality and/or significant impacts on either crop quality or storage losses, and/or severe impacts on market access.

Table 2. Established pests of biosecurity significance

Common name (Scientific name)	Hosts	Affected plant part	Distribution in Australia	State movement controls or markets impacted by pest	Factsheets	Comments
PATHOGENS						
FUNGI						
Fusarium basal rot (syn. Damping-off) *(Fusarium oxysporum f. sp. cepae)*	Onion, leek, garlic, and others	Leaves, whole plant	All except NT and Tas	No movement controls. Can be kept off farm through good biosecurity.	Yes, Onions Australia (shed poster)[11]	Soil borne
White rot *(Sclerotium cepivorum.* (syn. *Stromatinia cepivora))*	Onion, bean, beetroot, capsicum, carrot, cucurbits, sweet potato, potato and tomato.	Brown to black rot of the stem near the soil line	All	WA	Yes, Onions Australia (shed poster)[12] and DAF Qld[13]	
Onion rust (*Puccinia allii*)	*Allium* spp.	Leaves		WA		
Onion stunt (*Rhizoctonia solani* AG 8)	*Allium* spp. and cereals	Whole plant	SA, WA and Tas[14] and on cereals in Vic[15]	No movement controls. Can be kept off farm through good biosecurity.	Yes, APPS[16]	
VIRUS AND VIROIDS						

[11] www.onionsaustralia.org.au/biosecurity-agri-chemical/onion-disease-identification/
[12] www.onionsaustralia.org.au/biosecurity-agri-chemical/onion-disease-identification/
[13] www.daf.qld.gov.au/plants/fruit-and-vegetables/vegetables/onions/pests-and-diseases-onions
[14] Hall, B. (2016) Managing soil borne diseases of onions (VN13003 Final report), Horticulture Innovation Australia Limited
[15] Murray GM, Brown JF (1987) The incidence and relative importance of wheat diseases in Australia. Australasian Plant Pathology 16:34-37
[16] https://www.appsnet.org/Publications/potm/pdf/Oct09.pdf

Common name (Scientific name)	Hosts	Affected plant part	Distribution in Australia	State movement controls or markets impacted by pest	Factsheets	Comments
Iris yellow spot virus *(Iris yellow spot virus)*	Onion, shallot, leek, garlic, roses, and rubus spp.	Leaves, roots, whole plant and vegetative organs (bulbs)	NSW, Vic, WA	Tas	Yes, NSW DPI[17]	Vectored by thrips, climate limited
NEMATODES						
Bulb eelworm (*Ditylenchus dipsaci*)	Broad host range, including Allium spp., cereal crops, ornamental bulbs, and potatoes.	Roots and vegetative organs leading to whole plant decline	All		Yes, PHA[18], APPS[19] and CABI[20]	Can be kept off individual farms through good hygiene

[17] www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/423957/Iris-yellow-spot-virus-in-onions.pdf
[18] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Stem-nematode-FS.pdf
[19] https://www.appsnet.org/Publications/potm/pdf/Mar11.pdf
[20] http://www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=19287

Established weeds of biosecurity significance

Introduction

This section identifies established weeds of biosecurity significance for the onion industry. By identifying and prioritising weeds which onion producers already have to manage, or may have to deal with in the future, mechanisms can be put in place to better align industry and government resources and provide a strong base for biosecurity risk management for the onion industry.

Although weeds were not formally included in the EPPRD at the time that this biosecurity plan was released, exotic weeds may be responded to in a similar way to exotic plant pests in the future. Therefore, it is critical that the onion industry start reviewing the threat of weeds to their production system.

Identification of weeds of significance will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers and botanists, and development of specific incursion response plans if an incursion of the weed occurs, or if the weed spreads further in production regions of Australia.

Threat identification

Information on weeds of the onion industry described in this document came from a combination of:

- past records
- existing industry protection plans
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment.

Prioritising weed threats

Although established weeds listed in this plan (Table 3) had to meet the criteria listed below for establishment, spread and economic impact, these pests did not undergo a formal pest risk assessment. These weeds were considered in an effort to prioritise investment.

Spread: The natural spread of the weed to most production areas is largely unhindered and assisted spread within Australia is also difficult to manage. There may be state or territory specific regulations in place to prevent the pest spreading.

Establishment: The weed has the potential to survive and become established throughout most or all of the range of hosts. Distribution is not limited by environment conditions that prevail in Australia. Based upon its current distribution in Australia, and known conditions of survival, it is likely to survive in Australia in the majority of regions where the host is grown.

Economic Impact: There are severe impacts on production including host mortality and/or significant impacts on either crop quality or storage losses, and/or severe impacts on market access.

Table 3. Established weeds of biosecurity significance

Common name (Scientific name)	Distribution in Australia	State movement controls or markets impacted by weed	Factsheets	Additional comments
Branched broomrape (*Orobanche ramose)*	SA	No movement controls. Can be kept off farm through good biosecurity.	Several factsheets available from PIRSA[21]	Parasitic plant that can cause wilting, yellowing and necrosis of foliage and reduced root system

[21] http://www.pir.sa.gov.au/biosecurity/plant_health/branched_broomrape

Implementing biosecurity for the Australian onion industry 2017-2022

Following the prioritisation and gap analysis through the Biosecurity Implementation Group (BIG) biosecurity planning process, both industry and government have developed an implementation plan that sets out shared biosecurity goals and objectives. This section contains a Biosecurity Implementation Table which should act as a guide for biosecurity activities for the onion industry and the government for 2017-2022. It is intended that the plan is monitored using annual review by the Biosecurity Reference Panel.

Biosecurity Implementation Table

The Biosecurity Implementation Table aims to build upon the themes outlined in the Intergovernmental Agreement on Biosecurity (IGAB)[22] and the National Plant Biosecurity Strategy (NPBS)[23] by providing a clear line of sight between the development of this Biosecurity Plan and broader plant health policy and legislation.

This table aims to provide the focus and strategic direction for plant biosecurity activities relating to the onion industry over the next five years (i.e. the life of this Biosecurity Plan). The table provides specific recommendations on potential biosecurity activities identified by both industry and government to improve biosecurity preparedness for pest threats.

This table has been developed in recognition that biosecurity is a shared responsibility between the onion industry and governments, and for this reason, the Biosecurity Implementation Table has been produced to help coordinate actions and resources in the biosecurity system, with the view of creating an effective and productive biosecurity partnership. Activities may require additional funding to be sourced prior to commencement. By implementing the specific actions listed in the Biosecurity Implementation Table, it will not only strengthen the onion biosecurity system, but also the broader plant biosecurity system. Future versions of this table will contain information on the progress made by governments and industry on the Biosecurity Implementation Table (Table 4).

[22] For more information visit **www.agriculture.gov.au/animal-plant-health/pihc/intergovernmental-agreement-on-biosecurity**
[23] For more information visit **www.planthealthaustralia.com.au/national-programs/national-plant-biosecurity-strategy/**

Table 4. *The Biosecurity Implementation Table for the Australian Onion Industry (2017-2022)*

Strategy: Capacity and Capability

Aligns with Strategy 4 of NPBS, Schedule 6 of IGAB

Action		Responsible party (Other involved parties)	Due date	Current activities
1.1	Establish a biosecurity reference panel (BRP) to help coordinate future biosecurity activities, develop key biosecurity messages/materials, and review the implementation plan.	PHA (Industry, State Government)	First year of BP and then annually by telecon after the Onions Australia (OA) AGM	
1.2	Ensure that biosecurity priorities requiring funding, action or notification are tabled with the relevant funding body or committee - BRP to identify potential concept proposals to submit to Hort Innovation (Hort Innovation to be invited to annual BRP meeting) - BRP to identify potential cross sectoral priorities to submit to Plant Biosecurity Research Initiative (PBRI) - PHA to establish mechanisms to notify SNPHS and SPHD of biosecurity priorities	PHA or BRP	Annually at biosecurity reference panel (BRP) meeting	

Action	Responsible party (Other involved parties)	Due date	Current activities
1.3 Identify mechanisms to fund biosecurity - identify mechanisms to access funds for biosecurity through the PHA levy - establish an MoU between PHA and Onions Australia for use of funds associated with the PHA levy	Industry and PHA	Annually at BRP meeting	
1.4 Ensure PHA deed training is undertaken by industry board members and other stakeholders to increase general biosecurity awareness	Industry and PHA	Early 2019	Deed training being organised for new committee
1.5 Deliver an industry biosecurity program - investigate mechanisms for appointment of an industry development officer (IDO) with biosecurity as part of their role and/or - investigate mechanisms for partnership with the AUSVEG biosecurity program	Industry (AUSVEG)	2020	
1.6 Monitor the network of biosecurity champions within the industry to foster good biosecurity practices. - Work with Cox-Inall on videos to incorporate biosecurity messages about good producers	Industry	Annually at BRP meeting (Comms plan due for renewal mid-2019)	Video productions by Cox-Inall underway

Strategy: Plant Biosecurity Education and Awareness

Aligns with Strategy 7 of NPBS, Schedule 6 of IGAB

Action		Responsible party (Other involved parties)	Due date	Current activities
2.1	Identify industry biosecurity training and extension needs and recommend priorities to appropriate service provider.	BRP (PHA)	Annually at BRP meeting	
2.2	Continue to promote, disseminate and demonstrate biosecurity to industry through industry forums, newsletters, road shows, field days, networks and/or workshops (hardcopy and online).	Industry and Cox-Inall (PHA)	Biosecurity edition first quarter 2018	Ongoing regular biosecurity updates in OA publications
2.3	Organise biosecurity presentations/ workshops/ tradeshows at industry/AGM events - Presentation of BP review at AGM Oct 2017 - First BRP to be held in conjunction with AGM Oct 2018	Industry (PHA)	Ongoing	OA AGM (October 2017) OA levy payer day (June 2018) 2019 Hort Connections in June (Melbourne) Swan Hill for AGM/conf in Oct 2019

2.4	Incorporate development of biosecurity awareness materials into the existing industry communications plan - e.g. on-farm biosecurity planner, fact sheets (practice or pest specific), pest guides, shed poster etc), case studies and scenarios to encourage industry engagement on biosecurity issues. - Write the requirement for this content into future communications plan proposals. - Investigate the development of an app which includes biosecurity content. - Develop shed poster on exotic and established pests to encourage monitoring and reporting - Promote farm biosecurity website through activities in communications plan. - Raise awareness of the EPPRD and owner reimbursement cost (ORC) frameworks through activities in communications plan. - Prepare 3-4 articles per year for industry publications to raise understanding of risk pathways and areas of vulnerability for the industry e.g. mitigating pathway risks such as seed/ seedlings, equipment, contractors and the distribution of waste post-processing - PHA to identify existing fact sheets and forward to Onions Australia for use by Cox-	Industry and Cox-Inall (PHA)	Biosecurity edition of Layers and release of shed poster in Jan 2018. Future activities dependent upon new comms contract in mid-2019	Cox-Inall have published an exotic pests shed poster.

Action		Responsible party (Other involved parties)	Due date	Current activities
	Inall in developing their biosecurity awareness activities.			
2.5	Raise awareness of the economic case for good biosecurity practice	Industry, (Hort Innovation, state governments)	Dependent on completion of a cost-benefit- analysis – see R, D & E	
2.6	Develop the onion biosecurity manual and distribute to growers through awareness activities in growing regions.	PHA (industry, Hort Innovation)	April 2018 (sent with Layers Magazine)	Complete

Strategy: Preparedness and Response

Aligns with Strategy 3 of NPBS, Schedule 7 of IGAB

Action	Responsible party (Other involved parties)	Due date	Current activities
3.1 Develop/update industry specific contingency plans for high priority pests (HPPs) - BRP to identify priorities for development of contingency plans - Funding proposals for development of contingency plans to be submitted to Hort Innovation	Industry (Hort Innovation, PBRI, PHA)	Annually at BRP meeting	

Action	Responsible party (Other involved parties)	Due date	Current activities
3.2 Develop/update cross sectoral contingency plans for HPPs - PHA to identify priorities for development of contingency plans affecting multiple industries - PHA to provide updates to the BRP on work being completed as part of the cross sectoral initiative (led by cesar) to improve preparedness for and response to vegetable leafminer - Funding proposals to be submitted to Hort Innovation or PBRI	Industry (Relevant Industries, Hort Innovation, Commonwealth, PBRI, PHA)	Annually at BRP meeting	PHA to consult some experts on what they think the sequence of priorities should be
3.3 Consider development of emergency permits for HPPs of the onion industry - Funding proposals for development of emergency permits to be submitted to Hort Innovation	Industry (Hort Innovation, APVMA, PHA)	End of 2019	
3.4 Risk mitigation activities for planting material - Consult with the Imported Seed Regulation Working Group to determine if there are any issues being considered for onion seed - Monitor the need for a clean seed program, especially in relation to *Botrytis* diseases.	Commonwealth (Industry, State Government, PHA)	Ongoing	PHA to obtain a summary

Action		Responsible party (Other involved parties)	Due date	Current activities
3.5	Maintain an industry member database to facilitate critical information in the event of an emergency response (held by Onions Australia)	Industry	Ongoing	Onions Australia currently hold a member database
3.6	Develop a response management plan	PHA (Industry)	>2018	Developing a crisis management plan with Hort Innovation
3.7	Consider categorisation of HPPs in the Emergency Plant Pest Response - BRP to prioritise annually based on interceptions (entry risk) or emerging pest issues	Industry (State Government, Commonwealth, PHA)	Prioritise annually at BRP meeting	
3.8	Investigate the development of an owner reimbursement cost framework	PHA (industry)	> 2018	

Strategy: Surveillance

Aligns with Strategy 2 of NPBS, Schedule 4 of IGAB

Action	Responsible party (Other involved parties)	Due date	Current activities
4.1 Raise industry awareness of exotic and established HPPs to improve general surveillance - Highlight the need for pest monitoring and importance of record keeping through the biosecurity manual, shed poster and articles – see Education and Awareness section	Industry and Cox-Inall (PHA)	Year 1 - Year 5 Future activities dependent upon new comms contract in mid-2019	Exotic pests shed published
4.2 Identify surveillance needs for HPPs - BRP to identify actions for surveillance for industry's HPPs (e.g. early detection critical for potential eradication, absence data required for area freedom, early detection or early warning needed to improve management outcomes, general surveillance useful for detecting the pest).	BRP	Annually at BRP meeting	PHA referring to expert panel
4.3 Identify mechanisms to fund surveillance, partnerships to implement surveillance programs, and develop surveillance programs for early detection of HPPs or market access - Investigate mechanisms for an IDO to promote the need for surveillance for HPPs and capture surveillance data.	Industry (Hort Innovation, State Government, Commonwealth, PHA)	Ongoing	PHA to discuss with Hort Innovation (Sam)

Action	Responsible party (Other involved parties)	Due date	Current activities
4.4 Develop surveillance tools to support data capture or pest reporting - Investigate adoption or adaption of a surveillance tool to capture industry surveillance data - Investigate national collection of surveillance data	Industry (Hort Innovation, PHA)	>2018	
4.5 Continue to fund the National Bee Pest Surveillance Program	Industry (Hort Innovation, State Governments, Commonwealth, PHA)	Year 2017 - 2021	Onions Australia currently contributing to funding this program

Strategy: Diagnostics

Aligns with Strategy 5 of NPBS, Schedule 4 of IGAB

Action	Responsible party (Other involved parties)	Due date	Current activities
5.1 Identify diagnostic needs for HPPs. - BRP to identify and prioritise actions for diagnostics for the onion industry's HPPs	BRP (PHA)	Jan 2019	PHA referring to expert panel
5.2 Identify mechanisms to fund diagnostic priorities - Investigate opportunities to address diagnostic gaps for HPPs - Develop National Diagnostic Protocols for HPPs (as prioritised)	BRP (Hort Innovation, State government, Commonwealth, PHA)	Annually at BRP meeting	

Strategy: Established Pests and Weeds

Aligns with Strategy 6 of NPBS, Schedule 5 of IGAB

Action	Responsible party (Other involved parties)	Due date	Current activities
6.1 Raise industry awareness of established pests and weeds of biosecurity significance - Highlight the need for biosecurity best practice biosecurity in day to day operations for pests already within Australia through shed posters developed as part of communications plan – see Education and Awareness - Include established pests and weeds of biosecurity significance in the onion biosecurity manual and other biosecurity awareness material	Industry and Cox-Inall (PHA)	Ongoing 2018	Continued awareness raising through OA publications
6.2 Identify mechanisms to fund surveillance, partnerships to implement surveillance programs, and develop surveillance programs for established pests of market access concern - Identify established pests for which surveillance data are needed to support market access.	Industry and State Government	Annually at BRP meeting	

Strategy: Biosecurity Research, Development and Extension (RD&E)

Aligns with Strategy 8 of NPBS, Schedule 8 of IGAB

Action		Responsible party (Other involved parties)	Due date	Current activities
7.1	Prioritise biosecurity R, D & E activities annually for input into Hort Innovation plant biosecurity R, D & E implementation priorities	Industry (Hort Innovation, PBRI)	Annually	PHA to discuss with Hort Innovation (Sam)
7.2	Undertake/fund R, D & E to meet market access requirements	Industry, (Hort Innovation, SDQMA)	mid-2019	
7.3	Investigate cross sectoral investment/engagement opportunities through communication with PBRI - Keep a watching brief on cross-sectoral initiatives of importance to the onion industry	Industry and PBRI	Ongoing	
7.4	Develop a cost-benefit-analysis of the benefits of biosecurity at the grower level using Onion Smut as an example.	Industry (Hort Innovation, State governments, Commonwealth, PHA)	mid-2019	

Strategy: Legislative and Regulatory Issues of Importance

Aligns with Strategy 1 of NPBS

Action		Responsible party (Other involved parties)	Due date	Current activities
8.1	Raise awareness that in all states growers have a responsibility to practice good biosecurity under relevant biosecurity acts - State agencies to provide notification of any changes to biosecurity legislation to PHA and peak industry bodies.	Industry, State Governments, Commonwealth, PHA	Ongoing	

Australian Onion industry - biosecurity preparedness

This document represents the third industry biosecurity planning process undertaken for the Australian industry.

The following table (Table 5) has been populated with the high priority pests of the onion industry. The aim of this table is to document the current preparedness documents and activities which are available and are currently being undertaken. This will allow industry, governments and RD&E agencies to better prepare for these high priority pests and align future activities as listed in the Biosecurity Implementation Table (Table 4).

Table 5. Documents and activities currently available for high priority pests of the Onion Industry[24] [25]

Common name (Scientific name)	National diagnostic protocol	Surveillance programs	Fact sheets[26]	Contingency Plan	EPPRD Category[27]	DAWE National Priority Plant Pest list[28]	Affected Parties[29]
INVERTEBRATES							
DIPTERA (Flies and midges)							
Onion fly (*Delia antiqua*)	Not developed	Not covered by a pest specific surveillance program	Yes[30]	Not developed	Not categorised	Not listed	N&G
Bean fly (*Delia florilega*)	Not developed	Not covered by a pest specific surveillance program	Not developed	No Not developed	Not categorised	Not listed	N&G, Tomato,
Vegetable leafminer (*Liriomyza sativae*)	Not developed	Yes - NAQS; SA grains surveillance program	Yes[31]	Yes	3	Yes	Melon, tomato, vegetable
THYSANOPTERA (Thrips)							

[24] Copies of these documents are available from **www.planthealthaustralia.com.au/pidd**
[25] Information presented has been taken from the National Plant Health Status Report 2016 and confirmed or updated through either Plant Health Committee, the Subcommittee on Plant Health Diagnostic Standards, the Subcommittee on National Plant Health Surveillance or other stakeholders
[26] Where an industry is listed the factsheet can be found at the PHA website. Other Australian factsheets are listed where available
[27] For further information please refer to Schedule 13 of the EPPRD. Available from: **www.planthealthaustralia.com.au/biosecurity/emergency-plant-pest-response-deed/**.
[28] The National Priority Plant Pest List was developed by the Department of Agriculture, Water and the Environment. Available from: **www.agriculture.gov.au/pests-diseases-weeds/plant**
[29] This column includes other industries who have this pest in their biosecurity plan.
[30] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Onion-fly-FS.pdf
[31] http://keys.lucidcentral.org/keys/v3/leafminers/key/Polyphagous%20Agromyzid%20Leafminers/Media/Html/Liriomyza_sativae.htm ; http://www.planthealthaustralia.com.au/sci_name/liriomyza-sativae/

Common name (Scientific name)	National diagnostic protocol	Surveillance programs	Fact sheets[26]	Contingency Plan	EPPRD Category[27]	DAWE National Priority Plant Pest list[28]	Affected Parties[29]
Onion thrips (*Thrips tabaci* (exotic strains/biotypes))	Not developed	Not covered by a pest specific surveillance program	Yes[32]	No Not developed	Not categorised	Not listed	No other parties affected
PATHOGENS							
BACTERIA							
Xanthomonas leaf blight *(Xanthomonas axonopodis* pv. *allii)*	Not developed	Not covered by a pest specific surveillance program	Yes[33]	No	Not categorised	Not listed	No other parties affected
FUNGI							
Leaf rot and neck rot of onion (*Botrytis squamosa* syn.*Sclerotinia squamosa*)	Not developed	Not covered by a pest specific surveillance program	Yes[34]	No	Not categorised	Not listed	N&G
Leaf blotch (*Cladosporium allii* syn. *Heterosporium allii))*	Not developed	Not covered by a pest specific surveillance program	Not developed	No	Not categorised	Not listed	No other parties affected
Rust of garlic and chives (*Puccinia allii* ("Koike's race"))	Not developed	Not covered by a pest specific surveillance program	Not developed	No	Not categorised	Not listed	No other parties affected

[32] http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1260&context=extension_curall ; **http://www.pestnet.org/fact_sheets/onion_thrips_117.htm**
[33] http://horticulture.com.au/wp-content/uploads/2016/11/Bacterial-onion-blight-FS.pdf ; https://www.eppo.int/QUARANTINE/data_sheets/bacteria/XANTAL_ds.pdf
[34] http://www.appsnet.org/publications/potm/pdf/Apr10.pdf

Common name (Scientific name)	National diagnostic protocol	Surveillance programs	Fact sheets[26]	Contingency Plan	EPPRD Category[27]	DAWE National Priority Plant Pest list[28]	Affected Parties[29]
Rust of chives (*Puccinia mixta*)	Not developed	Not covered by a pest specific surveillance program	Not developed	No	Not categorised	Not listed	No other parties affected
Rust of leek *(Puccinia porri)*	Not developed	Not covered by a pest specific surveillance program	Not developed	No	Not categorised	Not listed	No other parties affected
Onion smut (*Urocystis cepulae)*	Not developed	Not covered by a pest specific surveillance program	Yes[35]	No	Not categorised	Not listed	No other parties affected
NEMATODES							
Root knot nematode *(Meloidogyne enterolobii* (syn. *Meloidogyne mayaguensis))*	Not developed	Not covered by a pest specific surveillance program	Yes[36]	No	Not categorised	Not listed	Solanaceous vegetables

[35] http://www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=55787 ; www.padil.gov.au/aus-smuts/pest/pdf/140139
[36] http://www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=33248 ; http://www.pestnet.org/fact_sheets/root_knot_nematodes_127.htm

Onions Australia industry biosecurity statement

All EPPRD Parties are required under clause 13 of the EPPRD to produce a Biosecurity statement, the purpose of which is to provide acknowledgement of and commitment to risk mitigation measures and preparedness activities related to plant biosecurity. The Biosecurity statement will inform all Parties of activities being undertaken by the Industry Party to meet this commitment. Parties are required to report to PHA each year any material changes to the content of, or the Party's commitment to, the Party's Biosecurity statement. Biosecurity statements are included in schedule 15 of the EPPRD, which can be found on the PHA website at
www.planthealthaustralia.com.au/biosecurity/emergency-plant-pest-response-deed/

NATIONAL BIOSECURITY SYSTEM

What is biosecurity and why is it important?

Plant biosecurity is a set of measures which protect the economy, environment and community from the negative impacts of plant pests. A fully functional and effective biosecurity system is a vital part of the future profitability, productivity and sustainability of Australia's plant production industries and is necessary to preserve the Australian environment and way of life.

Plant pests are insects, mites, snails, nematodes or pathogens (diseases) that have the potential to adversely affect food, fibre, ornamental crops, bees and stored products, as well as environmental flora and fauna. For agricultural systems, if exotic pests enter Australia they can reduce crop yields, affect trade and market access, significantly increase costs to production and in the worst-case scenario, bring about the complete failure of a production system. Historical examples present us with an important reminder of the serious impact that exotic plant pests can have on agricultural production.

Australia's geographic isolation and lack of shared land borders have, in the past, provided a degree of natural protection from exotic plant pest threats. Australia's national quarantine system also helps to prevent the introduction of harmful exotic threats to plant industries. However, there will always be some risk of an exotic pest entering Australia, whether through natural dispersal (such as wind) or assisted dispersal as a result of increases in international tourism, imports and exports, mail and changes to transport procedures (e.g. refrigeration and containerisation of produce).

The plant biosecurity system in Australia

Australia has a unique and internationally recognised biosecurity system to protect our plant production industries and the natural environment against new pests. The system is underpinned by a cooperative partnership between plant industries and all levels of government.

The framework for managing the cooperative partnership for delivering an effective plant biosecurity system is built on a range of strategies, policies and legislation, such as the

Intergovernmental Agreement on Biosecurity[37] and the National Plant Biosecurity Strategy[38]. These not only provide details about the current structure, but provide a vision of how the future plant biosecurity system should operate.

Australia's biosecurity system has been subject to several reviews in recent times, with the recommendations recognising that a future-focused approach is vital for maintaining a strong and resilient biosecurity system that will protect Australia from new challenges. As a result, there is a continuous improvement from industry and governments to Australia's plant biosecurity system, with the key themes including:

- Targeting what matters most, including risk-based decision making and managing biosecurity risks across the biosecurity continuum (pre-border, border and post-border).
- Good regulation, including reducing regulatory burden and having effective legislation in place.
- Better processes, including service delivery modernisation with electronic, streamlined systems.
- Sharing the responsibility, including maintaining productive relationships with all levels of government, primary industries and the wider Australian public.
- Maintaining a capable workforce.

Through these themes, a focus on the biosecurity continuum better supports consistent service delivery offshore, at the border, and onshore, and provides an effective biosecurity risk management underpinned by sound evidence and technical justification.

The benefits of the modern biosecurity system are realised by industry, government and the community, with positive flow on effects to the economy more generally. This is through streamlined business processes, productivity improvements and reduced regulatory burden in a seamless and lower cost business environment, by emphasising risk-based decision making and robust partnerships.

Onion Peak Industry Body

Onions Australia is the peak industry body for the onion industry. They are a signatory to the EPPRD and are the key industry contact point if a suspect Emergency Plant Pest affecting the onion industry is detected. For further information about Onions Australia in relation to response procedures following the identification of a suspect exotic pest refer to page 103. For a background on the onion industry refer to page 111.

[37] For more information visit **www.agriculture.gov.au/animal-plant-health/pihc/intergovernmental-agreement-on-biosecurity**
[38] For more information visit **www.planthealthaustralia.com.au/national-programs/national-plant-biosecurity-strategy/**

Plant Health Australia

Plant Health Australia (PHA) is the national coordinator of the government-industry partnership for plant biosecurity in Australia.

PHA is a not-for-profit, subscription-funded public company based in Canberra. PHA's main activities are funded from annual subscriptions paid by members. The Australian Government, state and territory governments and 39 plant industry organisations are all members of PHA and each meet one third of the total annual membership subscription. This tripartisan funding model ensures the independence of the company.

The company was formed to address priority plant health issues, and to work with all its members to develop an internationally outstanding plant health management system that enhances Australia's plant health status and the sustainability and profitability of plant industries. Through PHA, current and future needs of the plant biosecurity system can be mutually agreed, issues identified, and solutions to problems found. PHA's independence and impartiality allow the company to put the interests of the plant biosecurity system first and support a longer-term perspective.

For more information about PHA visit **www.planthealthaustralia.com.au**

The Biosecurity Plan

The Biosecurity Plan for the Onion Industry was developed in consultation with the Technical Expert Group (TEG) and Biosecurity Implementation Group (BIG), which consisted of plant health and biosecurity experts and industry representatives. These groups were coordinated by Plant Health Australia (PHA) and included representatives from Onions Australia, relevant state and territory agriculture agencies and PHA.

The biosecurity plan not only details exotic pest threats of the Australian onion industry but also contains information on the current mitigation and surveillance activities being undertaken and identifies contingency plans, fact sheets and diagnostic protocols that have been developed for pests relevant to the onion industry.

This plan is a framework to coordinate biosecurity activities and investment for Australia's onion industry and to address the strengths and weaknesses in relation to industry's current biosecurity position. It provides a mechanism for industry, governments and stakeholders to better prepare for and respond to, incursions of pests that could have significant impacts on the onion industry.

Biosecurity planning

Biosecurity planning provides a mechanism for the onion industry, government and other relevant stakeholders to actively determine pests of highest priority, analyse the risks they pose and put in place practices and procedures that would rapidly detect an incursion, minimise the impact if a pest incursion occurs and/or reduce the chance of pests becoming established. Effective industry biosecurity planning relies on all stakeholders, including government agencies, industry, and the public (Figure 1).

Ensuring the onion industry has the capacity to minimise the risks posed by pests, and to respond effectively to any pest threats is a vital step for the future sustainability and viability of the industry. Through this pre-emptive planning process, the industry will be better placed to maintain domestic and international trade, and reduce the social and economic costs of pest incursions on both growers and the wider community. The information gathered during these processes provides additional assurance that the Australian onion industry is free from specific pests and has systems in place to control and manage biosecurity risks, which assists the negotiation of access to new overseas markets.

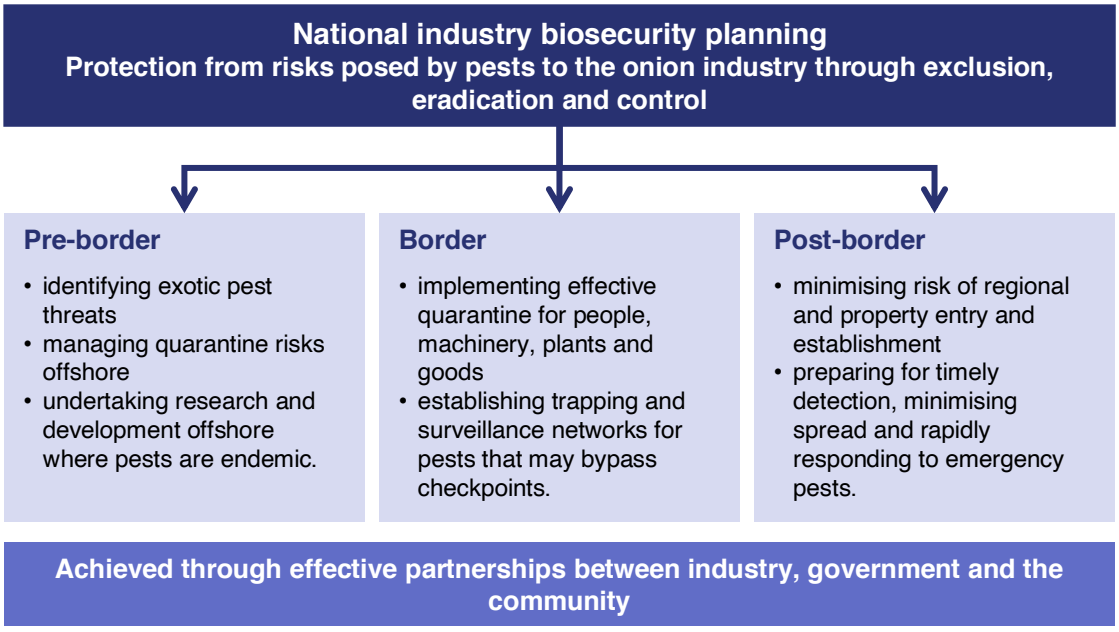


Figure 1. *Industry biosecurity: a shared responsibility*

Biosecurity Plan development

With the assistance of Onions Australia, a Technical Expert Group (TEG) and a Biosecurity Implementation Group (BIG) were formed to work on the review the Biosecurity Plan for the Onion Industry (BP). These groups were coordinated by Plant Health Australia (PHA) and

included representatives from Onions Australia, relevant state and territory agriculture agencies and PHA (Table 6 and Table 7).

Key roles of the technical expert group for the onion BP included:

- identifying and documenting key threats to the onion industry
- confirming an agreed high priority pest (HPP) list

Key roles of the biosecurity implementation group for the onion BP included:

- documenting pest-specific fact sheets, contingency plans, diagnostic protocols and surveillance programs for HPPs
- documenting the roles and responsibilities of stakeholder groups.
- developing a biosecurity implementation table for future biosecurity related work to be conducted over the life of this biosecurity plan

Table 6. *Members of the technical expert group and/or biosecurity implementation group*

Name	Organisation	Area of expertise	Member of Technical Expert Group	Member of Biosecurity Implementation Group
Greg Baker	PIRSA	Entomology	✓	
Lionel Hill	DPIPWE	Entomology	✓	
Elizabeth Minchinton	DJPR	Pathology	✓	✓
Barbara Hall	SARDI	Pathology		✓
Mandy Christopher	DAF	Biosecurity preparedness	✓	✓
Andrew Moon	Moon Rocks, Queensland	Onion grower		✓
Peter Shadbolt	Scotties Point Farms, Victoria	Onion grower		✓
Dean Metcalf	Metcalf Bio Control, Tasmania	Pathologist/ consultant		✓
Lechelle Earl	Onions Australia	CEO of Onions Australia		✓
Alison Saunders	PHA	Biosecurity preparedness	✓	
David Gale	PHA	Biosecurity preparedness	✓	✓
Sharyn Taylor	PHA	Biosecurity preparedness		✓
Tom Langley	PHA	Biosecurity preparedness	✓	

Table 7: *Scientists and others who contributed information for review of the biosecurity plan*[39]

Name	Organisation	Area of expertise
Anna Balzer	DAF	Pathology
Barbara Hall	PIRSA	Pathology
Dean Metcalf	Metcalf Bio Control	Pathology/consultant
Fiona Constable	DJPR	Virology
Jamie Davies	DPIPWE	Entomology
Jianhua Mo	NSW DPI	Entomology
John Duff	DAF	Pathologist
Laurence Mound	CSIRO	Entomology
Lechelle Earl	Onions Australia	CEO Onions Australia
Mike Hodda	CSIRO	Entomology
Owen Seeman	Queensland Museum	Entomology
Peter Cross	DPIPWE	Pathology
Peter Ridland	Consulting Entomologist	Entomology
Rebekah Pierce	NSW DPI	Biosecurity preparedness

Review processes

With the support of the relevant onion industry bodies and PHA this plan should be reviewed on a 5 year basis. The review process will ensure:

- Threat Summary Tables are updated to reflect current knowledge
- pest risk assessments are current
- changes to biosecurity processes and legislation is documented
- contact details and the reference to available resources is accurate

In addition to the formal review process above, the document should be reviewed/revisited annually by a Biosecurity Reference Panel comprised of industry, government and PHA to ensure currency and relevance and to monitor progress with implementation. As an example, the industry biosecurity priorities identified within the plan could feed directly into industry R&D priority setting activities on an annual basis.

[39] These people did not attend the technical expert group or biosecurity implementation group meetings but were approached for assistance during the biosecurity plan review process.

Opportunities to make out of session changes to the biosecurity plan, including the addition/subtraction of high priority pests or changes to legislation are currently being investigated. Such changes would need to include consultation and agreement of industry and government. This flexibility will facilitate the plan's currency and relevance.

THREAT IDENTIFICATION AND PEST RISK ASSESSMENTS

Introduction

This section identifies high risk exotic pest threats to the onion industry, and presents a framework for assessing the potential economic, social and environmental impacts associated with each threat. This part of the biosecurity plan uses a nationally consistent and coordinated approach to threat identification and risk assessment to provide a strong base for future risk management in the onion industry.

By identifying key threats a pre-emptive approach may be taken to risk management. Under this approach, mechanisms can be put into place to increase our response effectiveness if pest incursions occur. One such mechanism is the EPPRD that has been negotiated between PHA's government and industry members. The EPPRD ensures reliable and agreed funding arrangements are in place in advance of EPP incursions, and assists in the response to EPP incursions, particularly those identified as key threats.

Identification of high risk exotic pests will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers and diagnosticians, and development of pest-specific incursion response plans.

Established pests and weeds of biosecurity significance have also been listed in this plan. It is well understood that good biosecurity practice is beneficial for the ongoing management of established pests and weeds, as well as for surveillance and early detection of exotic pests. Established pests cause ongoing hardships for growers and these pests have been listed with the support of industry and government in recognition that they need a strategic, consistent, scientific and risk-based approach to better manage these pests for the onion industry.

Exotic pests of the onion industry

Threat identification

Information on exotic pest threats to the onion industry described in this document came from a combination of:

- past records
- existing industry protection plans
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment.

At this time, only invertebrate pests (insects, mites, molluscs and nematodes) and pathogens (disease causing organisms) have been identified, for risk assessment as these are what are responded to under national agreed arrangements, under the EPPRD. If exotic weeds were to be included in the EPPRD then this would be revisited through future reviews of the plan.

Pest risk assessments

The assessment process used in this BP was developed in accordance with the International Standards for Phytosanitary Measures (ISPM) No. 2 and 11 [Food and Agriculture Organization of the United Nations (FAO), 2004; 2007]. A summary of the pest risk analysis protocol followed in this BP is shown in Table 8, and the complete protocol used for pest risk analysis in this BP can be found on the PHA website[40].

While there are similarities in the ranking system used in this document and the Import Risk Analysis (IRA) process followed by the Department of Agriculture, Water and the Environment (DAWE), there are differences in the underlying methodology and scope of consideration that may result in different outcomes between the two assessment systems. This includes different guidance to assignment of qualitative probabilities when compared with DAWE's IRA process.

Modifications of the DAWE (Department of Agriculture Fisheries and Forestry, 2011) protocol have been made to suit the analysis required in the BP development process, including, but not limited to:

[40] Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

- **Entry potential:** The determination of entry potential in this BP takes into account multiple possible pathways for the legal importation of plant material as well as illegal pathways, contamination and the possibility of introduction through natural means such as wind. Therefore, the scope is wider than that used by the DAWE in their IRA process, which only considers legal importation of plants or plant commodities.
- **Potential economic impact** of pest establishment in this document only takes into account the impacts on the onion industry. The DAWE IRA process has a wider scope, including the effects to all of Australia's plant industries, trade, the environment and public health.
- **Risk potentials and impacts:** The number of categories used in this BP for describing the entry, establishment, spread, and potential economic impact (see 'Description of terms used in pest risk tables', page 62) differs in comparison to that used in the DAWE Resources IRA process.

Table 8. *Summary of pest risk assessment process used in BPs*

Step 1	Clearly identify the pest	• Generally, pest defined to species level • Alternatively, a group (e.g. family, genus level) can be used • Sub-species level (e.g. race, pathovar, etc.) may be required
Step 2	Assess entry, establishment and spread likelihoods	• Assessment based on current system and factors • Negligible, low, medium, high or unknown ratings
Step 3	Assess likely consequences	• Primarily based on likely economic impact to industry based on current factors • Negligible, low, medium, high, extreme or unknown ratings
Step 4	Derive overall risk	• Entry, establishment and spread likelihoods are combined to generate a likelihood score • Likelihood score combined with the likely economic impact to generate an overall risk score
Step 5	Review the risk	• Risk ratings should be reviewed with the BP

The objective of risk assessment is to clearly identify and classify biosecurity risks and to provide data to assist in the evaluation and treatment of these risks. Risk assessment involves consideration of the sources of risk, their consequences, and the likelihood that those consequences may occur. Factors that affect the consequences and likelihood may be identified and addressed via risk mitigation strategies.

Risk assessment may be undertaken to various degrees of refinement, depending on the risk information and data available. Assessment may be qualitative, semi-quantitative, quantitative, or a combination of these. The complexity and cost of assessment increase with the production of more quantitative data. It is often more practical to first obtain a general indication of the level of risk through qualitative risk assessment, and if necessary, undertake

more specific quantitative assessment later [Australian Standard/New Zealand Standard (AS/NZS) ISO 31000, 2009].

Ranking pest threats

Key questions required for ranking the importance of pests include the following:

- What are the probabilities of entry into Australia, establishment and spread, for each pest?
- What are the likely impacts of the pest on cost of production, overall productivity and market access?
- How difficult is each pest to identify and control and/or eradicate?

The TSTs (more information in Appendix 2) present a list of potential plant pest threats to the onion industry and provide summarised information on entry, establishment and spread potential, the economic consequences of establishment and eradication potential (where available). The most serious threats from the TSTs were identified through a process of qualitative risk assessment[41] and are listed in the HPP list (Table 1).

This document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling). This is a broader view of potential risk than the IRA conducted by the Department of Agriculture, Water and the Environment which focus only on specific regulated import pathways.

When a pest that threatens multiple industries is assessed, the entry, establishment and spread potentials take into account all known factors across all host industries. This accurately reflects the ability of a pest to enter, establish and spread across Australia and ultimately results in different industries, and their BPs, sharing similar pest ratings. However, the economic impact of a pest is considered at an industry specific level (i.e. for the onion industry only in this BP), and therefore this rating may differ between BPs.

[41] An explanation of the risk assessment method used can be found on the PHA website (**www.planthealthaustralia.com.au/biosecurity/risk-mitigation**)

Description of terms used in pest risk tables

The descriptions below relate to terms in Table 1 and elsewhere in the document.

Entry potential

Negligible	The probability of entry is extremely low given the combination of all known factors including the geographic distribution of the pest, quarantine practices applied, probability of pest survival in transit and pathways for pest entry and distribution to a suitable host.
Low	The probability of entry is low, but clearly possible given the expected combination of factors described above.
Medium	Pest entry is likely given the combination of factors described above.
High	Pest entry is very likely and potentially frequent given the combination of factors described above.
Unknown	The pest entry potential is unknown or very little of value is known.

Establishment potential

Negligible	The pest has limited potential to survive and become established within Australia given the combination of all known factors.
Low	The pest has the potential to survive and become established in approximately one-third or less of the range of hosts. The pest could have a low probability of contact with susceptible hosts.
Medium	The pest has the potential to survive and become established in between approximately one-third and two-thirds of the range of hosts.
High	The pest has potential to survive and become established throughout most or all of the range of hosts. Distribution is not limited by environmental conditions that prevail in Australia. Based upon its current world distribution, and known conditions of survival, it is likely to survive in Australia wherever major hosts are grown.
Unknown	The establishment potential of the pest is unknown or very little of value is known.

Spread potential

Negligible	The pest has very limited potential for spread in Australia given the combination of dispersal mechanisms, availability of hosts, vector presence, industry practices and geographic and climatic barriers.
Low	The pest has the potential for natural or assisted spread to susceptible hosts within Australia yet is hindered by a number of the above factors
Medium	The pest has an increased likelihood of spread due to the above factors
High	The natural spread of the pest to most production areas is largely unhindered and assisted spread within Australia is also difficult to manage
Unknown	The spread potential is unknown or very little of value is known.

Economic impact

Negligible	There are very minor, often undetectable, impacts on production with insignificant changes to host longevity, crop quality, production costs or storage ability. There are no restrictions to market access.
Very low	There are minor, yet measurable, impacts on production including either host longevity, crop quality, production costs or storage ability. There are no restrictions to market access.
Low	There are measurable impacts to production including either host mortality, reduction in yield, production costs, crop quality, storage losses, and/or minimal impacts on market access.
Medium	There are significant impacts on production with either host mortality, reduction in yield, production costs, crop quality, storage losses, and/or moderate impacts on market access.
High	There are severe impacts on production including host mortality and significant impacts on either crop quality or storage losses, and/or severe impacts on market access.
Extreme	There is extreme impact on standing crop at all stages of maturity, with high host mortality or unmanageable impacts to crop production and quality, and /or extreme, long term, impacts on market access.
Unknown	The economic potential of the pest is unknown or very little of value is known.

References

AS/NZS ISO 31000:2009 Risk management - Principles and guidelines. Standards Australia, Sydney, and Standards New Zealand, Wellington.

DAFF (2011) Import Risk Analysis Handbook 2011. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

FAO (2004) Pest risk analysis for quarantine pests including analysis or environmental risks and living modified organisms. International Standards for Phytosanitary Measures No. 11. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

FAO (2007) Framework for pest risk analysis. International Standards for Phytosanitary Measures No. 2. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

RISK MITIGATION AND PREPAREDNESS

Introduction

There are a number of strategies that can be adopted to help protect and minimise the risks of Emergency Plant Pests under International Plant Protection Convention (IPPC) standards (**www.ippc.int/standards**) and Commonwealth and State/Territory legislation.

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the onion industry (Figure 2). Such risk mitigation and preparedness practise are the responsibility of governments, industry and the community.

A number of key risk mitigation areas are outlined in this guide, along with summaries of the roles and responsibilities of the Australian Government, state/territory governments, and onion industry members. This section is to be used as a guide outlining possible activities that may be adopted by industry and growers to mitigate the risk and prepare for an incursion response. Each grower will need to evaluate the efficacy of each activity for their situation.

Figure 2. *Examples of biosecurity risk mitigation activities*

Barrier quarantine

Barrier quarantine refers to the biosecurity measures implemented at all levels of the onion industry including national, state, regional, and farm levels.

National level – importation restrictions

The Department of Agriculture, Water and the Environment (DAWE) is the Australian Government department responsible for maintaining and improving international trade and market access opportunities for agriculture, fisheries, forestry, and food industries. DAWE achieves this through:

- establishment of scientifically-based quarantine policies
- provision of effective technical advice and export certification services
- negotiations with key trading partners
- participation in multilateral forums and international sanitary and phytosanitary (SPS) standard-setting organisations
- collaboration with portfolio industries and exporters.

DAWE is responsible for developing biosecurity (SPS) risk management policy and reviewing existing quarantine measures for the importation of live animals and plants, and animal and plant products. In particular, DAWE undertakes import risk analyses to determine which products may enter Australia, and under what quarantine conditions. DAWE also consults with industry and the community, conducting research and developing policy and procedures to protect Australia's animal and plant health status and natural environment. In addition, DAWE assists Australia's export market program by negotiating other countries' import requirements for Australian animals and plants. Further information can be found at **www.agriculture.gov.au**.

The administrative authority for national quarantine is vested in DAWE under the *Biosecurity Act 2015*. Quarantine policies are developed on the basis of an IRA process. This process is outlined in the IRA Handbook 2011 (Department of Agriculture, Fisheries and Forestry, 2011). DAWE maintains barrier quarantine services at all international ports and in the Torres Strait region. The management of quarantine policy, as it relates to the introduction into Australia of fruit, seed, or other plant material, is the responsibility of DAWE.

The schedule 5 "Permitted Seeds" list from the *Quarantine Proclamation 1998* is maintained on the Import Conditions (BICON) database at **www.agriculture.gov.au/import/online-services/bicon**

BICON contains the current Australian import conditions for more than 20,000 foreign plants, animal, mineral and human products and is the first point of access to information about Australian import requirements for a range of commodities. It can be used to determine if a commodity intended for import to Australia requires a quarantine import permit and/or treatment or if there are any other quarantine prerequisites. There are currently a number of cases for onions listed on BICON (see Table 9). For export conditions see the Manual of Importing Country Requirements (MICoR) database at **www.agriculture.gov.au/micor/plants**.

The Australian Government is responsible for the inspection of machinery and equipment being imported into Australia. Any machinery or equipment being imported into Australia must meet quarantine requirements. If there is any uncertainty, contact DAWE on (02) 6272 3933 or 1800 020 504, or visit the website at **www.agriculture.gov.au/biosecurity/import**.

The World Trade Organization (WTO) SPS Agreement facilitates international trade while providing a framework to protect the human, animal and plant health of WTO members. SPS measures put in place must minimise negative effects on trade while meeting an importing country's appropriate level of protection. For plant products, these measures are delivered through the IPPC standard setting organisations and collaboration with portfolio industries and exporters. For more information on the IPPC visit **www.ippc.int**.

Table 9. *Product types for which import conditions are listed in BICON (as at June 2017)*[42]

Crop	Product type
Onion	Processed tuber and corm products for human consumption
Leek	*Allium porrum* for use as nursery stock
Garlic	Processed tuber and corm products for human consumption *Allium sativum* for use as nursery stock
Chives	Dried herbs (including leaves, spices, roots, crushed nut shells)
Any *Allium* spp. (including flowers)	Fresh Allium Fresh cut flowers and foliage *Allium* spp. seed for sowing Dried vegetables for human consumption Frozen fruit, vegetables and herbs for human consumption

State and regional level – movement restrictions

The ability to control movement of materials that can carry and spread onion pests is of high importance. Each state/territory has quarantine legislation in place to control the importation of onion material interstate and intrastate, and to manage agreed pests if an incursion occurs (refer to Table 10). Further regulations have been put in place in response to specific pest threats and these are regularly reviewed and updated by state/territory authorities and the Sub-Committee for Domestic Quarantine and Market Access (SDQMA).

Moving plant material between states/territories generally requires permits from the appropriate authority, depending on the plant species and which territory/state the material is being transferred to/from. Moving plant material intrastate may also require a permit from the appropriate authority. Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of onions can be obtained by contacting your local state or territory agriculture department directly (see Table 10), or through the SDQMA website **www.domesticquarantine.org.au** which lists relevant contacts in each state/territory as well as Interstate Certification Assurance (ICA) documents relating to each state/territory.

The movement of farm vehicles and equipment between states is also restricted because of the high risk of inadvertently spreading pests. Each state/territory has quarantine legislation in place governing the movement of machinery, equipment and other potential sources of pest

[42] Please note, this is a summary only. Conditions change overtime and BICON (**www.agriculture.gov.au/import/bicon**), or the Department of Agriculture, Water and the Environment will need to be consulted to confirm the specific conditions that apply to a given situation.

contamination. Further information can be obtained by contacting your local state/territory Department of Agriculture, Water and the Environment (Table 10).

Table 10. *Interstate and interregional movement of plant products – legislation, quarantine manuals and contact numbers*

State	Administering authority	Legislation	Links to quarantine manual[43]	Phone
ACT	Environment ACT **www.environment.act.gov.au**	*Plant Disease Act 2002* *Pest Plants and Animals Act 2005*	See NSW conditions	13 22 81
NSW	Department of Primary Industries **www.dpi.nsw.gov.au**	*Biosecurity Act 2015* *Biosecurity Regulations 2017*	**www.dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases**	02 6391 3384
NT	Department of Primary Industry and Fisheries **https://dpir.nt.gov.au/**	*Plant Health Act 2008* *Plant Health Regulations 2011*	**https://nt.gov.au/industry/agriculture/food-crops-plants-and-quarantine/plants-and-quarantine**	08 8999 2118
QLD	Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland **www.daf.qld.gov.au/biosecurity**	*Biosecurity Act 2014* *Biosecurity Regulation 2016*	**www.daf.qld.gov.au/plants/moving-plants-and-plant-products**	132 523[44] 07 3404 6999[45]
SA	Primary Industries and Regions SA **www.pir.sa.gov.au**	*Plant Health Act 2009* *Plant Health Regulations 2009*	**www.pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia**	08 8207 7820
TAS	Department of Primary Industries, Parks, Water and Environment **www.dpipwe.tas.gov.au**	*Biosecurity Act 2019*	**http://dpipwe.tas.gov.au/biosecurity-tasmania/plant-biosecurity/plant-biosecurity-manual**	1300 368 550
VIC	Department of Jobs, Precincts and Regions **www.economicdevelopment.vic.gov.au/**	*Plant Biosecurity Act 2010* *Plant Biosecurity Regulations 2016*	**www.agriculture.vic.gov.au/psb**	136 186
WA	Department of Primary Industries and Regional Development **www.agric.wa.gov.au/**	*Biosecurity and Agricultural Management Act 2007* *Biosecurity and Agricultural Management Regulations 2013*		08 9334 1800

[43] If the link does not work, the relevant documents can be found by going to the department home page and checking the quarantine section of each website

[44] Within Qld

[45] Interstate

New South Wales

Information on pre-importation inspection, certification and treatment requirements may be obtained from NSW DPI Regulatory Services by phone 02 6391 3384 or by visiting the NSW Department of Primary Industries website **www.dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases**.

Northern Territory

Administrative authority for regional quarantine in the Northern Territory (NT) is vested in the Department of Primary Industry and Resources (DPIR) under the *Plant Health Act 2008* and *Plant Health Regulations 2011*. The Act enables notifiable pests to be gazetted, quarantine areas to be declared and inspectors appointed to carry out wide ranging control and/or eradication measures. Plant import requirements for particular pests, plants or plant related materials are identified in the Regulations. Further information on NT import requirements and treatments can be obtained by contacting NT Quarantine on (08) 8999 5511 or email **quarantine@nt.gov.au.**

For more information refer to the DPIR website (**https://dpir.nt.gov.au/**).

Queensland

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Queensland, as well as maps of pest quarantine areas, may be obtained from the Biosecurity Queensland part of the DAF Queensland website (**www.daf.qld.gov.au/plants/moving-plants-and-plant-products**).

Further details can be obtained from the DAF Queensland Customer Service Centre (13 25 23 within Queensland, or phone 07 3404 6999 or fax 07 3404 6900 interstate).

South Australia

Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of fruit or plant material in South Australia (SA) may be obtained from Biosecurity SA - Plant Health by phone (08) 8207 7820 or fax (08) 8207 7844. Further information can be found at **www.pir.sa.gov.au/biosecurity/plant_health**.

Primary Industries and Regions South Australia (PIRSA) have strict regulations and requirements regarding the entry of plant material (fruit, vegetables, flowers, plants, soil and seeds) into the State.

For further information on import conditions consult the Plant Quarantine Standard (**www.pir.sa.gov.au/biosecurity/plant_health/importing_commercial_plants_and_plant_products_into_south_australia**).

Tasmania

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of any fruit or plant material into Tasmania may be obtained from the Department of Primary Industries, Parks, Water and Environment (DPIPWE) Biosecurity website (**www.dpipwe.tas.gov.au/biosecurity**) or by phoning 1300 368 550.

General and specific import conditions apply to the importation of plant material into Tasmania to prevent the introduction of pests and diseases into the State. Plants and plant products must not be imported into Tasmania unless State import requirements are met and a Notice of Intention to import has been provided to a Biosecurity Tasmania inspector not less than 24 hours prior to the importation.

For further information on import conditions consult the Plant Quarantine Manual (**http://dpipwe.tas.gov.au/biosecurity-tasmania/plant-biosecurity/plant-biosecurity-manualhttp://dpipwe.tas.gov.au/biosecurity/plant-biosecurity/plant-biosecurity-manual**).

Victoria

The movement into Victoria of plants and plant products may be subject to a prohibition, or to one or more conditions which may include chemical treatments. These prohibitions and conditions are described on the Department of Jobs, Precincts and Regions (DJPR) website (see link in Table 10). Some items may need to be presented to a DJPR inspector or an accredited business, for checking of details such as correct certification, labelling or treatment.

Further information on pre-importation inspection, certification and treatments and/or certification requirements for movement of fruit or plant material into or within Victoria may be obtained from DJPR on the web at **www.agriculture.vic.gov.au/psb** or by phone 136 186.

Western Australia

The lead agency for agricultural biosecurity in Western Australia is the Department of Primary Industries and Regional Development (WA DPIRD). Western Australia is naturally free from a large number of pests and diseases that are present in many other parts of the world. WA's geographical isolation in conjunction with a robust plant biosecurity system including border and intrastate regulations, industry and public awareness campaigns and surveillance programs maintains this status.

There are general and specific legislative requirements which underpin Western Australian plant biosecurity. Amongst other things the legislation regulates movement of potential carriers (such as plant material, honey, machinery, seeds etc.) into and within the state.

General conditions include (but are not limited to the following):

- The requirement for all potential carriers to be presented to an inspector for inspection upon arrival in WA
- Soil is prohibited entry and imported goods, including containers, must be free from soil
- Freedom from pests and diseases of quarantine concern to WA

In addition to the general requirements, specific requirements are also in place for movement into and within the state.

For further information on requirements contact Quarantine WA on (08) 9334 1800 or fax (08) 9334 1880.

Farm level – exclusion activities

A significant risk of spreading pests onto farms arises when propagation material, people, machinery and equipment move from property to property and from region to region. It is the responsibility of the industry and the owner/manager of each property to ensure these risks are minimised.

It is in the interests of industry to encourage and monitor the management of risk at the farm level, as this will reduce the probability of an incursion and increase the probability of early detection. This should in turn reduce the likelihood of a costly incident response, thereby reducing costs to industry, government and the community.

One major way this can be achieved is through management of industry biosecurity at the farm level using exclusion practices. Further detail on potential strategies is included in the Farm Biosecurity section (page 84). The onion industry is already a strong supporter of farm biosecurity with its ‘Come clean. Go clean’ message; but should continue to further extend this message of promoting good farm hygiene in a wide range of ways.

Surveillance

Surveys enhance prospects for early detection, minimise costs of eradication and are necessary to meet the treaty obligations of the WTO SPS Agreement with respect to the area freedom status of Australia’s states, territories and regions.

The SPS Agreement gives WTO members the right to impose SPS measures to protect human, animal and plant life health provided such measures do not serve as technical barriers to trade. In other words, for countries (such as Australia) that have signed the SPS Agreement, imports of food, including fresh fruit and vegetables, can only be restricted on proper, science-based quarantine grounds. Where quarantine conditions are imposed, these will be the least trade restrictive measures available that meet Australia's appropriate level of quarantine protection. The Agreement also stipulates that claims of area freedom must be supported by appropriate information, including evidence from surveillance and monitoring activities. This is termed "evidence of absence" data and is used to provide support that we have actively looked for pests and not found them.

ISPM 6 (**www.ippc.int/sites/default/files/documents/20140528/spec_61_revispm6_2014-05-28_201405281352--150.18%20KB.pdf**) provides international guidelines for structured pest surveys. Structured pest survey planning and implementation depends on the risk involved, the resources available, and the requirements of trading partners (particularly when Australia wishes to access overseas markets). The intensity and timing of surveys also depend on the spread characteristics of the pest and the costs of eradication.

Early detection of an exotic incursion can significantly increase the likelihood of a successful eradication campaign, and reduce the associated costs. Effective surveillance plays a critical role in working toward this goal. Surveillance can be either targeted toward specific pests, or general in nature. General non-targeted surveillance is based on recognising normal versus suspect plant material. Targeted surveillance is important for establishing whether particular pests are present in each state or region, and if so, where these occur.

Industry personnel can provide very effective early detection of new or unusual symptoms through their normal management practices (i.e. 'passive surveillance'), provided individuals are aware of what to look for and of reporting procedures. Consultants and crop scouts can provide valuable information as they are regularly in the field, and hence can observe any unusual pest activity or symptoms on plants.

National surveillance programs

The Department of Agriculture, Water and the Environment (DAWE) maintains barrier quarantine services at all international ports and in the Torres Strait region. DAWE also surveys the northern coast of Australia, offshore islands and neighbouring countries for exotic pests that may have reached the country through other channels (e.g. illegal vessel landings in remote areas, bird migrations, wind currents) as part of the Northern Australia Quarantine

Strategy (NAQS). NAQS surveillance programs relevant to the onion industry are listed in Table 11.

State surveillance programs

State level surveillance depends on the participation of all stakeholder groups, particularly state/territory agriculture departments, industry representative groups, agri-business and growers.

The state/territory agriculture department can provide:

- planning and auditing surveillance systems
- coordination of surveillance activities between industry and interstate groups
- diagnostic services
- field diagnosticians for special field surveillance
- surveillance on non-commercial sites
- liaison services with industry members
- communication, training and extension strategies with industry
- biosecurity training
- reporting services to all interested parties (Department of Agriculture, Water and the Environment, national bodies, trading partners and industry).

Various pest surveillance programs are managed by the Department of Agriculture, Water and the Environment and the state/territory agriculture departments. Many state/territory departments run general surveillance programs whereby suspect samples can be forwarded and diagnosed for the presence of exotic pests free of charge. Official surveillance programs that target pests of the onion industry (exotic or those under official control in a region or state/territory) are shown in Table 11.

Table 11. *Official surveillance programs that target pests of the onion industry (as at December 2016)*[46]

Surveillance program	Pests targeted	Hosts targeted
Australian Government		
NAQS	Vegetable leafminer	Multiple
New South Wales		
Onion seed crop surveillance	Varies but may include *Burkholderia gladioli* pv. *alliicola, Erwinia chrysanthemi, Alternaria porri, Pyrenochaeta trrestris, Urocystis cepulae, Ceratitis* spp. *Helix aspersa, Liriomyza trifolii, Naupactus leucoloma, Aphelenchoides fragariae, Ditylenchus destructor, D. dipsaci, Longidorus, Meloidogyne goeldi, Paratrichodorus, Pratylenchus filipjev*	Onions
There is currently no surveillance being undertaken in NSW for bulb onion pests		
Northern Territory		
General surveillance programs	General surveillance of plant health in commercial facilities and nurseries, with samples displaying unusual symptoms collected for detailed diagnosis.	Onions (mainly red, some white), spring onions and shallots
Queensland		
Qld DAF does ad hoc surveillance on field production of allium crops including onions, shallots and garlic		
South Australia		
Grains surveillance program	Vegetable leafminer	Multiple
SA does not currently have any specific onion surveillance programs in place		
Tasmania		
Multiple pest surveillance program – allium pest surveillance	*Delia antiqua, Eumerus amoenus, E. strigatus, Rhizoglyphus callae, R. setosus, Botrytis squamosa, Puccinia* spp.	Mature onion bulbs (commercial) and garlic plants
Western Australia		
DPIRD does not currently conduct any surveys on onions		

Farm surveillance activities

Farm level surveillance involves the participation and interaction of growers, agribusiness and industry representative groups. Examples of the surveillance activities that can be carried out by each of these groups are outlined in Figure 3. Conducting regular surveys of farms and nurseries provides the best chance of spotting new pests early and implementing eradication or management responses.

[46] Information presented has been taken from the National Plant Health Status Report 2016 and confirmed or updated in December 2016 by the Subcommittee on National Plant Health Surveillance (sub-committee of the Plant Health Committee)

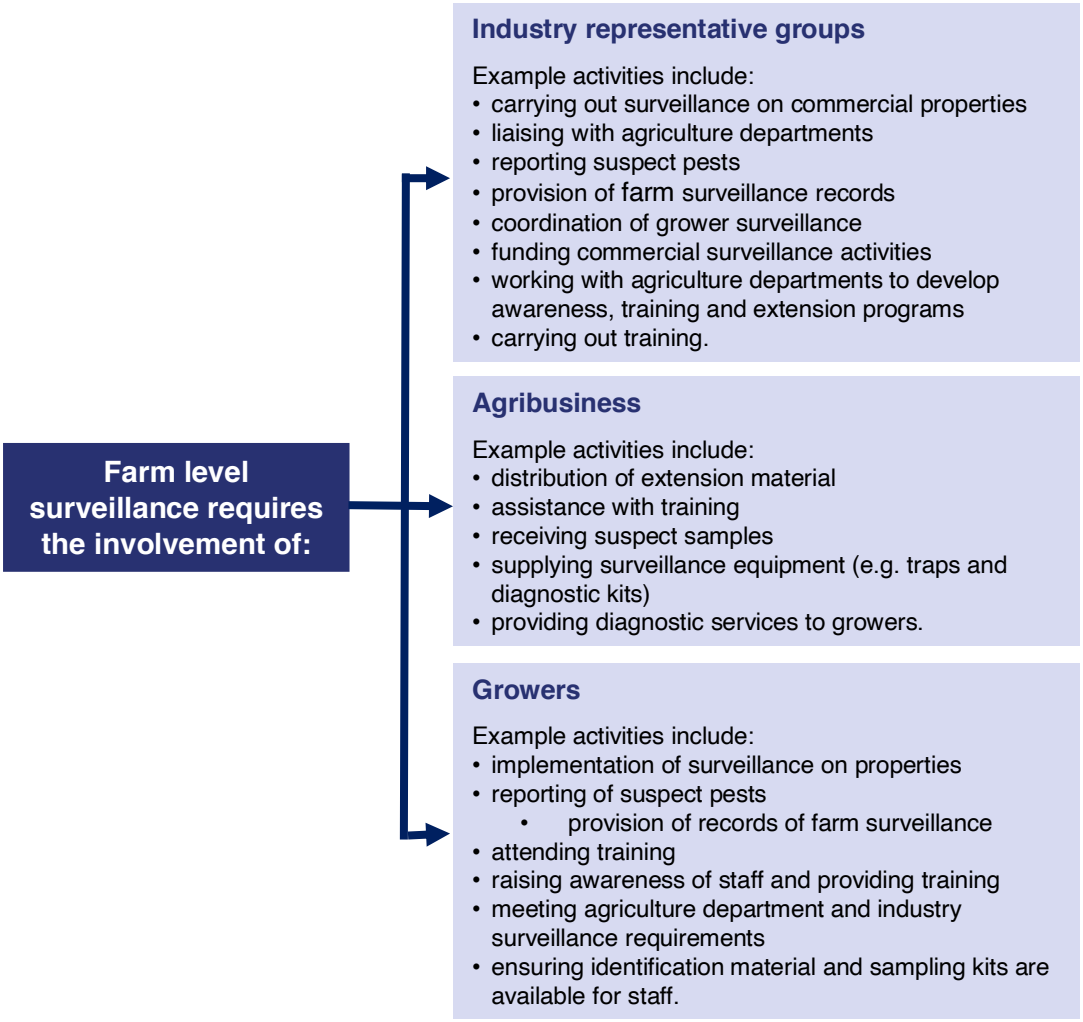


Figure 3. **Examples of farm level surveillance activities**

Training

A key component of biosecurity preparedness is ensuring personnel engaged are suitable and effectively trained for their designated roles in a response. Biosecurity preparedness training is the responsibility of all governments and industries involved in the biosecurity system.

National EPP Training Program

PHA supports its members in training personnel through the delivery of the National EPP Training Program. This program is focussed on ensuring personnel from the governments and peak industry bodies that will be involved in responding to EPPs have the skills and knowledge to effectively fulfil the roles and responsibilities, as signatories to the EPPRD. This covers a range of areas, from representatives on the national decision making committees (i.e. the Consultative Committee on Emergency Plant Pests and the National Management Group) through to industry liaison personnel in the State Coordination or Local Control Centres.

In addition to face to face training delivered to members and the provision of simulation exercises, PHA also offers biosecurity training through the Biosecurity OnLine Training (BOLT) platform which houses a variety of eLearning courses relevant to plant biosecurity. Access to BOLT is free and open to any stakeholder interested in biosecurity, and is available through **www.planthealthaustralia.com.au/bolt**.

For more information on the National EPP Training program, refer to **www.planthealthaustralia.com.au/training**.

Awareness

Early reporting enhances the chance of effective control and eradication. Awareness activities raise the profile of biosecurity and exotic pest threats to the onion industry, which increases the chance of early detection and reporting of suspect pests. Responsibility for awareness material lies with industry and government, with assistance from PHA as appropriate. Any unusual plant pest should be reported immediately to the relevant state/territory agriculture department through the Exotic Plant Pest Hotline (1800 084 881).

High priority plant pest threat-related documents

Pests listed in Table 1 have been identified as high priority threats to the onion industry by members of the TEG. They have been assessed as having high entry, establishment and spread potentials and/or a high economic impact. This list should provide the basis for the development of awareness material for the industry.

Further information on high priority pests

The websites listed below (Table 12) contain information on pests across most plant industries, including the onion industry.

Table 12. *Sources of information on high priority pest threats for the onion industry*

Source	Website
Department of Agriculture, Water and the Environment	**www.agriculture.gov.au**
Pest and Disease Image Library (PaDIL)	**www.padil.gov.au**
DAF Queensland A-Z list of significant plant pests and diseases	**www.daf.qld.gov.au/plants/health-pests-diseases/a-z-significant**
University of California Statewide Integrated Pest Management (IPM) Program	**www.ipm.ucdavis.edu/EXOTIC/exoticpestsmenu.html**
European and Mediterranean Plant Protection Organization (EPPO)	**www.eppo.int/DATABASES/pqr/pqr.htm**

Further information/relevant web sites

A range of government and grower organisation details and websites are provided below (Table 13) for persons seeking further information on onion industry biosecurity.

Table 13. *Relevant sources of further biosecurity information for the onion industry*

Agency	Website/email	Phone	Address
National			
Onions Australia	**onionsaustralia.org.au**	(08) 8725 8862	PO Box 9420, Mount Gambier West, SA 5291
Department of Agriculture, Water and the Environment	**www.agriculture.gov.au**	(02) 6272 3933 1800 020 504	GPO Box 858 Canberra, ACT 2601
Plant Health Australia	**www.planthealthaustralia.com.au** **biosecurity@phau.com.au**	(02) 6215 7700	Level 1, 1 Phipps Cl Deakin, ACT 2600
New South Wales			
Department of Primary Industries	**http://www.dpi.nsw.gov.au/biosecurity/plant**	(02) 6391 3535	Locked Bag 21 Orange, NSW 2800
Queensland			
Biosecurity Queensland, a part of the Department of Agriculture and Fisheries, Queensland	**www.daf.qld.gov.au** **callweb@daf.qld.gov.au**	**13 25 23**[47] **(07) 3404 6999**[48]	80 Ann Street Brisbane, QLD 4000

[47] Within Qld
[48] Interstate

Agency	Website/email	Phone	Address
Northern Territory			
Department of Primary Industry and Resources	**www.nt.gov.au/d/Primary_Industry** **info.DPIF@nt.gov.au**	(08) 8999 5511	Berrimah Farm, Makagon Road, Berrimah, NT 0828
South Australia			
Primary Industries and Regions SA	**www.pir.sa.gov.au**	(08) 8226 0900	GPO Box 1671, Adelaide, SA 5001
Biosecurity SA-Plant Health	**www.pir.sa.gov.au/biosecuritysa/planthealth** **PIRSA.planthealth@sa.gov.au**	(08) 8207 7820	33 Flemington Street, Glenside, SA 5065
Biosecurity SA-Plant Health Market access and Interstate Certification Assurance	**IRSA.planthealthmarketaccess@sa.gov.au**	(08) 8207 7814	
Biosecurity SA-Plant Health Transport manifest lodgement	**pirsa.planthealthmanifest@sa.gov.au**	Fax (08) 8124 1467	
South Australian Research and Development Institute	**www.sardi.sa.gov.au** **sardi@sa.gov.au**	(08) 8303 9400	2b Hartley Grove Urrbrae, SA 5064
Tasmania			
Department of Primary Industries, Parks, Water and Environment	**www.dpipwe.tas.gov.au** **BPI.Enquiries@dpipwe.tas.gov.au**	1300 368 550	GPO Box 44, Hobart, TAS 7001
Victoria			
Department of Jobs, Precincts and Regions	**https://djpr.vic.gov.au/**	136 186	Biosecurity-Regulation and Compliance, Private bag 15, Ferntree Gully Delivery Centre, Vic 3156

Agency	Website/email	Phone	Address
Western Australia			
Department of Primary Industries, Resources and Development	**www.agric.wa.gov.au** **enquiries@agric.wa.gov.au**	(08) 9368 3333	DAFWA 3 Baron-Hay Court, South Perth, WA 6151

Farm biosecurity

Introduction

Plant pests can have a major impact on production if not managed effectively. This includes pests already present in Australia and a number of serious pests of onion that Australia does not have.

Farm biosecurity measures can be used to minimise the spread of such pests before their presence is known or after they are identified, and therefore can greatly increase the likelihood that they could be eradicated. This section of the document outlines farm biosecurity and hygiene measures to help reduce the impact of pests on the industry.

The biosecurity and hygiene measures outlined here can be considered as options for each farm's risk management. Many of these measures can be adopted in a way that suits a given farm so that each can have an appropriate level of biosecurity.

Farm biosecurity reporting procedures and hygiene strategies to reduce threats covered in this document are:

- selection and preparation of appropriate plant material
- chemical control measures
- control of vectors
- control of alternative hosts
- neglected farms and volunteer plants
- post-harvest handling and produce transport procedures
- use of warning and information signs
- managing the movement of vehicles and farm equipment
- movement of people
- visiting overseas farms/orchards – what to watch out for when you return
- including farm biosecurity in Industry best management practice and quality assurance schemes
- farm biosecurity checklist

Development of an on farm biosecurity plan tailored to the needs of an individual operation is a good way to integrate best practice biosecurity with day to day operations (**www.farmbiosecurity.com.au/planner/**). Further information on farm biosecurity can be found at **www.farmbiosecurity.com.au** or by contacting Onions Australia**.**

Reporting suspect exotic plant pests

Rapid reporting of exotic plant pests is critical: early detection gives Australia the best chance to effectively control and eradicate pests. If you find something you believe could be an exotic plant pest, call the Exotic Plant Pest Hotline immediately to report it to your local state or territory government.

The one phone number – 1800 084 881 – will connect to an automated system that allows the caller to choose the state or territory that the report relates to. The caller will then be connected to the relevant authority for that jurisdiction. Most lines are only monitored during business hours. Messages can be left outside of those hours and calls will be returned as soon as an officer is available. A summary of the opening hours for each state and territory is provided in Table 14. Each jurisdiction also has an alternative contact to ensure no report is missed. It does not matter which of these methods is used to report a suspect exotic plant pest. The important thing is to report it.

Calls to the Exotic Plant Pest Hotline will be answered by an experienced person, who will ask some questions to help understand the situation, such as:

- What was seen (describe the pest or send a photo)
- Where it was found
- What it was found on
- How many pests are present/how infected is the crop
- How widely distributed it is
- When it was first noticed

It is important not to touch or move the suspect material as this may spread the exotic pest or render samples unsuitable for diagnostic purposes. A biosecurity officer may attend the location to inspect and collect a sample. In some cases, the biosecurity officer will explain how to send a sample for testing. In this circumstance they will explain how to do this without risk of spreading the pest and allowing it to arrive at the laboratory in a suitable condition to be identified.

Every report will be taken seriously, will be followed up and treated with confidentiality.

Table 14. *Exotic Plant Pest Hotline hours of operation and alternate contact information for reporting per jurisdiction*

State/ territory	Hotline hours	Alternative contact
NSW	Operates 0830 – 1630 Monday to Friday. After hours answering machine service with messages followed up the next business day.	**biosecurity@dpi.nsw.gov.au**
NT	Operates 0800 – 1630 Monday to Friday. After hours answering machine service with messages followed up the next business day.	**quarantine.NT@nt.gov.au**
QLD	Operates 0800-1700 Monday to Friday (0900-1700 Thursday). Calls outside these hours answered by a third party who will take the message and depending on the urgency of the report, organise a response from a biosecurity officer as soon as possible.	Biosecurity Queensland on 13 25 23
SA	Operates 24 hrs/ 7 days	**Online plant pest report form**[49]
TAS	Operates 24 hrs/ 7 days	Biosecurity Tasmania 03 6165 3777
VIC	Operates 0800 – 1800 Monday to Friday. After hours answering machine service with messages followed up the next business day. Option also to forward to the 24 hr Emergency Animal Disease Watch Hotline.	**plant.protection@ecodev.vic.gov.au**
WA	Operates 0830 – 1630 Monday to Friday. After hours answering machine service with messages followed up the next business day.	**info@agric.wa.gov.au**

Recent changes to legislation in some states includes timeframes for reporting and have implications for those who do not report. It is important that individuals know the obligations for their jurisdiction.

Some onion pests are notifiable under each state or territory's quarantine legislation. Each state or territory's list of notifiable pests are subject to change over time so contacting your local state/territory agricultural agency (details in Table 10)) will ensure information is up to date. Landowners and consultants have a legal obligation to notify the relevant state/territory agriculture agency of the presence of those pests within a defined timeframe (Table 14).

[49] Available from **https://form.jotform.co/70732909804864**

Preparedness

Pest-specific preparedness and response information documents

To help prepare for an incursion response a list of pest-specific preparedness and response information documents are provided in Table 5 that may support a response. Over time, as more resources are produced for pests of the onion industry they will be included in this document and made available through the PHA website. Resources include the development of pest-specific information and emergency response documents, such as fact sheets, contingency plans, diagnostic protocols and a summary of surveillance programs currently in operating for these high priority pests (see **www.planthealthaustralia.com.au/pidd**). These documents and programs should be developed over time for all medium to high risk pests listed in the TSTs (Appendix 2).

Fact sheets

Fact sheets or information sheets are a key activity of biosecurity extension and education with growers. Fact sheets provide summary information about the pest, its biology, what it looks like and what symptoms it may cause. They also contain detailed images. For a list of current fact sheets available from PHA for olive producers see (Table 13).

Contingency Plans

Contingency Plans provide background information on the pest biology and available control measures to assist with preparedness for incursions of a specific pest into Australia. The contingency plan provides guidelines for steps to be undertaken and considered when developing a response plan for the eradication of that pest. Any response plan developed using information in whole or in part from a contingency plan must follow procedures as set out in PLANTPLAN and be endorsed by the National Management Group prior to implementation.

As a part of contingency planning, biological and chemical control options are considered as are options for breeding for pest resistance. Through the planning process, it may be discovered that there are gaps in knowledge. Such gaps should be identified and consequently be considered as RD&E needs to be met within the implementation table.

For a list of current contingency plans see **www.planthealthaustralia.com.au/pidd**.

Table 15. Pest-specific information documents for the onion industry[50]

Scientific name	Common name	Fact sheet	Contingency plan
INVERTEBRATES			
DIPTERA (Flies and midges)			
Chromatomyia horticola	Pea leaf miner	Yes[51]	Yes[52]
Delia antiqua	Onion fly	Yes[53]	No
Eumerus strigatus	Lesser bulb fly	Yes[54]	No
Liriomyza huidobrensis	Serpentine pea leaf miner	Yes[55]	Yes[56]
Liriomyza sativae	Vegetable leaf miner	Yes[57]	Yes[58]
Liriomyza trifolii	American serpentine leaf miner	Yes[59]	Yes[60]
Phytomyza gymnostoma	Allium leaf miner	Yes[61]	No
THYSANOPTERA (Thrips)			
Frankliniella occidentalis	Western flower thrips	Yes[62]	No
Thrips tabaci (exotic strains/biotypes)	Onion thrips	Yes[63]	No
PATHOGENS			
BACTERIA			
Xanthomonas axonopodis pv. *allii*	Xanthomonas leaf blight	Yes[64]	No
FUNGI			
Botrytis squamosa (syn.*Sclerotinia squamosa*)	Leaf rot and neck rot of onion	Yes[65]	No

[50] Copies of these documents are available from www.planthealthaustralia.com.au/pidd or by contacting the relevant state/territory agriculture agency.
[51] http://www.planthealthaustralia.com.au/wp-content/uploads/2014/02/Exotic-leaf-miners-FS-Grains.pdf
[52] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/American-serpentine-and-other-leaf-miners-CP-2008.pdf
[53] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Onion-fly-FS.pdf
[54] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Lesser-bulb-fly-FS.pdf
[55] http://www.planthealthaustralia.com.au/wp-content/uploads/2014/02/Exotic-leaf-miners-FS-Grains.pdf; http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Exotic-leaf-miners-FS-Vegetable.pdf; http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Serpentine-leaf-miner-FS.pdf
[56] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/American-serpentine-and-other-leaf-miners-CP-2008.pdf ; http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Serpentine-leaf-miner-CP-2009.pdf
[57] http://keys.lucidcentral.org/keys/v3/leafminers/key/Polyphagous%20Agromyzid%20Leafminers/Media/Html/Liriomyza_sativae.htm ; http://www.planthealthaustralia.com.au/sci_name/liriomyza-sativae/
[58] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/American-serpentine-and-other-leaf-miners-CP-2008.pdf
[59] http://www.planthealthaustralia.com.au/wp-content/uploads/2014/02/Exotic-leaf-miners-FS-Grains.pdf; http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Exotic-leaf-miners-FS-Vegetable.pdf
[60] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/American-serpentine-and-other-leaf-miners-CP-2008.pdf
[61] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Allium-leaf-miner-FS.pdf
[62] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/01/Western-flower-thrips-FS.pdf
[63] http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1260&context=extension_curall ; http://www.pestnet.org/fact_sheets/onion_thrips_117.htm
[64] http://horticulture.com.au/wp-content/uploads/2016/11/Bacterial-onion-blight-FS.pdf ; https://www.eppo.int/QUARANTINE/data_sheets/bacteria/XANTAL_ds.pdf
[65] http://www.appsnet.org/publications/potm/pdf/Apr10.pdf

Scientific name	Common name	Fact sheet	Contingency plan
Urocystis cepulae	Onion smut	Yes[66]	No
VIRUSES			
Tomato black ring virus (Nepovirus)	Tomato black ring virus	Yes[67]	No
Tomato spotted wilt virus (Tospovirus)	Tomato spotted wilt virus	No	Yes[68]
NEMATODES			
Meloidogyne enterolobii (syn. *Meloidogyne mayaguensis)*	Root knot nematode	Yes[69]	No

National Diagnostic Protocols

Diagnostic protocols are documents that contain information about a specific plant pest, or related group of pests, relevant to its diagnosis. National Diagnostic Protocols (NDPs) are diagnostic protocols for the unambiguous taxonomic identification of a pest in a manner consistent with ISPM No. 27 – Diagnostic Protocols for Regulated Pests. NDPs include diagnostic procedures and data on the pest, its hosts, taxonomic information, detection and identification.

Australia has a coherent and effective system for the development of NDPs for plant pests managed by the Subcommittee on Plant Health Diagnostics (SPHD). NDPs are peer reviewed and verified before being endorsed by Plant Health Committee (PHC).
Endorsed NDPs are available on the National Plant Biosecurity Diagnostic Network (NPBDN) website (**www.plantbiosecuritydiagnostics.net.au**), together with additional information regarding their development and endorsement.

Diagnostic information for some onion pests is also available through the PHA website **www.planthealthaustralia.com.au/pidd**. For diagnostic information on fruit flies, refer to the Australian Handbook for the Identification of Fruit Flies, available from the PHA website.

[66] http://www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=55787 ; www.padil.gov.au/aus-smuts/pest/pdf/140139
[67] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Nepovirus-group-FS.pdf
[68] http://www.planthealthaustralia.com.au/wp-content/uploads/2013/03/Thrips-transmitted-viruses-CP-2011.pdf
[69] http://www.plantwise.org/KnowledgeBank/Datasheet.aspx?dsid=33248 ;
http://www.pestnet.org/fact_sheets/root_knot_nematodes_127.htm

Table 16. Onion pests for which draft diagnostic protocols or diagnostic information exists

Scientific name	Common name	Document link
Shallot yellow stripe potyvirus (Potyvirus)	Shallot yellow stripe potyvirus	(Draft NDP for "*Potyvirus general*")
Welsh onion yellow stripe potyvirus (Potyvirus)	Welsh onion yellow stripe potyvirus	(Draft NDP for "*Potyvirus general*")

Research Development and Extension

Research, Development and Extension – Linking Biosecurity Outcomes to Priorities

Through the biosecurity planning process, gaps in knowledge or extension of knowledge will have been identified and need to be documented in the implementation table. Some of these gaps will require further research and development (e.g. understanding risk pathways, developing surveillance programs or diagnostic protocols, developing tools to facilitate preparedness and response, developing IPM or resistance breeding strategies), other gaps will require communication or extension of that knowledge to various target audiences (developing awareness raising materials, undertaking training exercises, running workshops, consideration of broader target audiences).

It is important that the RD&E gaps identified through this plan feed directly into the normal annual RD&E priority setting and strategic planning activities that an industry undertakes. This is fundamental if an industry is to progress biosecurity preparedness and response throughout the life of the biosecurity plan.

Market access

As an active trading nation, Australia has entered into a number of multilateral and bilateral trade agreements that influence its plant biosecurity system. On a multilateral level, Australia's rights and obligations in relation to plant biosecurity are set out under World Trade Organization (WTO) agreements, particularly the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), although others may apply in certain circumstances.

The SPS Agreement provides WTO member countries with the right to use sanitary and phytosanitary measures to protect human, animal and plant life or health. Under this agreement countries are allowed to specify consistent, science-based conditions aimed at providing sanitary and phytosanitary protection but not unnecessarily restricting trade. The establishment of exotic pests in Australia may result in conditions on Australian exports that previously did not apply and in some cases, may result in the short or long term loss of overseas markets, depending on the significance of the pest to the trading partner and the availability of options to reduce the risk to acceptable levels. These options could include measures such as pest free areas or place of production or treatments e.g. cold or fumigation. The time taken to regain access will depend on the availability and acceptance of measures to reduce risk and the receiving markets risk appetite.

Market access for the onion industry

Export is a high priority for the onion industry. The Australian onion industry have identified Japan, Singapore, the United Arab Emirates, New Zealand, Malaysia and Kuwait as existing markets for onion exports. Potential markets the onion industry may move into are China, South Korea, Japan, Taiwan and Indonesia. The development of these markets may be hampered by the establishment of exotic pests. To this end, the likelihood of entry restrictions being imposed by these ten markets if a high priority pest is detected in Australia has been summarised below (Table 17 and Table 18).

***Table 17**. Likelihood of entry restrictions being imposed for existing markets if an exotic high priority pest establishes in Australia*

Common name (Scientific name)	Europe	Japan	Malaysia	Thailand	UAE	Singapore	Taiwan	Hong Kong
Rust of chives *(Puccinia mixta)*	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present
Rust of garlic and chives (*Puccinia allii* ("Koike's race"))	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present
Rust of leek (*Puccinia porri)*	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is present
Bean fly (*Delia florilega*[70]*)*	Unlikely as pest is present	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present
Leaf blotch *(Cladosporium allii (*syn. *Heterosporium allii))*	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present

[70] From http://eol.org/pages/733037/overview

Common name (Scientific name)	Europe	Japan	Malaysia	Thailand	UAE	Singapore	Taiwan	Hong Kong
Leaf rot and neck rot of onion (*Botrytis squamosa* (syn. *Sclerotinia squamosa)*)	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present
Onion fly (*Delia antiqua)*	Unlikely as pest is present	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present
Onion smut (*Urocystis cepulae)*	Unlikely as pest is present	Unlikely as pest is present	Possible as pest is not known to be present	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is present	Unlikely as pest is likely to be present
Onion thrips (*Thrips tabaci* (exotic strains/biotypes))	Unlikely as pest is present	Unlikely as pest is present	Possible as pest is not known to be present	Unlikely as pest is present	Possible as pest is not known to be present	Unlikely as pest is present	Unlikely as pest is present	Unlikely as pest is present
Root knot nematode (*Meloidogyne enterolobii* (syn. *Meloidogyne mayaguensis*))	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present
Vegetable leafminer (*Liriomyza sativae)*	Possible as pest is not known to be present	Unlikely as pest is present	Unlikely as pest is present	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present

Common name (Scientific name)	Europe	Japan	Malaysia	Thailand	UAE	Singapore	Taiwan	Hong Kong
Xanthomonas leaf blight (*Xanthomonas axonopodis* pv. *allii)*	Possible as pest is not known to be present	Unlikely as pest is present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present

Table 18. *Likelihood of entry restrictions being imposed for potential markets if an exotic high priority pest establishes in Australia*

Common name (Scientific name)	Qatar	Bahrain	Kuwait	Saudi Arabia	Korea	Philippines	Cambodia	Laos
Rust of chives *(Puccinia mixta)*	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present
Rust of garlic and chives (*Puccinia allii* ("Koike's race"))	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present
Rust of leek (*Puccinia porri)*	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present

Common name (Scientific name)	Qatar	Bahrain	Kuwait	Saudi Arabia	Korea	Philippines	Cambodia	Laos
Bean fly (*Delia florilega*[71])	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present
Leaf blotch *(Cladosporium allii* (syn. *Heterosporium allii))*	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present
Leaf rot and neck rot of onion (*Botrytis squamosa* (syn. *Sclerotinia squamosa))*	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present
Onion fly (*Delia antiqua)*	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is present	Unlikely as pest is present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present
Onion smut (*Urocystis cepulae)*	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is present	Unlikely as pest is present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present

[71] From http://eol.org/pages/733037/overview

Common name (Scientific name)	Qatar	Bahrain	Kuwait	Saudi Arabia	Korea	Philippines	Cambodia	Laos
Onion thrips (*Thrips tabaci* (exotic strains/biotypes))	Unlikely as pest is present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present	Unlikely as pest is present	Unlikely as pest is present	Unlikely as pest is present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present
Root knot nematode (*Meloidogyne enterolobii* (syn. *Meloidogyne mayaguensis*))	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present
Vegetable leafminer (*Liriomyza sativae)*	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present
Xanthomonas leaf blight (*Xanthomonas axonopodis* pv. *allii)*	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Possible as pest is not known to be present	Unlikely as pest is likely to be present	Unlikely as pest is likely to be present

Implementation actions

To help maintain or facilitate market access, in the event of an incursion, the onion industry in partnership with the Department of Agriculture, Water and the Environment and the relevant state and territory governments should develop the following, for the pests identified in Table 17 and Table 18:

- Surveillance plan including a method for collecting and storing surveillance data
- Diagnostic protocols that have been assessed in the Australian environment
- Biosecurity treatment measures (e.g. irradiation or fumigation)

Implementation of these actions will be required for all pests as this data will also be crucial for maintaining interstate trade should an incursion occur within Australia, resulting in a restricted distribution or quarantine zone. The implemented system should also take into account the likelihood of having entry restrictions imposed by overseas trade partners for those pests identified as possible in Table 17. A single system will facilitate market access discussions for both domestic and international trade and will minimise the potential disruption to the industry.

References

Department of Agriculture, Fisheries and Forestry (2011) Import Risk Analysis Handbook 2011. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

RESPONSE MANAGEMENT

Introduction

No matter how many preparedness activities are undertaken or how much surveillance is done at the border, a small amount of plant pests will inevitably make their way into Australia. This section outlines the national agreements and processes in place to effectively respond to such incursions.

The Emergency Plant Pest Response Deed

A fundamental component of the Australian plant biosecurity system is the Emergency Plant Pest Response Deed (EPPRD), which is an agreement between the Australian government, the state/territory governments,33 plant industries (including Onions Australia) and PHA (collectively known as the signatories), that allows the rapid and efficient response to Emergency Plant Pests (EPPs)[72]. The EPPRD is a legally binding document that outlines the basic operating principles and guidelines for eradication responses of EPPs.

The EPPRD provides:

- A national response management structure that enables all governments and plant industry signatories affected by the EPP to contribute to the decisions made about the response.
- An agreed structure for the sharing of costs to deliver eradication responses to EPPs detected in Australia. Costs are divided between signatories affected by the EPP in an equitable manner.
- A mechanism to encourage reporting of EPP detections and the implementation of risk mitigation activities.
- A mechanism to reimburse growers whose crops or property are directly damaged or destroyed as a result of implementing a Response Plan.

For further information on the EPPRD and frequently asked questions, visit **www.planthealthaustralia.com.au/epprd** or **www.planthealthaustralia.com.au/epprd-qa**.

[72] Refer to the PHA website for details of what an EPP is **http://www.planthealthaustralia.com.au/biosecurity/emergency-plant-pests/**

PLANTPLAN

PLANTPLAN outlines the generic approach to response management under the EPPRD and introduces the key roles and positions held by industry and government during a response. The document is supported by a number of operating guidelines, job cards and standard operating procedures that provide further detail on specific topics.

PLANTPLAN underpins the EPPRD and is endorsed by all EPPRD signatories.
The current version of PLANTPLAN and supporting documents are available on the PHA website (**http://www.planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/**).

Funding a response under the EPPRD

This section outlines how eradication responses are nationally cost shared between affected industries and governments.

Cost sharing a response

Affected industries and governments invest in the eradication of EPPs and share the costs of an agreed response plan, this is referred to as 'cost sharing'. Not all activities in a response are eligible to be cost shared, with some activities considered as normal commitments[73] for signatories.

The cost shared costs of a response are divided between affected industries and governments in an equitable manner directly relating to the public versus private benefit of eradicating the EPP. These relative benefits are represented by the category of the pest, with the overall view that 'the higher the benefit, the greater the investment'.

There are four categories for EPPs, as shown in Table 19. The category indicates how the funding will be split between government and industries; with the governments funding the

[73] Further information can be found in the guideline document for Normal Commitments for Parties to the Emergency Plant Pest Response Deed available from **http://www.planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/**

share of public benefit and industry funding the share of private benefit. The category does not indicate the likelihood of eradication or the overall importance of the EPP.

Table 19. *The categories and funding allocations to government and industry parties to the EPPRD*

Category	Government allocation	Industry allocation
Category 1	100%	0%
Category 2	80%	20%
Category 3	50%	50%
Category 4	20%	80%

Pest categorisation

The list of categorised EPPs can be found in *schedule 13 of the EPPRD*. In the event that a response plan is endorsed for an uncategorised EPP, cost sharing will commence using the default category (category 3), and may be revised later.

Any signatory to the EPPRD can request for additional pests to be categorised and added to *schedule 13 of the EPPRD*. Contact **EPPRD@phau.com.au** for more information and guidance on this process.

Once a substantiated request has been received by PHA a group of independent scientific technical experts (known as the categorisation group) will be convened to assess all known information about the EPP to identify the public and private benefits. Full details can be found in *clause 7 and schedule 3 of the EPPRD*.

Categorised Onion EPPs

The EPPs for the onion industry that are categorised and listed on *schedule 13 of the EPPRD*[74] are listed in Table 20.

[74] For the latest version of *schedule 13*, refer to the EPPRD version found at **www.planthealthaustralia.com.au/epprd**.

Table 20. *Categorised EPPs for onion industry (as at 30 September, 2017)*[75]

Formal Category	Scientific name	Common name
3	*Liriomyza sativae*	Vegetable leafminer

How to respond to a suspect EPP

Following the detection of a suspect EPP, the relevant state or territory agricultural agency will be notified either directly or through the Exotic Plant Pest Hotline. Within 24 hours of the state agency having a reasonable suspicion that they are dealing with an EPP the, Chief Plant Health Manager (CPHM) of the state or territory, will inform the Australian Chief Plant Protection Officer (ACPPO) within the Federal Department of Agriculture, Water and the Environment. All signatories affected by the EPP (both government and industry) will be notified immediately, and the Consultative Committee on Emergency Plant Pests (CCEPP) convened (this process is outlined in Figure 4). Only the industry signatories affected by the EPP are engaged in the response process and are determined based on the known hosts of the EPP.

[75] Note scientific and common names are listed as they appear in the EPPRD

Figure 4. *Reporting suspect EPPs and notification process*

Once a pest is notified to the CCEPP, all signatories that are affected by the EPP play a part in the national management of the incursion. This is primarily through the two national decision making committees, both of which Onions Australia have a representative on:

- The Consultative Committee on Emergency Plant Pests (CCEPP) which provide technical expertise on the response
- The National Management Group (NMG) which acts on recommendations from the CCEPP and make the final decisions about EPP responses and funding.

Technical and economic considerations are reviewed, and a decision made on whether to eradicate using the cost sharing mechanisms under the EPP (i.e. develop a response plan) or take another course of action (potentially to contain or stand down the response to the incursion, which will mean long term management of the pest).

The relevant state/territory agriculture department is responsible for the on ground response to EPPs and will adopt precautionary emergency containment measures if appropriate. Depending on the nature of the EPP, measures could include:

- Restriction of operations in the area
- Disinfection and withdrawal of people, vehicles and machinery from the area
- Restricted access to the area
- Control or containment measures

Each response to an EPP is applied differently due to the nature of the incursion, however each follows the defined phases of a response as summarised in Figure 5 and in the text below.

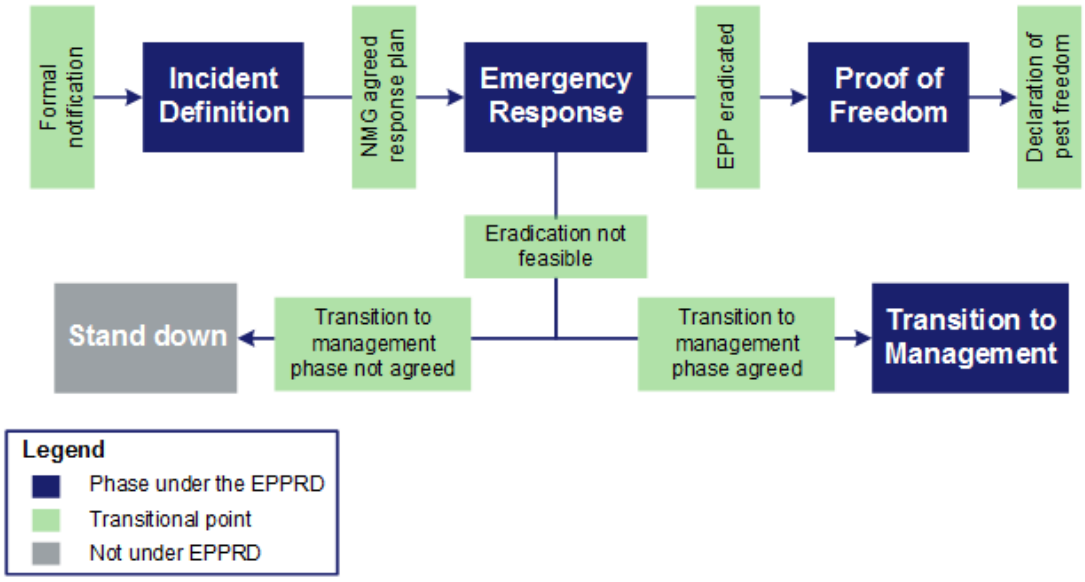
Figure 5. *EPPRD response phases*

Incident definition phase

The aim of the incident definition phase is to investigate the nature and extent of the incursion. The phase commences following formal notification to the CCEPP and continues until the NMG endorses a response plan or determines that the EPP is not eradicable.

Emergency response phase

The aim of the emergency response phase is to implement the response plan to eradicate the EPP. This phase commences once a response plan is endorsed by the NMG and continues until the CCEPP declares that the EPP has been eradicated or it is deemed by the NMG that the EPP is no longer eradicable.



Proof of freedom phase

The aim of the proof of freedom phase is to undertake activities to confirm whether the EPP has been eradicated. This phase begins once the CCEPP determines that the emergency response activities have been successfully completed and continues until the NMG declares freedom from the EPP or that the proof of freedom phase should come to an end.

Transition to management phase

The aim of the transition to management phase is to undertake activities seeking eradication of the EPP during an emergency response to management of the EPP outside of the EPPRD. If during the course of the emergency response phase the CCEPP and NMG agree it is no longer feasible to eradicate the EPP, a transition to management phase may be agreed. This phase will begin if determined by the NMG as appropriate and transition to management activities are achievable within a defined and reasonable timeframe not exceeding 12 months. This phase continues until the NMG determines that transition to management has been completed or that the transition to management phase should come to an end.

Further information about the response processes under the EPPRD can be found in the PHA Foundation Course and National EPP Response Management BOLT courses[76].

Owner Reimbursement Costs

Owner Reimbursement Costs (ORCs) were developed to encourage early reporting and increase the chance of successful eradication. ORCs are included in the shared costs of a response and are available to eligible growers to alleviate the financial impacts of crops or property that are directed to be destroyed under an agreed response plan.

ORCs are paid to the owner and may cover direct costs associated with implementing a response plan, including:

- Value of crops destroyed
- Replacement of destroyed capital items
- Fallow periods
- Extra treatments directed under the response plan

[76] All of PHA's BOLT courses are feely available at **https://pha.canopihr.com.au**

ORCs are only available when there is an approved response plan under the EPPRD, and only to industries that are signatories to the EPPRD, such as the onion industry. The value of ORCs is directed by the **ORC Evidence Framework** and is based on an agreed valuation approach developed for each industry.

Further information about ORCs is available from **www.planthealthaustralia.com.au/biosecurity/incursion-management/owner-reimbursement-costs/**

Industry involvement in a response

Onions Australia are the peak industry body for the onion industry, i.e. signatory to the EPPRD, and for the purposes of the EPPRD, represent the crops listed in *schedule 7 of the EPPRD*. Onions Australia is the key industry contact point if a plant pest affecting the onion industry is detected and responded to using the EPPRD (Table 21). Onions Australia representatives will sit on the CCEPP and the NMG and make decisions on behalf of the onion industry. It is important that all signatories to the EPPRD ensure their contacts for these committees are nominated to PHA[77] and updated swiftly when personnel change.

Table 21. *Contact details for Onions Australia.*

Website	onionsaustralia.org.au
Postal address	PO Box 9420, Mount Gambier West, SA 5291
Email	lechelle@onionsaustralia.org.au
Phone	(08) 8725 8862
Fax	(08) 8725 8863

Cooperation is required between relevant government and industry bodies to ensure the effective development and implementation of a response to an EPP, and the management of media, communications and trade issues. As such, there is also the opportunity for Onions Australia to appoint an Industry Liaison Coordinator in the State Coordination Centre for the response and Industry Liaison Officers in Local Control Centres at the heart of the response activities to allow industry input in all levels of the response activities. In addition to the state or territory agricultural agency leading the response, Onions Australia have the responsibility for delivering relevant industry communication and media regarding the incursion (refer to PLANTPLAN and the supporting documents for information on approved communications during a response).

Readers should refer to PLANTPLAN or undertake the relevant BOLT courses[76] for further information.

[77] Contact **EPPRD@phau.com.au** for more information.

References

Plant Health Australia Ltd (2017) Government and Plant Industry Cost Sharing Deed in respect of Emergency Plant Pest Responses (2017) Plant Health Australia, Canberra, ACT.

PLANTPLAN (2016) PLANTPLAN Australian Emergency Plant Pest Response Plan. Version 3. (**www.planthealthaustralia.com.au/plantplan**).

APPENDIX 1: PROFILE OF THE AUSTRALIAN ONION INDUSTRY

Onion industry background

To develop any biosecurity plan it is critical to understand the profile and context of the industry.

Industry profile

Onions Australia is the national peak industry body, representing Australian onion growers.

The main growing areas for onion production include the Lockyer Valley, St George and Darling Downs in Queensland; Murrumbidgee Irrigation Area in NSW; Adelaide Plains, Riverland and south eastern SA; Manjimup and Pemberton in WA; Werribee and Cranbourne in Victoria; and the north western to northern midlands of Tasmania.

Sowing of onions starts in Queensland during February (short day types) and finishes in the southern states in August (long day types). Harvest starts in Queensland during September and finishes during April in the southern states.

During the financial year ending June 2016, the industry produced 260,674 tonnes of onions (2015-16 Australian Horticulture Statistics Handbook). The value of production was $157.7 million while the wholesale value of the fresh supply was $159.4 million. This was broken down into 77% of onions produced that were used for fresh onion supply, 7% for processing and 17% for fresh onion export.

References

Horticulture Innovation Australia Limited (2017a) 2015/16 Australian Horticulture Statistics Handbook. Available from: **http://horticulture.com.au/wp-content/uploads/2016/09/Horticulture-Statistics-Handbook-2015-16-Vegetables.pdf**

Horticulture Innovation Australia Limited (2017b) Australian onion industry strategic investment plan 2012-2017 Available from: **http://horticulture.com.au/wp-content/uploads/2016/01/HortInn-SIP-Onion.pdf**

Onions Australia (2017), Allium crops in Australia. Available from: **www.onionsaustralia.org.au/aboutonions/allium-crops.htm**.

APPENDIX 2: THREAT SUMMARY TABLES

Onion industry threat summary tables

The information provided in the threat summary is an overview of exotic plant pest threats to the onion industry. More than 113 exotic plant pests were identified. Summarised information on entry, establishment and spread potentials and economic consequences of establishment are provided where available. Pests under official control[78] or eradication may be included in these tables where appropriate. However, onion pests that are established but regionalised within Australia are not covered by TSTs, but may be assessed in state biosecurity plans. Assessments may change given more detailed research, and will be reviewed with the biosecurity plan.

Full descriptions of the risk rating terms can be found on page 62. An explanation of the method used for calculating the overall risk can be found on the PHA website[79]. Additional information on a number of the pests listed in the TSTs can be found in pest-specific information document (Table 5).

[78] Official control defined in ISPM No. 5 as 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

[79] Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

***Table 22**: Onion invertebrate threat summary table*

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
ACARI (Mites e.g. spider and gall mites)										
***Tetranychus urticae* (exotic biotypes)[80]**	Two-spotted spider mite	Onion	Bulb	Wind, plants, tools and machinery, people[81]	Worldwide	HIGH	HIGH	HIGH	UNKNOWN	**UNKNOWN**
COLEOPTERA (Beetles and weevils)										
Agriotes lineatus	Common click beetle	Polyphagous including all *Allium* spp., potato, corn, carrot and tomato	Seedling, foliage	Infested soil	North America, Western Europe	MEDIUM	MEDIUM	MEDIUM	MEDIUM[82]	**LOW**
Ceutorhynchus jakovlevi	Onion weevil	Onion and garlic	Foliage	Unknown	Unknown	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Ceutorhynchus suturalis	Onion weevil	Onion	Foliage	Unknown	Europe[83]	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Colaphellus alpinus	Chrosmelds leaf beetle	Onion	Leaves	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Ctenicera strangulata		Onion and garlic	Roots	Unknown	Unknown	MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**
Epitrix cucumeris	Potato flea beetle	Onions, leek and garlic, potato, tomato, capsicum.	Roots	Infested soil[84]	The Americas, Europe.	LOW	MEDIUM	LOW	LOW[85]	**NEGLIGIBLE**
Galeruca daurica	Stone leek leaf beetle	Onion and wild onion	Foliage	Unknown	Asia[86]	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Galeruca tanaceti		Onion, chives, leek, garlic and shallot[87]	Foliage	Unknown	Europe	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**

[80] Whilst there is said to be no evidence of exotic biotypes, if an exotic biotype of two-spotted mite were to arrive in Australia the effect would be the same as those which are endemic. To distinguish between an endemic and exotic biotype sophisticated characterisation would need to be completed. Vigilance around pesticide resistance needs to be maintained as new individuals may carry new resistance.
[81] Miticide resistance issues.
[82] Damage is mainly caused by larvae which take around 4 years to develop in the soil. Adults are carnivorous but can attack leaves of plants.
[83] Unconfirmed records in Europe - Germany and Hungary.
[84] Most likely to be transported while in diapause or pupating in the soil.
[85] Primarily feeds on potato, switching to other hosts when potato is unavailable but unclear which plant part would be affected for onions.
[86] Geographic range information is limited - one abstract mentions this species in Mongolia.
[87] Reported as a pest of oregano in Crete.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Lilioceris lilii	Lily beetle	Onion and garlic	Foliage	Infested plant material. Movement of potted lilies, flowering bulbs, or cut flowers[88].	Asia, Africa, North America, Europe.	MEDIUM	MEDIUM	HIGH	LOW	**VERY LOW**
Lilioceris merdigera	Lily beetle	Onion and garlic	Foliage	Infested plant material	Asia, Europe.	MEDIUM	MEDIUM	HIGH	LOW	**VERY LOW**
Oxycetonia versicolor	Flower beetle, flower chafer beetle	Onion	Flowers	Unknown	Asia	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
DIPTERA (Flies and midges)										
Acrolepia sapporensis	Allium leafminer	Onion, shallot, garlic, leek, Japanese bunching onion and Welsh onion	Foliage	Infested plant material	Asia[89]	MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**
Ceroxys latiusculus		Onion	Bulb	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Chromatomyia horticola	Pea leafminer	Polyphagous including *Allium* spp., cucurbits, lettuce, bean, pea, tomato and daisy	Foliage	Infested plant material	Europe, Asia, Africa.	MEDIUM	MEDIUM	MEDIUM	MEDIUM	**LOW**
Delia antiqua	Onion fly	Onion, shallot, Japanese bunching onion or Welsh onion, leek, garlic and chives	Bulb, foliage, roots, seedling	Infested soil and plant material.	Palearctic Asia, Americas, Europe	HIGH	MEDIUM	HIGH	HIGH	**HIGH**
Delia floralis	Turnip maggot	Onion, turnip, leek and Brassicaceae	Roots, stalks	Infested soil[90]	Asia, North America, Europe.	MEDIUM	MEDIUM	MEDIUM	LOW	**VERY LOW**

[88] Appears to be spread with movement of potted lilies, flowering bulbs, or cut flowers.
[89] Unconfirmed records in Japan and South Korea.
[90] Eggs are transported in soil.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Delia florilega	Bean fly[91]	Onion, leek, garlic, Brassicaceae, tomato, potato and corn	Bulb, seedling	Infested soil and plant material.	North America, Western Europe and the Mediterranean region, Russia, Central and eastern Asia	HIGH	MEDIUM	HIGH	HIGH[92]	**HIGH**
Delia hirticrura	Onion maggot	*Allium* spp.	Seedling, stalk,	Unknown	Mediterranean	HIGH	MEDIUM	HIGH	MEDIUM	**MEDIUM**
Eumerus amoenus	Onion bulb fly	Onion	Attacks damaged bulbs	Infected planting material. Flight.	Egypt, Andorra, Croatia, Cyprus, France, Serbia, Germany, Italy, Malta, Portugal, Philippines, Romania, Montenegro, Spain, Tunisia	HIGH	MEDIUM	HIGH	MEDIUM[93]	**MEDIUM**
Eumerus strigatus	Lesser bulb fly	Onion and garlic	Attacks damaged bulbs	Flight. Movement of infested bulbs	North America including Canada, Eastern Europe, and Japan[94]	HIGH	HIGH	HIGH	MEDIUM[95]	**MEDIUM**
Euxesta anna		Onion	Bulb	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Euxesta notata	Cherry worm	Onion	Bulb	Unknown	Asia, North America[96]	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Liriomyza cepae[97]	Onion leafminer	Onion and garlic	Bulb, foliage	Unknown	Europe	MEDIUM	MEDIUM	MEDIUM	HIGH	**MEDIUM**

[91] According to Ellis and Scratherd (2007) at some UK sites in their study bean seed fly posed significantly greater threat to onions than did onion fly (*D. antiqua*), and that in the past bean seed fly damage has been wrongly attributed to onion fly.
[92] Limited insecticide options are available.
[93] Only attacks already damaged bulbs
[94] May be in New Zealand
[95] Only attacks already damaged bulbs
[96] Unconfirmed records in Japan, Taiwan, USA, and New Zealand.
[97] Global Diversity Information Facility lists this species as 'removed' - name may have changed, potentially to *Dizygomyza cepae*.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Liriomyza chinensis	Stone leek leafminer	Onion and leek	Foliage	Infested plant material[98].	Asia (including Indonesia and China), limited distribution in Europe.	HIGH	MEDIUM	MEDIUM	MEDIUM	**LOW**
Liriomyza huidobrensis	Serpentine Pea leafminer	Onion, garlic and grains	Foliage	Infested plant material	Central and South America, parts of Europe and Asia (including PNG)	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Liriomyza nietzkei		Onion, leek and garlic	Foliage	Infested plant material	Western Europe	LOW	MEDIUM	MEDIUM	MEDIUM	**LOW**
Liriomyza sativae	Vegetable leafminer	Polyphagous including a wide range of vegetable and flower crops including eggplant, onion, garlic, chives, pulses, cucurbits, vegetables, beans, celery, peas, potato and tomato	Leaves	Infested planting material.	Much of Asia, Africa and the Americas. Indonesia (Java), PNG, Vanuatu, Torres Strait (nominally part of Qld – Far northern biosecurity zone 1)	HIGH	HIGH	MEDIUM	HIGH	**HIGH**
Liriomyza trifolii	American serpentine leafminer	Polyphagous including a wide range of vegetable and flower crops including eggplant, onion, garlic, chives, pulses, cucurbits, vegetables, beans, celery, peas, potato and tomato	Foliage	Infested plant material. Borne internally.	Americas, parts of Europe, Africa and Asia. Limited distribution in Oceania	HIGH	HIGH	MEDIUM	MEDIUM	**MEDIUM**
Lonchaea chorea	Bulb fly	Onion	Bulb	Unknown	Europe	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**

[98] There is said to be anecdotal evidence in Indonesia that the puparia can lodge in the skins of the onion bulbs and so could be transported between regions relatively easily.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Merodon equestris	Large narcissus fly	Onion, *Amaryllis*, *Galtonia*, *Flanthus*, *Hyacinthus*, Iris, *Leucofum*, *Narcissus*, *Scilla*, *Vallota*, *Allium*, lilies and tulips	Bulbs	Infested bulbs, flight.	Europe, North America, New Zealand	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**
Phytomyza gymnostoma	Onion leaf miner	Onion, leek, garlic and chives	Stalks and bulbs	Movement of infested bulbs	Europe including UK (absent in some countries), USA, Turkey, and parts of Russia and Turkmenistan	MEDIUM[99]	MEDIUM	HIGH	HIGH	**MEDIUM**
Suillia lurida	Garlic fly	Onion, garlic and leek	Bulb, foliage	Unknown	Europe	MEDIUM	MEDIUM	MEDIUM	LOW	**VERY LOW**
Syritta pipiens	Thick-legged hoverfly	Onion, *Narcissus* bulbs	Secondary pest of bulbs[100]	Unknown	Europe	MEDIUM	MEDIUM	MEDIUM	LOW	**VERY LOW**
Tritoxa flexa	Black onion fly	Onion, garlic	Bulb	Unknown	North America	LOW	MEDIUM	MEDIUM	MEDIUM	**LOW**
HEMIPTERA (Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers)										
Capsodes lineolatus		Onion	Foliage	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Cyrtomenus bergi	Cassava root bug	Onion, cassava and corn	Bulb	Unknown	Central and South America	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Dolycoris indicus	Shield bug	Onion	Flowers	Infested plant material	Africa, South Asia	LOW	LOW	MEDIUM	LOW	**NEGLIGIBLE**
Dysmicoccus neobrevipes	Grey pineapple mealybug, Annona mealybug	Polyphagous including pineapple, apple, citrus, mango, banana, onion, coconut, avocado, vegetables, cotton, sugarcane, maize, ginger, lucerne, pine	Upper stalk, inflorescence, leaves	Infested soil and plant material.	Widespread	MEDIUM	HIGH	HIGH	LOW	**LOW**

[99] The main crop host of this species is leeks and leeks are only imported from Belgium and China where *Phytomyza gymnostoma* is not established.
[100] Feeds on rotting material.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Lindbergocapsus allii	Onion plant bug	Onion	Foliage	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Lygus elisus	Lucerne plant bug	Onion, lucerne, carrot, mustard	Seedling	Unknown	North America	LOW	HIGH	HIGH	UNKNOWN	**UNKNOWN**
Lygus gemellatus		Onion, cucumber, sunflower, common bean, maize	Shoots	Unknown	Europe	LOW	HIGH	HIGH	LOW	**VERY LOW**
Lygus hesperus	Western plant bug	Onion	Seedling	Infested soil and plant material.	North America	LOW	HIGH	HIGH	UNKNOWN	**UNKNOWN**
Macrosteles quadrilineatus **(without *Onion yellows phytoplasma*)**	Aster leafhopper	Onion, oats, carrot, barley, lettuce, lucerne, rice, parsley, grasses, rye, wheat - polyphagous	Whole plant above ground[101]	Infested plant material[102].	North America	LOW	HIGH	HIGH	LOW	**VERY LOW**
Macrosteles quadrilineatus **(with *Onion yellows phytoplasma*)**	Aster leafhopper	Onion, oats, carrot, barley, lettuce, lucerne, rice, parsley, grasses, rye, wheat - polyphagous	Whole plant above ground	Infested plant material.	North America	LOW	HIGH	HIGH	MEDIUM	**LOW**
Trioza tremblayi	Jumping plant louse	Onion, leek, beet, cabbage, parsley, potato, carrot	Foliage	Unknown	Middle East[103]	LOW	HIGH	HIGH	MEDIUM	**LOW**
LEPIDOPTERA (Butterflies and moths)										
Acrolepiopsis assectella	Leek moth	Onion, leek, garlic, shallot, chives and Welsh onion	Bulb, foliage, flowering heads	Infested plant material	Europe, parts of North Asia, parts of North America	LOW	MEDIUM	MEDIUM	MEDIUM	**LOW**
Agrotis exclamationis	Heart and dart moth	Polyphagous including onion, lucerne, tomato, potato, wheat and corn	Foliage, stalks, roots	Infested plant material. Flight.	Europe - Italy and Spain	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**

[101] Vector of Aster yellows phytoplasma.
[102] Has wings, but unclear if flight occurs.
[103] Appears to be present in Iran

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Agrotis segetum	Turnip moth, black cutworm	Polyphagous including onion, leek, round headed garlic, blackcurrant, grapevine, cotton, potato, tomato, cereals and ornamentals (daisy, carnation)	Foliage, roots	Flight, infested plant material[104].	Europe, Africa, Asia.	MEDIUM	MEDIUM	HIGH	MEDIUM	**LOW**
Agrotis tokionis	Cutworm	Onion, tobacco, potato, wheat and corn	Foliage	Flight	Asia - China	LOW	LOW	MEDIUM	LOW	**NEGLIGIBLE**
Clepsis spectrana[105]	Cyclamen tortrix	Polyphagous including onion, apple, broccoli, Brussels sprouts, cauliflower, grapevine and blackcurrant, herbaceous plants	Foliage	Flight[106]	North America, Europe[107].	LOW	LOW	MEDIUM	LOW	**NEGLIGIBLE**
***Copitarsia* spp.**		Polyphagous including onion, pistachio, carrot, sunflower, lettuce, cabbage, cauliflower, broccoli, coriander, spinach, broad bean, chick pea, garlic, asparagus, wheat, maize, strawberry, apple, raspberry, tomato, eggplant, potato.	Foliage	Infested plant material[108]	Central and South America	MEDIUM	MEDIUM	MEDIUM	MEDIUM	**LOW**
Dyspessa ulula	Garlic borer	Onion and garlic	Bulb	Infested bulbs and cut flowers	Europe, Middle East	MEDIUM	MEDIUM	MEDIUM	MEDIUM	**LOW**

[104] Capable of migratory of flight.
[105] Highly variable in appearance.
[106] Flies during European summer.
[107] Present in Canada, the UK, Nordic European countries, and some unconfirmed records in Mediterranean countries.
[108] This species is most intercepted at the US border on cut flower species.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Estigmene acrea	Salt marsh caterpillar	Polyphagous including onion, *Brassica* spp., bean, strawberry, asparagus, bean, beet, cabbage, carrot, celery, corn, lettuce, onion, pea, tomato, turnip, alfalfa, clover, cotton, soybean, sugarbeet and tobacco	Whole plant	Flight	North, Central, and South America[109].	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**
Euxoa tritici	Army worm, white line dart moth	Onion, herbaceous plants	Foliage	Flight	Europe	LOW	MEDIUM	LOW	LOW	**VERY LOW**
***Faronta* spp.**	Army worm	Onion	Foliage	Flight	Central America[110]	LOW	MEDIUM	LOW	LOW	**VERY LOW**
***Gymnoscelis rufifasciata* (syn *G. pumilata*)**	Double-striped pug, olive geometrid moth	Polyphagous including onion, raspberry, citrus, olive, corn, sorghum and carnation	Flowers, seeds	Flight.	North Africa, middle east.	LOW	MEDIUM	HIGH	LOW	**VERY LOW**
Hadula trifolii	Clover cutworm	Onion, leek, cabbage, Lucerne and corn	Foliage	Flight	Northern Asia, Middle East, Africa, North America, Europe.	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**
Hydraecia mongoliensis	Onion stem borer	Onion	Stalk	Unknown	Unknown	LOW	LOW	MEDIUM	LOW	**NEGLIGIBLE**
Lacanobia oleracea	Bright-line brown-eye moth	Onion, *Brassica* spp. and tomato	Foliage	Flight	Europe	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**

[109] More likely to be found in the southern parts of USA.
[110] Geographic range is unknown - may be present in South America.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Loxostege sticticalis	Beet webworm	Wide host range including onion, peanut, faba bean, wheat, maize, sunflower, soybean, canola, cotton, onion, beets, cucumber, carrot, flax, lucerne, potato	Foliage	Long distance migration.	Northern Hemisphere	MEDIUM	MEDIUM	HIGH	LOW	**VERY LOW**
Mamestra brassicae	Cabbage armyworm, Cabbage moth	Highly polyphagous including onion, leek, garlic, potato, sugarbeet, lettuce, maize, bean, pea, tomato, grapevine, *Brassica* spp.[111]	Whole plant, above ground[112].	Flight. Infested plant material[113]	Europe and Asia.	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**
Peridroma saucia	Variegated cutworm, pearly underwing moth	Polyphagous including raspberry, capsicum, cabbage, tomato, beetroot, lettuce, artichoke, lucerne, tobacco, maize, onion, passionfruit, avocado and cherry	Stalks	Flight. Migratory flight.	Europe, the Americas,	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**
Sarcopolia illoba	Mulberry caterpillar	Shallot, onion, lucerne	Bulb	Unknown	Asia[114]	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Spodoptera eridania	Southern armyworm	Onion	Stalks	Flight. Eggs or larvae on leaves of host plant[115].	The Americas	LOW	HIGH	HIGH	LOW	**VERY LOW**

[111] Larvae are polyphagous but have a preference for Brassica crops.
[112] Older larvae burrow into the crop, causing severe damage as well as leaving faeces which encourages secondary infections of fungi and bacteria.
[113] M. brassica is capable of diapause/aestivation periods for cold/warm weather.
[114] Unconfirmed records in Japan, South Korea, and Russia.
[115] Has not been observed undertaking long distance migrations.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Spodoptera frugiperda	Fall armyworm	Highly polyphagous including onion, potato, tomato, eggplant, sorghum, cowpea, grape, maize, ginger, banana, tobacco, rice, beans, pea, peach, cotton, soybean, citrus, chickpea, capsicum, quinoa, cabbage, groundnut, asparagus, onions, amaranth, sugarbeet	Leaves and stalks	Migratory flight. Eggs or larvae on leaves of host plant[116].	The Americas	LOW	HIGH	HIGH	LOW	**VERY LOW**
Spodoptera littoralis	Cotton leafworm[117]	Highly polyphagous including onion, potato, tomato, eggplant, okra, onion, amaranth, celery, asparagus, beetroot, sugarbeet, cabbage, cauliflower, tea, capsicum, cut flowers, watermelon, citrus, pumpkin, carrot, eucalyptus, legumes, soybean, cotton, sweet potato, lettuce, lantana, banana, tobacco, rice, avocado, beans, pepper, pea, plum, cocoa, cowpea, maize	Leaves	Flight. Eggs or larvae on leaves of host plant[118]	Africa, Middle East, Europe	LOW	HIGH	HIGH	LOW	**VERY LOW**

[116] In the Americas flights occur in summer, from south to north as far as Southern Canada.
[117] Note that *S. litura* (endemic to Australia) is often mistaken for *S. littoralis*.
[118] Does not appear to take part in migratory flight, but can fly ~2km per flight.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Trichoplusia ni	Cabbage looper	Highly polyphagous including onion, potato, tomato, eggplant, okra, onion, amaranth, celery, groundnut, sunflower, horseradish, asparagus, beetroot, brassicas, capsicum, cut flowers, citrus, cucumber, cucurbits, carrot, strawberry, soybean, cotton, sweetpotato, lettuce, sweet pea, lucerne, mints, beans, parsley, tobacco, clover, vetch, mung bean, cowpea, maize	Leaves	Flight. Eggs or larvae on leaves of host plant. Wind dispersed	Present on every continent except Australia and New Zealand; closest occurrence is Indonesia[119]	HIGH	HIGH	HIGH	LOW	**LOW**
***Xestia c-nigrum* (syn. *Amathes c-nigrum*)**	Spotted cutworm	Polyphagous including raspberry, grapevine, blueberry, willow, rose, onion, sunflower and maple	Leaves and stalks	Infested plant material[120]	Asia, North and Central America, Europe, North Africa	LOW	HIGH	HIGH	LOW	**VERY LOW**
ORTHOPTERA (Locusts, grasshoppers and katydids)										
Melanoplus bivittatus	Two striped grasshopper	Polyphagous including potato, maize, vetch, wheat, turfgrass, rye, lucerne, barley, oats, beetroot, onion	Foliage	Flight	North America[121]	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**
Zonocerus elegans	Elegant grasshopper	Onion	Leaves	Infested soil, flight.	Africa.	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**
Zonocerus variegatus	Variegated grasshopper	Onion	Leaves	Infested soil, flight.	Africa	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**

[119] Flight range has been estimated at approximately 200km.
[120] Can be spread during mechanical harvesting.
[121] Seldom found in abundance in dry areas - prefer moist conditions.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
THYSANOPTERA (Thrips)										
Caliothrips indicus	Groundnut thrips[122]	Onion, garlic, leek, groundnut, soybean and Fabaceae	Foliage	Unknown	Parts of Asia	MEDIUM	MEDIUM	MEDIUM	LOW	**VERY LOW**
Frankliniella intonsa	Eastern flower thrips	Polyphagous including onion, chrysanthemum, strawberry, rice, pea, bean, peach, cotton, tomato and bell pepper	Foliage	Infested plant material[123].	Asia, Europe.	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**
Frankliniella tenuicornis		Onion, Japanese, bunching onion, Welsh onion, garlic, grasses[124]	Flowers, foliage	Infested plant material	Europe	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**
Haplothrips aculeatus	Cereal thrips	Polyphagous including onion, cotton, oats, barley, rice, sugarcane, rye, wheat, maize	Foliage, seeds[125]	Infested plant material, including seeds.	Europe, parts of Asia.	HIGH	HIGH	HIGH	LOW	**LOW**
Thrips alliorum		Onion[126]	Foliage	Unknown	Unknown	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	**UNKNOWN**
Thrips angusticeps	Cabbage thrips (syn. field thrips)	Onion, garlic and leek	Whole plant	Infested plant material.	Throughout Europe, also present in North Africa, the Middle East and Israel	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**

[122] Other common names: black thrips; lucerne thrips; onion thrips; pea thrips
[123] Easily transported by the cut flower trade. Restricted distribution in the USA.
[124] *F. tenuicornis* may be associated with grasses including cereal crops.
[125] Feeds on seeds of cereals and can be found on the ear between seeds.
[126] This species breeds mainly on *A. fistulosum* but may also breed in low numbers on leaves of onion and garlic as well. In Japan *Thrips tabaci* are said to be commonly found on the leaves of onion but not *T. alliorum*. In the context of quarantine in Japan *T. alliorum* is said to be commonly intercepted on *A. fistulosum*, but has rarely been intercepted on *A. schoenoprosum, sativum, tuberosum.*

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
***Thrips tabaci* (exotic strains/biotypes)**	Onion thrips	Wide host range including onion, garlic, leek, shallot, horseradish, daisy, cotton and cucurbits	Foliage, bulb, flowers	Capable of flight. Infested plant material.	Africa, Asia, Central and Southern America. Limited distribution in North America[127]	HIGH	HIGH	HIGH	HIGH[128]	**HIGH**

[127] Onion thrips, including the biotypes which are exotic to Australia, have a wide global distribution.
[128] Pesticide resistance risk issues

Pathogens and nematodes

Table 23. *Onion pathogen and nematode threat summary table*

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
BACTERIA (including phytoplasmas)										
***Candidatus* Phytoplasma asteris**	Onion yellows phytoplasma, aster yellows	Onion	Foliage	Infected propagating material. Vector: *Macrosteles quadrilineatus*[129]	Widespread	LOW	MEDIUM	HGH	HIGH	**MEDIUM**
***Pseudomonas syringae* pv. *porri* (exotic strains)**	Bacterial leaf spot	Onion, leek, spring onion, shallot and garlic	Foliage	Infected seed and plant material	Widespread	MEDIUM	MEDIUM	MEDIUM	MEDIUM	**LOW**
Xanthomonas axonopodis pv. allii	Xanthomonas leaf blight	Onion, garlic, leek, chives, shallot and Welsh onion	Foliage	Infested soil and plant material, seed	Americas, parts of Asia, Southern Africa.	HIGH	MEDIUM	HIGH	HIGH[130]	**HIGH**
FUNGI										
***Ascochyta allii-cepae*[131]**	White leaf blotch, dieback	Onion	Leaf-tips causing leaf blotches and tip dieback	Water splash	United Kingdom	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
***Botrytis squamosa* (syn. *Botryotinia squamosal, Sclerotinia squamosa*)[132]**	Leaf rot and neck rot of onion	Onion, Japanese bunching onion, Welsh onion, leek and garlic	Foliage, seeds	Infested soil, plant material, wind, and rain.	Widespread	HIGH	MEDIUM	HIGH	HIGH	**HIGH**
Cercospora duddiae	Withertip	Onion, garlic and leek	Foliage	Wind, water, and leaf debris.	Central America and Asia	MEDIUM	MEDIUM	HIGH	MEDIUM	**LOW**
***Ciborinia allii* (syn. *Botryotinia allii, Sclerotinia allii*)[133]**	Neck rot	Welsh onion, onion, Japanese bunching onion	Foliage	Wind, rain, planting material.	Widespread[134]	MEDIUM	MEDIUM	MEDIUM	HIGH[135]	**MEDIUM**

[129] Although *Macrosteles quadrilineatus* is the main vector it's not clear that it attacks onions. Other leafhoppers (*Macrosteles* spp.) may be capable of acting as a vector.
[130] Yield losses of 10 to 50% have been reported in the USA on bulb onions and death of spring onions has been reported in Japan.
[131] Anamorph - *Ascochyta coelomycetous*
[132] Anamorph - *Botrytis squamosa*
[133] Anamorph - *Botrytis byssoidea*
[134] Two old records in NSW 1963 & 1968 considered to be erroneous
[135] Losses up to 50% reported

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
***Cladosporium allii* (syn. *Heterosporium allii* *Cladosporium allii-cepae* *Mycosphaerella allii*)[136]**	Leaf blotch (aka Leaf spot)	Onion, shallot, chive, garlic and leek	Foliage	Infected debris, soil and seed	Parts of Europe and Northern America.	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
Phyllosticta allii	Leaf blight	Onion	Foliage	Water splash	Americas	LOW	MEDIUM	MEDIUM	HIGH	**MEDIUM**
***Puccinia allii* ("Koike's race")[137]**	Rust of garlic and chives	*Allium* spp.	Foliage	Wind dispersal. Infected plant material - seed and mother bulbs. Imported garlic planted in backyard gardens.	USA	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM[138]**
***Puccinia mixta*[139]**	Rust of chives	Chives	Foliage	Wind dispersal. Infected plant material - seed and mother bulbs. Imported garlic planted in backyard gardens.	Europe	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM[140]**
***Puccinia porri*[141]**	Rust of leek	*Allium* spp. including leek, wild leek and spring onion,	Foliage	Wind dispersal. Infected plant material - seed and mother bulbs. Imported garlic planted in backyard gardens.	Widespread, incl. New Zealand[142]	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM[143]**

[136] Anamorph - *Davidiella allii-cepae*
[137] McTaggart, A.R., Shivas, R.G., Doungsa-ard, C. et al. Australasian Plant Pathol. (2016) 45: 581
[138] These ratings assume that the onion crop is not proximal to a garlic, spring onion or shallot crop. Proximity to these crops will considerably increase the risk of these rusts to onion crops.
[139] McTaggart, A.R., Shivas, R.G., Doungsa-ard, C. et al. Australasian Plant Pathol. (2016) 45: 581
[140] These ratings assume that the onion crop is not proximal to a garlic, spring onion or shallot crop. Proximity to these crops will considerably increase the risk of these rusts to onion crops.
[141] McTaggart, A.R., Shivas, R.G., Doungsa-ard, C. et al. Australasian Plant Pathol. (2016) 45: 581; http://www.gbif.org/species/2515274
[142] Ethiopia, Canada, Czech Republic, Finland, Greece, Hong Kong, Hungary, Ireland, Italy, Malta, Mauritius, Norway, Pakistan, Poland, Sweden, Tanzania, Thailand, Uganda,
[143] These ratings assume that the onion crop is not proximal to a garlic, spring onion or shallot crop. Proximity to these crops will considerably increase the risk of these rusts to onion crops.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Urocystis cepulae	Onion smut	Onion, spring onion, leek, garlic	Whole plant	Seedlings, soil, bulbs and as a contaminant of seed	Every continent except Australia. Eradicated from Australia October 2017.	MEDIUM	HIGH	HIGH	HIGH	**HIGH**
VIRUSES AND VIROIDS										
Shallot virus X **(Allexivirus)**	Shallot virus X	Shallot, onion, garlic[144][145]	Mosaic and chlorosis of leaves[146]	The only vector known is the mite *Aceria tulipae*[147]	Russia, Netherlands, Germany, India, New Zealand, Sudan[148]	UNKNOWN	LOW	LOW	UNKNOWN	**UNKNOWN**
Sint-Jan's onion latent carlavirus **(Carlavirus)**	Sint-Jan's onion latent virus	Onion, various Allium spp.	Whole plant	Vector: *Myzus ascalonicus* (Shallot aphid)	Indonesia	LOW	LOW	MEDIUM	MEDIUM	**VERY LOW**
Artichoke yellow ringspot virus **(Nepovirus)**	Artichoke yellow ringspot virus	Many (>9) families susceptible[149]. including dill, artichoke, onion, tobacco, beans, broad bean	Leaves	Mechanical, by pollen to the seed or by pollen to the pollinated plant[150,151].	Eurasian region; Greece and Italy	MEDIUM	MEDIUM	LOW	MEDIUM[152]	**VERY LOW**
Tomato black ring virus **(Nepovirus)** **Rating without vector**	Tomato black ring virus	Broad host range including onion, shallot, top onion, leek, chives, lettuce, capsicum, cucumber, beans, peas, tomato, grape, artichoke, and strawberry	Whole plant, seeds	Vector: *Longidorus elongatus* (needle nematode)[153]	Europe	HIGH	HIGH	MEDIUM	MEDIUM	**MEDIUM**

[144] Onion is an experimental host of *Shallot virus X*. It is not known if this virus is mechanically spread or transmitted in seed.
[145] https://viralzone.expasy.org/266
[146] https://www.ndrs.org.uk/article.php?id=015052
[147] http://www.dpvweb.net/dpv/showdpv.php?dpvno=397
[148] https://apsjournals.apsnet.org/doi/abs/10.1094/PDIS-03-12-0253-PDN
[149] http://sdb.im.ac.cn/vide/descr044.htm
[150] http://sdb.im.ac.cn/vide/descr044.htm
[151] Some isolates transmitted by mechanical inoculation and grafting; not transmitted by contact, seed or pollen. It is not known if there is a nematode vector for this species.
[152] Reports of diseases incidences of up to 80% in Greece.
[153] *Longidorus* species are widespread in Australia. *L. elongatus* may be present in Tasmania (see APPD).

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Tomato black ring virus **(Nepovirus)** **Rating with vector**	Tomato black ring virus	Broad host range including onion, shallot, top onion, leek, chives, lettuce, capsicum, cucumber, beans, peas, tomato, grape, artichoke and strawberry	Whole plant, seeds	Vector: *Longidorus elongatus* (needle nematode)[154]	Europe	HIGH	HIGH	MEDIUM	MEDIUM	**MEDIUM**
Onion mite-borne latent virus **(Potexvirus)**	Onion mite-borne latent virus	Onion, shallot, rakkyo, leek and crow garlic	Whole plant	Vector: *Aceria tulipae* (dry bulb mite)[155]	Europe[156].	LOW	LOW	MEDIUM	MEDIUM	**VERY LOW**
Shallot mite-borne latent virus **(Potexvirus)**	Shallot mite borne latent virus	Onion, shallot and crow garlic	Whole plant	Vector: *Aceria tulipae* (dry bulb mite)[157]	Eastern Europe, China. Possibly in NZ	LOW	LOW	MEDIUM	MEDIUM	**VERY LOW**
Onion yellow dwarf virus **onion strain (Potyvirus)**	Onion yellow dwarf virus – O	Onions, garlic, leek and some Narcissus species[158]	Leaves and whole plant[159]	Infected bulbs, mechanical and aphids (*Myzus persicae*)	Widespread[160] [161]	LOW	MEDIUM	MEDIUM	MEDIUM	**LOW**
Shallot yellow stripe virus **(Potyvirus)**	Shallot yellow stripe virus	Onion, various *Allium* spp.	Whole plant	Vector: *Acyrthosiphon pisum* (pea aphid)[162]	Parts of Asia	LOW	MEDIUM	MEDIUM	HIGH	**MEDIUM**
Welsh onion yellow stripe virus **(Potyvirus)**	Welsh onion yellow stripe virus	Onion, rakkyo, Japanese bunching onion, Welsh onion and crow garlic	Whole plant	Vectors: *Myzus persicae* (green peach aphid), *Rhopalosiphum maidis* (green corn aphid), *Acyrthosiphon pisum* (pea aphid)	Parts of Asia.	MEDIUM	MEDIUM	MEDIUM	HIGH	**MEDIUM**

[154] *Longidorus* species are widespread in Australia. *L. elongatus* may be present in Tasmania (see APPD).
[155] Mother bulbs and/or seeds could contain mites or their eggs. No treatments currently used on imported seeds to kill mites or eggs.
[156] Occurs in Europe. Not seed borne but vectored by dry bulb mite (*Aceria tulipae*) (Brunt et al., 1996 onwards B), which occurs in Australia.
[157] Mother bulbs and/or seeds could contain mites or their eggs. No treatments currently used on imported seeds to kill mites or eggs.
[158] **https://wiki.bugwood.org/HPIPM:Onion_Yellow_Dwarf_Virus**
[159] **http://www.seminis-us.com/resources/disease-guides/onions/onion-yellow-dwarf/**
[160] Garlic strain is in Australia but onion strain has not been detected.
[161] **http://www.seminis-us.com/resources/disease-guides/onions/onion-yellow-dwarf/**
[162] *Myzus cymbalariae* may also be a vector.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
NEMATODES										
Belonolaimus gracilis	Sting nematode	Polyphagous onion, pea, bean, pine, cucurbits, peanut, corn, cotton, strawberry, oat, citrus, tomato and turf grasses	Roots	Soil, water, transplanted plants and seedlings	North America[163]	LOW	MEDIUM	MEDIUM	LOW[164]	**VERY LOW**
Belonolaimus longicaudatus	Sting nematode	Polyphagous; Onion, pea, bean, potato, grape, peanut, citrus, melon, carrot, cotton, strawberry, tomato, corn and turf grasses	Roots	Soil, water, transplanted plants and seedlings	Asia, North America, Central America[165]	MEDIUM	MEDIUM	MEDIUM	MEDIUM[166]	**LOW**
***Ditylenchus* spp. (including *D. dipsaci, D. destructor*) (exotic strains)**	Stem and bulb nematode	Broad host range including *Brassica* spp., *Allium* spp., pea, bean, potato, parsley, strawberry, hyacinth, daffodil, tulip, potato and corn	Roots	Soil, water, transplanted plants and seedlings		MEDIUM	HIGH	HIGH	MEDIUM[167]	**MEDIUM**
Longidorus elongatus	Needle nematode	Polyphagous including onion, grapevine, roses, berries, apples, strawberry, carrot, grasses	Roots	Soil, water, transplanted plants and seedlings	Parts of Asia, Europe, and North America, and New Zealand.	LOW	MEDIUM	MEDIUM	MEDIUM	**LOW**
Longidorus vineacola	Needle nematode	Onion	Roots	Soil, water, transplanted plants and seedlings	Western Europe	LOW	LOW	LOW	MEDIUM	**VERY LOW**

[163] Particularly important in sandy soils in the United States
[164] Sting nematode is sensitive to rapid changes in soil conditions, thus can be managed through physical means such as irrigation.
[165] Particularly important in sandy soils in the United States
[166] Sting nematode is sensitive to rapid changes in soil conditions, thus can be managed through physical means such as irrigation.
[167] *D. Destructor* is a trade issue. Listed as absent from Australia.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Meloidogyne chitwoodi	Colombia root-knot nematode	Onion and garlic	Foliage, roots	Soil, water, transplanted plants and seedlings	Some countries in Europe and North America.	MEDIUM	HIGH	MEDIUM	HIGH[168]	**MEDIUM**
Meloidogyne exigua	Coffee root-knot nematode	Amaranthus, banana, coffee, citrus, cucumber, onion, pepper, rice, stagger weed, sugarcane, tomato and watermelon	Root	Soil, water, transplanted plants and seedlings	Central and south America	LOW	MEDIUM	MEDIUM	MEDIUM[169]	**LOW**
Meloidogyne graminicola	Rice root knot nematode	Onion	Roots	Soil, water, transplanted plants and seedlings	Asia. Restricted distribution in the Americas.	MEDIUM	MEDIUM	MEDIUM	MEDIUM[170]	**LOW**
Meloidogyne enterolobii **(syn. *Meloidogyne mayaguensis*[171])**	Root knot nematode	Polyphagous including herbaceous and woody plants. The principal hosts are bean, coffee, cotton, eggplant, guava, papaya, pepper, potato, soybean, sweet potato, tobacco, tomato, watermelon[172]	Roots	Soil, water, transplanted plants and seedlings	Africa, Asia, Central and Southern America. Limited distribution in North America.	MEDIUM	HIGH	HIGH	HIGH[173]	**HIGH**
Paratrichodorus allius	Stubby root nematode	Onion	Roots	Soil, water, transplanted plants and seedlings	North America[174]	LOW	LOW	LOW	MEDIUM	**VERY LOW**

[168] Generally root knot is more severe in sandy textured and muck soils than in clay soils.
[169] Generally root knot is more severe in sandy textured and muck soils than in clay soils.
[170] Generally root knot is more severe in sandy textured and muck soils than in clay soils.
[171] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3332022/
[172] https://gd.eppo.int/download/doc/704_ds_MELGMY_en.pdf
[173] Generally root knot is more severe in sandy textured and muck soils than in clay soils.
[174] Known to be present in North America, no information available on other locations.

Scientific name	Common name	Host(s)	Affected plant part	Means of movement and dispersal	Geographic distribution	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Scutellonema clathricaudatum		Onion	Roots	Soil, water, transplanted plants and seedlings	Africa, Southern Asia	NEGLIGIBLE	HIGH	LOW	LOW	**NEGLIGIBLE**
Xiphinema diversicaudatum	Dagger nematode	Onion and leek	Roots	Soil, water, transplanted plants and seedlings	Europe	LOW	MEDIUM	MEDIUM	MEDIUM	**LOW**
Zygotylenchus guevarai		Onion[175]	Roots	Soil, water, transplanted plants and seedlings	Asia, Africa, North America, Europe.	MEDIUM	MEDIUM	MEDIUM	MEDIUM	**LOW**

[175] CABI lists this only as a pest of leek.

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