TECHNICAL ISSUES PAPER

Import Risk Analysis for the Importation of Unshu Mandarin Fruit from Japan

December 2002

AGRICULTURE, FISHERIES AND FORESTRY - AUSTRALIA

Foreword

CONTENTS

GLOSSARY OF TERMS AND ABBREVIATIONS

AFFA	Commonwealth Department of Agriculture, Fisheries and Forestry - Australia
ALOP	appropriate level of protection
AQIS	Australian Quarantine and Inspection Service
Area	an officially defined country, part of a country or all or parts of several countries
Biosecurity Australia (BA)	an agency within the Commonwealth Department of Agriculture, Fisheries and Forestry - Australia. Biosecurity Australia protects consumers and animal and plant health, and facilitates trade, by providing sound scientifically based and cost effective quarantine policy
Control (of a pest)	suppression, containment or eradication of a pest population
Endangered area	an area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss
Entry (of a pest)	movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled
Entry potential	likelihood of the entry of a pest
Establishment potential	likelihood of the establishment of a pest
Establishment	the perpetuation, for the foreseeable future, of a pest within an area after entry
FAO	Food and Agriculture Organization of the United Nations
Fresh	not dried, deep-frozen or otherwise conserved
ICA	Interstate Certification Assurance
ICON	AQIS Import Conditions database
Introduction potential	likelihood of the introduction of a pest
Introduction	entry of a pest resulting in its establishment
IPPC	International Plant Protection Convention, as deposited in 1951 with FAO in Rome and as subsequently amended
IRA	import risk analysis
ISPM	International Standard on Phytosanitary Measures
MAFF	Ministry of Agriculture, Fisheries and Forestry, Japan

National Plant Protection Organisation	official service established by a government to discharge the functions specified by the IPPC
Non-quarantine pest	pest that is not a quarantine pest for an area
Official	established, authorised or performed by a National Plant Protection Organisation
Official control (of a regulated pest)	the active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective or eradication or containment of quarantine pests or for the management of regulated non-quarantine pests
OIE	International Office of Epizootics
Pathway	the ordered sequence of steps leading to an outcome, or event
PBPM	Plant Biosecurity Policy Memorandum
Pest	any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products
Pest categorisation	the process for determining whether a pest has or has not the characteristics of a quarantine pest or those of a regulated non-quarantine pest
Pest free area	an area in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained
Pest risk analysis	the process of evaluating biological or other scientific evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it
Pest risk assessment	determination of whether a pest is a quarantine pest and evaluation of its introduction potential
Pest risk assessment (for quarantine pests)	evaluation of the probability of the introduction and spread of a pest and of the associated potential economic consequences
Pest risk management	the decision-making process of reducing the risk of introduction of a quarantine pest
Pest risk management (for quarantine pests)	evaluation and selection of options to reduce the risk of introduction and spread of a pest

Phytosanitary measure	any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests
PRA	pest risk analysis
PRA area	area in relation to which a pest risk analysis is conducted
Quarantine pest	a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled
Regulated non-quarantine pest	a non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party
Spread potential	likelihood of the spread of a pest
Spread	expansion of the geographical distribution of a pest within an area
SPS	Sanitary and Phytosanitary
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures
WTO	World Trade Organization

EXECUTIVE SUMMARY

The Commonwealth Department of Agriculture, Fisheries and Forestry – Australia (AFFA) is considering the importation of fresh Unshu mandarin fruit from Japan. The Import Risk Analysis (IRA) is to be conducted using the protocol outlined in the Guidelines for Import Risk Analysis (The Guidelines) (Biosecurity Australia (BA), in preparation).

This *Technical Issues Paper* contains the following sections:

- Biosecurity Australia's framework for quarantine policy and for IRA and the international framework for trade in animal- and plant-derived products
- Pest risk analysis (PRA) methodology
- Background to this IRA
- Current quarantine policy for importation of fresh citrus
- Results of pest categorisation
- An outline of further steps in the IRA process.

The introductory sections of this paper provide important information that is fundamental to understanding the national and international framework for considering import applications from other countries. Information specific to the citrus industry is covered in a section entitled "Proposed Importation of Unshu Mandarin Fruit from Japan".

Biosecurity Australia will consult with stakeholders and relevant experts as necessary throughout the IRA process. Stakeholders are strongly encouraged to contribute to the IRA by providing relevant technical information and raising issues as early as possible, preferably while commenting on the *Technical Issues Paper* or during meetings with Biosecurity Australia.

To date, Biosecurity Australia has identified a total of 323 pests of Unshu mandarin in Japan. These pests include mites, insects, snails, nematodes, bacteria, fungi, viroids and viruses. Of these pests, 117 are present in Australia and do not need to be considered further in the IRA. Of the remaining 206 pests that are not present in Australia (or present but not widely distributed and being officially controlled), 98 are found on the import pathway (fresh fruit). These pests will need to be considered further in the IRA.

The next stage in the IRA will involve determining the potential of these pests to enter, establish or spread in Australia and the potential economic consequences of their entry. This part of the risk assessment will be covered in the draft IRA paper. The draft IRA paper will also consider risk management measures to achieve Australia's appropriate level of protection (ALOP) and a preliminary position on the importation of fresh Unshu mandarin from Japan.

After considering all technical issues, including stakeholder comments on the draft IRA report, Biosecurity Australia will finalise the IRA recommendations consistent with Australia's ALOP and international rights and obligations under the *SPS agreement.*

Biosecurity Australia will submit its recommendations to the Director of Animal and Plant Quarantine (the Director) for consideration. The Director will consider the recommendations and make the final determination. The Director's determination and the final IRA paper will be available from the AFFA website or stakeholders can request copies from Biosecurity Australia.

Any stakeholder of the opinion that the process outlined in the Guidelines has not been properly followed, including that the analysis failed to consider a significant body of relevant scientific or technical information, may appeal to the Director. If the appeal is upheld, Biosecurity Australia will rectify the deficiency. If the appeal is rejected, the recommendations will be adopted

BIOSECURITY FRAMEWORK

AUSTRALIA'S BIOSECURITY POLICY

Legislative framework

AFFA's objective is to adopt biosecurity policies that provide the health safeguards required by government policy in the least trade-restrictive way and that are, where appropriate, based on international standards. In developing and reviewing quarantine (or biosecurity) policies, pest risks associated with importations may be analysed using import risk analysis — a structured, transparent and science-based process.

The *Quarantine Act 1908* (Quarantine Act) and its subordinate legislation, including the *Quarantine Proclamation 1998* (Quarantine Proclamation), are the legislative basis of human, animal and plant biosecurity in Australia.

Section 4 of the Quarantine Act defines the scope of quarantine as follows:

In this Act, quarantine includes, but is not limited to, measures:

- *for, or in relation to, the examination, exclusion, detention, observation, segregation, isolation, protection, treatment and regulation of vessels, installations, human beings, animals, plants or other goods or things*
- *having as their object the prevention or control of the introduction, establishment or spread of diseases or pests that will or could cause significant damage to human beings, animals, plants, other aspects of the environment or economic activities.*

Quarantine risk

The concept of level of quarantine (or biosecurity) risk has been introduced as the basis of quarantine decision-making. When making decisions under the Quarantine Act, decision-makers must consider the level of quarantine risk and must take prescribed actions to manage the risk if it is unacceptably high. Section 5D of the Quarantine Act includes harm to the environment as a component of the level of quarantine risk.

Section 5D: level of quarantine risk

A reference in this Act to a level of quarantine risk is a reference to:

(a) the probability of:

(i) a disease or pest being introduced, established or spread in Australia or the Cocos Islands; and

(ii) the disease or pest causing harm to human beings, animals, plants, other aspects of the environment, or economic activities; and

(b) the probable extent of the harm.

Quarantine Proclamation

Subsection 13 (1) of the Quarantine Act provides that the Governor-General in Executive Council may, by proclamation, prohibit the importation into Australia of any articles or things likely to introduce, establish or spread any disease or pest affecting people, animals or plants. The Governor-General may apply this power of prohibition generally or subject to any specified conditions or restrictions.

The Quarantine Proclamation is the principal legal instrument used to control the importation into Australia of goods of quarantine (or biosecurity) interest. A wide range of goods are specified in the Quarantine Proclamation including animals, plants, animal and plant products, micro-organisms, and certain other goods which carry a high risk if uncontrolled importation is allowed — e.g. soil, water, vaccines, feeds.

For articles or things prohibited by proclamation, the Director of Animal and Plant Quarantine may permit entry of products on an unrestricted basis or subject to compliance with conditions, which are normally specified on a permit. An import risk analysis provides the scientific and technical basis for biosecurity policies that determine whether an import may be permitted and, if so, the conditions to be applied.

The matters to be considered when deciding whether to issue a permit are set out in Section 70 of the Quarantine Proclamation as follows:

70 Things a Director of Quarantine must take into account when deciding whether to grant a permit for importation into Australia

(1) In deciding whether to grant a permit to import a thing into Australia or the Cocos Islands, or for the removal of a thing from the Protected Zone or the Torres Strait Special Quarantine Zone to the rest of Australia, a Director of Quarantine:

(a) must consider the level of quarantine risk if the permit were granted; and

(b) must consider whether, if the permit were granted, the imposition of conditions on it would be necessary to limit the level of quarantine risk to one that is acceptably low; and

(c) may take into account anything else that he or she knows that is relevant.

The matters include the level of quarantine risk (see above), whether the imposition of conditions would be necessary to limit the quarantine risk to a level that would be acceptably low, and anything else known to the decision maker to be relevant.

Environment

While protection of the natural and built environment has always been an objective of Australian quarantine policy and practice, recent amendments to the Quarantine Act make explicit the responsibility of quarantine officers to consider impact on the environment when making decisions. In particular, the scope of quarantine (as described in Section 4 of the Quarantine Act), and the level of quarantine risk (as described in Section 5D of the Quarantine Act), includes explicit reference to the environment.

Environment is defined in Section 5 of the Quarantine Act as:

> *... all aspects of the surroundings of human beings, whether natural surroundings or surroundings created by human beings themselves, and whether affecting them as individuals or in social groupings.*

When undertaking an import risk analysis, Biosecurity Australia fully takes into account the risk of harm to the environment to ensure that the biosecurity policies developed reflect the Australian Government's approach to risk management. This is achieved through the involvement of Environment Australia in decisions on the import risk analysis work program and, for particular import risk analyses, discussions on the scope, the likely risks, and the expertise that may be required to address those risks. Environment Australia may identify additional technical issues that it believes should be considered during an import risk analysis, and may nominate officers with relevant expertise who would be available to participate in the import risk analysis.

Policy framework

The primary purpose of biosecurity is to protect Australia from the entry, establishment and spread of unwanted pests and diseases that may cause social, economic or environmental damage, while minimising the restrictions on the entry of agricultural commodities.

Successive Australian Governments have maintained an appropriate level of protection (ALOP) that reflects the value placed on Australia's unique and diverse flora and fauna and the value of its Agricultural industries. However, at the same time they recognise that a zero-risk approach to the management of biosecurity risks is not tenable. This approach is evident in the strictness of all biosecurity-related activities, including policies on imported commodities, procedures at the border and operations against incursions of pests and diseases.

Recent inquiries into Australia's biosecurity regime have recognised that it is impossible in practice to operate a zero-risk biosecurity regime. In 1979, the Senate Standing Committee on Natural Resources stressed that there is no such thing as a zero-risk quarantine policy, and it believed that Australia's approach should be better described as '*scientific evaluation of acceptable risk*'. In 1988, the Lindsay review of Australian quarantine concluded that '*a no risk policy is untenable and undesirable and should be formally rejected*'. In 1996, the Senate Rural and Regional Affairs and Transport Committee was of the view that a zero-risk approach was unrealistic and untenable, and that its currency only demonstrated that the concepts of risk assessment and risk management were widely misunderstood. These themes were repeated in the AQRC report (AQRC, 1996). In its 1997 response to that report, the Government confirmed a managed risk approach.

Import risk analysis provides the basis for considering import applications for the importation of animals and animal-derived products, and plants and plant-derived products. In keeping with the scope of the Quarantine Act and Australia's international obligations, only factors relevant to the evaluation of quarantine risk (i.e. the risk associated with the entry, establishment and spread of unwanted pests and diseases) are considered in the import risk analysis. The potential competitive economic impact of prospective imports is not within the scope of the import risk analysis process, and any discussion on industry support mechanisms would need to remain quite separate from the import risk analysis.

WTO AND IMPORT RISK ANALYSIS

One of the principal objectives in developing the administrative framework for import risk analysis was to ensure that it complied with Australia's international rights and obligations.

These derive principally from the WTO *Agreement on the Application of Sanitary and Phytosanitary Measures* (*SPS Agreement*), although other WTO Agreements (including the *Agreement on Technical Barriers to Trade* - the TBT Agreement) may be relevant in certain circumstances. Specific international guidelines on risk analysis developed under the International Plant Protection Convention (IPPC) and by International Office of Epizootics (OIE) are also relevant.

The *SPS Agreement* applies to measures designed to protect human, animal and plant life and health from pests and diseases, or a country from pests, and which may directly or indirectly affect international trade. It also recognises the right of WTO Member countries to determine the level of protection they deem appropriate and to take the necessary measures to achieve that protection. Sanitary (human and animal health) and phytosanitary (plant health) measures apply to trade in or movement of animal and plant based products within or between countries.

In the *SPS Agreement,* SPS measures are defined as any measures applied:

- *to protect animal or plant life or health within the territory of the Member from risks arising from the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms;*
- *to protect human or animal life or health within the territory of the Member from risks arising from additives, contaminants, toxins or disease-causing organisms in foods, beverages or feedstuffs;*
- *to protect human life or health within the territory of the Member from risks arising from diseases carried by animals, plants or products thereof, or from the entry, establishment or spread of pests; or*
- *to prevent or limit other damage within the territory of the Member from the entry, establishment or spread of pests.*

The key provisions of the *SPS Agreement* are as follows:

- An importing country has the sovereign right to adopt measures to achieve the level of protection it deems appropriate (its appropriate level of protection) to protect human, animal or plant life or health within its territory, but such a level of protection must be consistently applied in different situations.
- An SPS measure must be based on scientific principles and not be maintained without sufficient evidence.
- In applying SPS measures, an importing country must avoid arbitrary or unjustifiable distinctions in levels of protection, if such distinctions result in discrimination or a disguised restriction on international trade.
- An SPS measure must not be more trade restrictive than necessary to achieve an importing country's ALOP, taking into account technical and economic feasibility.
- An SPS measure should be based on an international standard, guideline or recommendation, where these exist, except to the extent that there is scientific justification for a more stringent measure which is necessary to achieve an importing country's ALOP.
- An SPS measure conforming to an international standard, guideline or recommendation is presumed to be necessary to protect human, animal or plant life or health, and to be consistent with the *SPS Agreement.*

- Where an international standard, guideline or recommendation does not exist or where, in order to meet an importing country's ALOP, a measure needs to provide a higher level of protection than accorded by the relevant international standard, such a measure must be based on a risk assessment; the risk assessment must take into account available scientific evidence and relevant economic factors.
- When there is insufficient scientific evidence to complete a risk assessment, an importing country may adopt a provisional measure(s) by taking into account available pertinent information; additional information must be sought to allow a more objective assessment and the measure(s) reviewed within a reasonable period.
- An importing country must recognise the measures of other countries as equivalent, if it is objectively demonstrated that the measures meet the importing country's ALOP.

The rights and obligations in the *SPS Agreement* must be read as a whole. The articles must be interpreted in relation to each other. That is, the articles do not stand alone.

In many instances, the biosecurity policies Biosecurity Australia develops are based on the relevant international standards, guidelines and recommendations. In certain instances and in conformity with rights under the *SPS Agreement*, Australia has not adopted such international norms because to do so would result in an unacceptably high level of risk of disease or pest entry and establishment. Instead, the policies are based on a risk analysis.

The text of the *SPS Agreement* can be found at the WTO Internet site.[1]

The following issues are discussed in greater detail:

- notification obligations;
- use of international standards;
- equivalence;
- risk assessment;
- appropriate level of protection; and
- consistency in risk management.

Notification obligations

The WTO SPS Committee has been established to oversee the implementation of the *SPS Agreement*, and to provide a forum for the discussion of any trade issues related to biosecurity policies. Like other WTO committees, all WTO Members have the right to participate in the work and decision making of the SPS Committee; decisions are taken by consensus. The SPS Committee has accepted, as observers, the Codex Alimentarius Commission (Codex), OIE and IPPC, as well as other international and regional intergovernmental organisations with activities in food safety, animal health and plant protection to maximise knowledge of and participation in its work.

The SPS Committee normally meets three times a year at the WTO headquarters in Geneva, Switzerland.

[1] Available at http://www.wto.org/english/docs_e/docs_e.htm

In addition to considering any specific trade concerns raised by governments, the *SPS Agreement* has set specific tasks for the Committee. One of these is to monitor the extent to which governments are using internationally developed standards as the basis for their requirements for imported products. Countries identify cases where the non-use, or non-existence, of an appropriate international standard is causing difficulties for international trade. After consideration by the SPS Committee, these concerns may be brought to the attention of the relevant standard-setting organisations.

Under the *SPS Agreement*, Members are required to notify WTO of new sanitary or phytosanitary regulations or modifications to existing regulations that are not substantially the same as the content of an international standard and that may have a significant effect on international trade. Australia notifies new measures and comments on draft policies proposed by other countries through the SPS Notification Point in AFFA.

Use of international standards

The *SPS Agreement* has conferred new responsibilities on three international organisations by requiring WTO Members to harmonise their sanitary and phytosanitary measures on the standards, guidelines and recommendations produced by those organisations unless there is scientific justification for a more stringent measure.

The three international organisations are referenced in Annex A of the *SPS Agreement* as follows:

- *for food safety, the standards, guidelines and recommendations established by the Codex Alimentarius Commission relating to food additives, veterinary drug and pesticide residues, contaminants, methods of analysis and sampling, and codes and guidelines of hygienic practice;*
- *for animal health and zoonoses, the standards, guidelines and recommendations developed under the auspices of the International Office of Epizootics;*
- *for plant health, the international standards, guidelines and recommendations developed under the auspices of the Secretariat of the International Plant Protection Convention in cooperation with regional organizations operating within the framework of the International Plant Protection Convention.*

International Plant Protection Convention

IPPC is a multilateral treaty deposited with the Director-General of the Food and Agriculture Organization of the United Nations. IPPC provides a framework and forum for international cooperation, standards harmonisation and information exchange on plant health in collaboration with regional and national plant protection organisations (RPPOs and NPPOs). Its prime purpose is to secure common and effective action to prevent the spread and introduction of pests of plants and plant products and to promote measures for their control.

Currently, 117 governments are contracting parties to IPPC.

The New Revised Text of the IPPC enabled the establishment of an Interim Commission on Phytosanitary Measures to serve as the IPPC's new governing body. Membership in the Interim Commission is open to all contracting parties of the IPPC. The Interim Commission meets annually to establish priorities for standard setting and harmonisation of phytosanitary measures in co-ordination with the IPPC Secretariat.

The functions of the Interim Commission are to provide direction to the work program of the IPPC Secretariat and promote the full implementation of the objectives of the Convention and, in particular, to:

- review the state of plant protection in the world and the need for action to control the international spread of pests and control their introduction into endangered areas;
- establish and keep under review the necessary institutional arrangements and procedures for the development and adoption of international standards, and to adopt international standards;
- establish rules and procedures for the resolution of disputes; and
- co-operate with other relevant international organisations.

The new IPPC and ISPM Pub. No.11 *Pest Risk Analysis for Quarantine Pests* adopt a similar approach to that of OIE and note the importance of documenting all steps in the process.

Equivalence

Article 4 of the *SPS Agreement* states that:

> *Members shall accept the sanitary or phytosanitary measures of other Members as equivalent, even if these measures differ from their own or from those used by other Members trading in the same product, if the exporting Member objectively demonstrates to the importing Member that its measures achieve the importing Member's appropriate level of sanitary or phytosanitary protection.*

Members must accept the SPS measures of other Members, as equivalent to their own if the latter can demonstrate objectively that their measures provide the level of protection required by the importing country.

Article 5.6 of the *SPS Agreement* states that:

> *Often there are several alternative measures that may either singly or in combination achieve ALOP. In choosing among such alternatives, a Member should apply measures that are no more trade-restrictive than necessary to achieve its ALOP, taking into account technical and economic feasibility.*

Risk assessment

Articles 5.1 to 5.3 of the *SPS Agreement* outline the requirements that Members should follow when carrying out risk assessment.

Article 5.1 provides a basic statement of the obligation:

> *Members shall ensure that their sanitary or phytosanitary measures are based on an assessment, as appropriate to the circumstances, of the risks to human, animal or plant life or health, taking into account risk assessment techniques developed by the relevant international organizations*

Annex A of the *SPS Agreement* contains two definitions of risk assessment; the following is the definition applicable to biosecurity assessments:

> *The evaluation of the likelihood of entry, establishment or spread of a pest or disease within the territory of an importing Member according to the sanitary or phytosanitary*

> *measures which might be applied, and of the associated potential biological and economic consequences*

On the basis of this definition, the Appellate Body examining Australia's appeal against the dispute settlement panel's finding on Australia's prohibition of imports of Canadian salmon considered that a risk assessment within the meaning of Article 5.1 must:

- identify the hazards whose entry, establishment or spread within its territory a Member wants to prevent, as well as the associated potential biological and economic consequences;
- evaluate the likelihood of entry, establishment or spread of these hazards, as well as the associated potential biological and economic consequences; and
- evaluate the likelihood of entry, establishment or spread of these hazards according to the SPS measures that might be applied; measures which might be applied are those which reduce the risks to the appropriate level, with the aim of being least trade restrictive.

The Appellate Body believed that, for a risk assessment to fall within the meaning of Article 5.1 and the first definition in paragraph 4 of Annex A of the Agreement, it is not sufficient that it conclude that there is a 'possibility' of entry, establishment or spread of diseases and their associated biological and economic consequences. That is, an assessment must evaluate the 'likelihood' (the 'probability') of entry, establishment or spread of diseases and their associated biological and economic consequences. Furthermore, likelihood should be evaluated without and then with any SPS measures that might be required.

Article 5.2 outlines factors that should be considered when assessing the risks associated with a proposed importation. Specifically, it states that:

> *In the assessment of risks Members shall take into account available scientific evidence; relevant processes and production methods; relevant inspection, sampling and testing methods; prevalence of specific diseases or pests; existence of pest- or disease-free areas; relevant ecological or environmental conditions; and quarantine or other treatment.*

This paragraph emphasises the need to consider a wide range of factors in both the importing and exporting country.

Article 5.3 describes the need to include a consequence assessment in a risk assessment, and lists dimensions that should be considered when assessing 'potential damage' arising from a disease or pest incursion. Specifically, it states that:

> *Members shall take into account as relevant economic factors; the potential damage in terms of loss of production or sales in the event of the entry, establishment or spread of a pest or disease; the cost of control or eradication in the territory of the importing Member*

This list of 'relevant economic factors' may be viewed as the bare minimum that must be considered if an analysis is to comply with the terms of the *SPS Agreement.* In addition, both the *OIE Code* and IPPC standards for risk analysis have outlined factors that should be considered when assessing consequences. These two standards also stress the need to consider the 'likely magnitude' of consequences — that is, to base an assessment of consequences on the likelihood of various levels of damage in the importing country. Finally, Article 5.3 states that Members should consider '*... the relative cost-effectiveness of alternative approaches to limiting risks...*' This is an

issue that should be explored during risk management. Among factors that may not be taken into account are those relating to import competition.

The environmental and ecological consequences of pest or disease introduction are legitimate considerations in a risk assessment. The *SPS Agreement* provides a basic right to take measures to protect animal or plant life or health (Article 2). In Annex A, 'animal' is defined to include fish and wild fauna; and 'plant' to include forests and wild flora.

Additional to the economic factors identified in Article 5.3, the definition of risk assessment in Annex A, paragraph 4 (' ... *evaluation of the likelihood of entry, establishment or spread of a pest or disease … and of the associated potential biological and economic consequences...*') provides for general consideration of the biological consequences, including those for the environment. The environment is included in paragraph 1(d), which states that an SPS measure is one that is applied to ' ... *prevent or limit other damage to a country from the entry, establishment or spread of pests...*'.

Appropriate level of protection

The *SPS Agreement* defines *'appropriate level of sanitary or phytosanitary protection'* as the level of protection deemed appropriate by the Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory. The *SPS Agreement* notes that many Members also refer to this concept as the *'acceptable level of risk'*. In setting their ALOP, Members are to take into account the objective of minimising negative trade effects (Article 5.4).

Determination of Australia's ALOP is an issue for government in consultation with the community — it is not a prerogative of WTO. ALOP reflects government policy that is affected by community expectations; it is a societal value judgement to which AFFA contributes by providing technical information and advice. It is important to note that the *SPS Agreement* does not require a Member to have a scientific basis for its ALOP determination.

ALOP can be illustrated using a *risk estimation matrix* (Table 1). The cells of this matrix describe the product of likelihood and consequences — termed 'risk'.

When interpreting the risk estimation matrix it should be remembered that although the descriptors for each axis are similar ('low', 'moderate', 'high', etc.), the vertical axis refers to *likelihood* and the horizontal axis refers to *consequences*.

One implication of this is that a 'negligible' probability combined with 'extreme' consequences, is not the same as an 'extreme' probability combined with 'negligible' consequences — that is, that the matrix is *not symmetrical.* Another implication is that 'risk' is expressed in the same units as are used to estimate consequences — that is, risk is *not* a likelihood.

Table 1. Risk estimation matrix

Likelihood of entry, establishment and spread	Negligible impact	Very low	Low	Moderate	High	Extreme impact
High likelihood	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Moderate	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
Low	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk	High risk
Very low	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk
Extremely low	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk
Negligible likelihood	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk

Consequences of entry, establishment and spread

The band of cells in Table 1 marked ‘very low risk’ represents Australia's ALOP, or tolerance of loss. This band of cells represents an approximation of a continuous ‘iso-risk curve’ — a curve that will be asymptotic at the minimum level of consequences considered to be ‘acceptable’ (which, in Australia's case, is ‘very low’) and at a likelihood that tends toward zero. The principle of an iso-risk curve is illustrated in Figure 1.

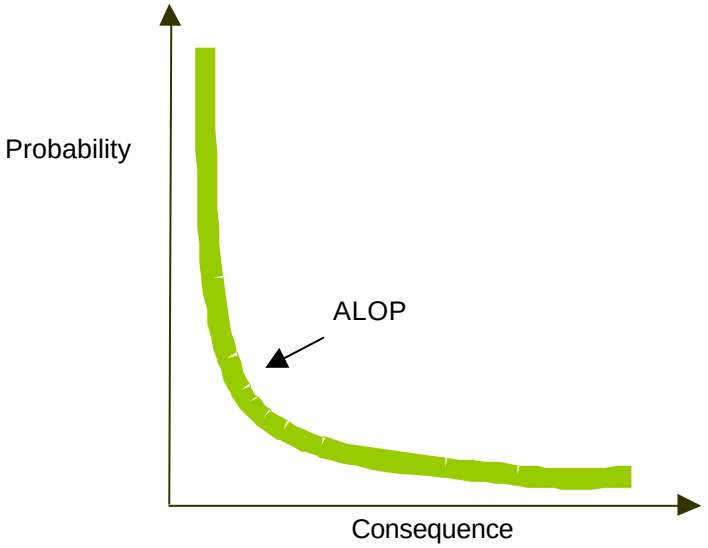


Figure 1. Theoretical iso-risk curve

Consistency in risk management

Article 5.5 states:

> *With the objective of achieving consistency in the application of the concept of appropriate level of sanitary or phytosanitary protection against risks to human life or health, or to animal and plant life or health, each Member shall avoid arbitrary or unjustifiable distinctions in the levels it considers to be appropriate in different situations, if such distinctions result in discrimination or a disguised restriction on international trade*

Members are obliged to avoid arbitrary or unjustifiable distinctions in the levels of protection applied in different situations, if such distinctions result in discrimination or a disguised restriction on international trade. This obligation reflects the objective of consistency in applying the concept of ALOP against risks to human, animal and plant life or health — that is, consistency in risk management. In other words, it is not open to a Member to arbitrarily vary its attitude to the acceptance of risk from one situation to another, where the situations are comparable.

Consistency is achieved in Biosecurity Australia's IRA process by using the risk estimation matrix (Table 1).

METHOD FOR PEST RISK ANALYSIS

The technical component of an IRA for plants or plant products is termed a 'pest risk analysis', or PRA. In accordance with ISPM Pub. No. 11 *Pest Risk Analysis for Quarantine Pests*[2], a PRA comprises three discrete stages:

- Stage 1: initiation of the PRA
- Stage 2: risk assessment
- Stage 3: risk management

The *initiation* of a risk analysis involves the identification of the pest(s) and pathways of concern that should be considered for analysis. *Risk assessment* comprises pest categorisation, assessment of the probability of introduction and spread, and assessment of the potential economic consequences (including environmental impacts). *Risk management* describes the evaluation and selection of options to reduce the risk of introduction and spread of a pest. Because the key objective of this *Technical Issues Paper* is to document the approach to and preliminary results of pest categorisation, this component of the PRA is discussed in further detail.

Under ISPM Pub. No. 11 *Pest Risk Analysis for Quarantine Pests*, pest categorisation describes the process for determining whether a pest has or has not the characteristics of a quarantine pest, or those of a regulated non-quarantine pest. The objective of pest categorisation is thus to screen an exhaustive pest list to identify those that require an in-depth examination of the likelihood and consequences of introduction and spread.

ELEMENTS OF PEST CATEGORISATION

In accordance with ISPM Pub. No. 11 pest categorisation is based on the following elements or steps:

- identity of the pest;
- presence or absence in the PRA area;
- regulatory status;
- potential for establishment and spread in the PRA area; and
- potential for economic consequences (including environmental consequences) in the PRA area.

A description of these elements of pest categorisation from ISPM Pub. No. 11 is given below.

Identity of the pest

The identity of the pest should be clearly defined to ensure that the assessment is being performed on a distinct organism, and that biological and other information used in the assessment is relevant to the organism in question. If this is not possible because the causal agent of particular symptoms has not yet been fully identified, then it should have been shown to produce consistent symptoms and to be transmissible.

[2] PRA is used throughout this document as an abbreviation of Pest Risk Analysis. AFFA uses the term PRA to describe the technical component of an import risk analysis.

The taxonomic unit for the pest is generally species level. The use of a higher or lower taxonomic level should be supported by scientifically sound rationale. In the case of levels below the species, this should include evidence demonstrating that factors such as differences in virulence, host range or vector relationships are significant enough to affect phytosanitary status.

In cases where a vector is involved, the vector may also be considered a pest to the extent that it is associated with the causal organism and is required for transmission of the pest.

Presence or absence in the PRA area

The pest should be absent from all or a defined part of the PRA area.

Regulatory status

If the pest is present but not widely distributed in the PRA area, it should be under official control or expected to be under official control in the near future.

Potential for establishment and spread in the PRA area

Evidence should be available to support the conclusion that the pest could become established or spread in the PRA area. The PRA area should have ecological/climatic conditions including those in protected conditions suitable for the establishment and spread of the pest and where relevant, host species (or near relatives), alternate hosts and vectors should be present in the PRA area.

Potential for economic consequences in the PRA area

There should be clear indication that the pest is likely to have an unacceptable economic impact (including environmental impact) in the PRA area.

PROPOSAL TO IMPORT UNSHU MANDARIN FRUIT FROM JAPAN

BACKGROUND

The importation of "Unshu Mikan" mandarin from Japan into Australia was first discussed (together with access requests for peaches, nectarines and table grapes) at the 4th Japan-Australia Bilateral Plant Quarantine Technical Discussions in July 1989. At this time Australia asked Japan to present invertebrate and disease pest lists categorised with information on plant part affected, biology and control measures. The pest lists for these commodities were provided to the Australian Quarantine and Inspection Service (AQIS) by the Ministry of Agriculture, Forestry and Fisheries (MAFF) Japan in July 1990.

At the 6th Japan-Australia Plant Quarantine Technical Discussions held on 20-21 July 1992, AQIS presented MAFF with an amended copy of the pest list, containing additional information on pests of citrus in Japan. AQIS categorised the pests according to their quarantine status in Australia and requested verification of the list by MAFF. At this time, AQIS requested further information on occurrence and controls of pests on fruit, and also suggested several management options for pests of quarantine importance to Australia. The major pests of concern at that time were the moths, *Adoxophyes* sp. (smaller tea tortrix) and *Homona magnanima* (large tea tortrix) and the fruit fly *Dacus tsuneonis*. Major diseases of concern were *Xanthomonas axonopodis* (citrus canker) and *Liberobacter asiatum* (citrus greening).

On 19 November 1992, AQIS formally asked MAFF to provide additional information on viruses and potential yield losses from certain pests. Information on viral diseases of Unshu mandarin was received on 28 June 1993. At the 8th Japan-Australia Plant Quarantine Technical Discussions of October 1995, AQIS requested MAFF to provide harvest dates for the commodities it wished to import. AQIS then advised that a systems approach would be necessary to manage the risk from *Aculops pelekassi* (pink citrus rust mite) and a disinfestation treatment or a systems approach would be required to manage the risk from *Adoxophyes* sp. and *Homona magnanima* on citrus.

At the 10th Japan-Australia Plant Quarantine Technical Discussions held in 1998, MAFF advised that Unshu mandarin access was Japan's next priority after Fuji apple. AFFA adopted a new IRA process in 1998 and decided to conduct an IRA on Japanese Unshu mandarin using this new process. On 13 July 1999, AQIS's Plant Quarantine Policy Branch advised the Director, Plant Protection Division of MAFF of Australia's progress in relation to their access proposal for Unshu mandarin and requested a full updated list of pests and diseases and biological data and management options, especially for fruit fly and citrus canker. The required information was sent to AQIS on 1 November 1999 and included proposed management methods for the three pests and two diseases identified as quarantine concern by AQIS in 1992. Requests for further information on production areas of Unshu mandarin and the distribution of citrus canker and *Dacus tsuneonis* in Japan were requested by letter on 21 November 1999 and 9 January 2000.

In October 2000, Biosecurity Australia (BA) was established within AFFA to take responsibility for assessing the quarantine risks associated with commodity imports. Responsibility for the conduct of IRAs previously rested with AQIS.

BA issued a Plant Biosecurity Policy Memorandum (PBPM) 2001/05 on 16 March 2001 advising stakeholders that AFFA had received an import request for Unshu mandarin from Japan.

A reply to the letters to MAFF of November 1999 and January 2000 was received in April 2001, and the relevant parts translated by June 2001. The information included a map showing the distribution of the fruit fly *Dacus tsuneonis*, showing that it does not occur in Shizuoka Province, the source area for exports.

In July 2001, BA requested further information on a number of pests and diseases of quarantine concern, with a particular focus on citrus canker. This issue was discussed at the 12th bilateral discussions held in Canberra in December 2001, where MAFF assured BA of a full and prompt response to the request. BA also assured Japan of the high priority of the Unshu IRA on the BA workplan and its commitment to completing the IRA in a timely manner.

Biosecurity Australia conducted a review of the import risk analysis process in 2001, as advised in Plant Biosecurity Policy Memorandum 2001/21 on 28 September 2001. The initial paper for consultation with stakeholders will now be a technical issues paper for all IRAs, providing an opportunity for early stakeholder input into the science. This paper will list the pests and diseases that the IRA team has identified as needing to be assessed and seek stakeholder comment including any additional pests and diseases of concern.

BA issued PBPM 2002/03 on 29 January 2002 officially advising stakeholders of the commencement of an IRA on the importation of fresh Unshu mandarin from Japan. The PBPM proposed that the IRA use an in-house team of scientists to consider the quarantine risks associated with pests and diseases of Unshu mandarins from Japan. BA received two comments from stakeholders at the end of the 30-day comment period on 28 February 2002. One comment concerned the revised IRA process and composition of the IRA team and the other concerned the scope of the IRA and the major diseases issues.

After consideration of these comments, stakeholders were advised in PBPM 2002/16 on 23 April 2002 that technical experts from within BA would be used for the IRA. BA did not receive any appeals by the close of the 30-day appeal period on 24 May 2002.

ADMINISTRATION

Timetable

Further steps in the IRA process are outlined in a later section of this paper (p 41). Given the nature of the task, it is not possible to give definitive time frames for these steps at this stage. Stakeholders will be advised in a timely manner of key forthcoming events throughout the process.

Scope

The IRA considers quarantine risks that may be associated with the importation of fresh Unshu mandarin from Japan into Australia. In the IRA, Unshu mandarin is defined as mature fruit of *Citrus reticulata* var. *unshiu* synonym *Citrus unshiu*, (commonly called Unshu mandarin, Unshu orange, Unshu-mikan tangerine, Satsuma) produced in Japan. As proposed by MAFF, the fruit for import will only be sourced from Shizuoka prefecture. Further, the Unshu mandarin must have been produced, harvested, packed and stored using appropriate chemical, biological and physical pest control and management systems, to reduce the level of risk posed by any harmful pest species that may be present.

AUSTRALIA'S CURRENT QUARANTINE POLICY FOR IMPORTS OF CITRUS FRUIT

International arrangements

Citrus fruits are imported into Australia from Egypt, Israel, Italy, New Zealand, Spain and the USA (Arizona, California, Texas) under specified, approved quarantine treatments and area freedom from certain diseases. Details of species and varieties permitted entry are given in Table 2. Details of import conditions for citrus fruit are given on the AQIS Import Conditions (ICON) database website http://www.aqis.gov.au/icon/. All imported consignments of citrus fruit are also subject to 'General requirements for all fruits and vegetables' as outlined on the ICON database. No fresh citrus fruit or juice is currently imported into Australia from Japan.

Table 2. Citrus fruits currently permitted entry into Australia

Common name	Scientific name	Israel	New Zealand	Spain	USA (Arizona, California, Texas only)	Italy
Calamondin	*Citrus mitis*	No	Yes	Yes	Yes	No
Etrogs	*Citrus medica*	Yes	No	No	No	Yes
Grapefruit	*Citrus paradisi*	Yes	Yes	Yes	Yes	No
Kaffir limes	*Citrus hystrix*	No	Yes	Yes	Yes	No
Lemons	*Citrus limon*	No	Yes	Yes	Yes	No
Limes	*Citrus aurantifolia*	No	Yes	Yes	Yes	No
Mandarins and tangerines	*Citrus reticulata*	Yes	Yes	Yes	Yes	No
Orange (sour)	*Citrus aurantium*	No	Yes	Yes	Yes	No
Orange (sweet)	*Citrus sinensis*	Yes	Yes	Yes	Yes	No
Pomelo	*Citrus grandis, Citrus maximus*	Yes	Yes	Yes	Yes	No
Rangpur limes	*Citrus limonia*	No	Yes	Yes	Yes	No
Tahitian limes	*Citrus latifolia*	No	Yes	Yes	Yes	No
Tangelo	*Citrus reticulata* x *Citrus paradisi*	No	Yes	Yes	Yes	No

Source: AQIS ICON Database http://www.aqis.gov.au/icon/

Domestic arrangements

The Commonwealth Government is responsible for regulating the movement of plants and their products into and out of Australia, but the State and Territory Governments have primary responsibility for plant health controls within Australia. Legislation relating to resource management or plant health may be used by State and Territory government agencies to control interstate movement of plants and their products.

To help facilitate interstate trade and ensure produce is pest free, the Interstate Certification Assurance (ICA) system was developed. The ICA scheme is a national scheme of Plant Health Certification that is accepted by all Australian states and the Northern Territory. The ICA scheme is based on documented operational procedures and provides a harmonised approach to the audit and accreditation of businesses throughout Australia and the mutual recognition of Plant Health Assurance Certificates accompanying consignments of produce moving within Australia. Interstate quarantine authorities maintain the right to inspect the certified produce at any time and to refuse to accept a certificate where produce is found not to conform to specific requirements.

There are a number of ICAs with specific conditions or restrictions currently in place regarding the interstate movement of fresh citrus fruits produced in Australia. The main pests of interstate quarantine concern are the Queensland fruit fly (*Bactrocera tryoni*) and Mediterranean fruit fly (*Ceratitis capitata*).

Interstate requirements are based on the following ICAs:

ICA-01: Post-harvest dipping with dimethoate or fenthion.

ICA-02: Post-harvest flood spraying with dimethoate or fenthion.

ICA-04: Post-harvest fumigation with methyl bromide.

ICA-07: Post-harvest cold treatment.

Biosecurity Australia has responsibility for phytosanitary issues in Australia, while Foods Standards Australia New Zealand (FSANZ) (formerly Australia New Zealand Food Authority (ANZFA)) is responsible for food safety issues.

THE CITRUS INDUSTRY

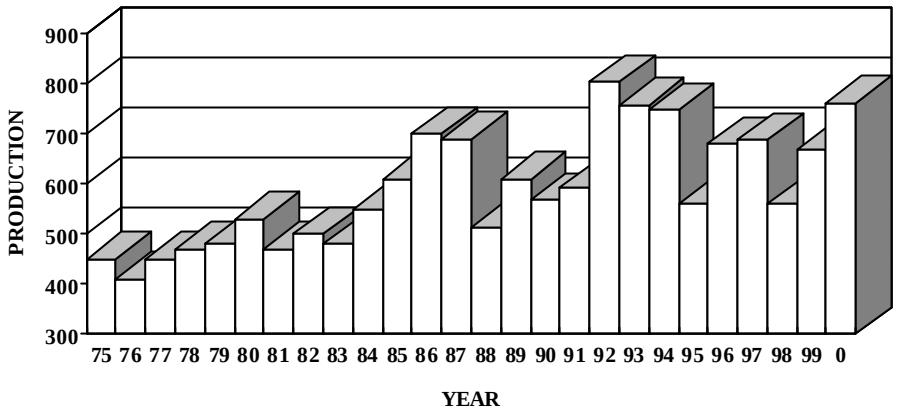
Production of citrus in Australia

Citrus is currently one of the largest horticultural industries in Australia. Since the early 1970s, production has risen from around 400,000 tonnes to a peak of 804,000 tonnes in 1992/93 (Figure 2). In 1999/00, total production of Australian citrus amounted to 761,500 tonnes (ABS, 2001). The rise in production in the early 1990s resulted mainly from an increased planting of oranges in response to the growing orange juice market during the late 1970s and early 1980s (ABS, 2001).

Australia is the fourth largest citrus producing country in the Southern Hemisphere after Brazil, Argentina and South Africa. However, Australia is a relatively small producer on a global scale, ranking 16th in the world, and contributing only about 1% to global citrus production. In total, world citrus production is around 90 million tonnes annually. International fresh citrus exports are 9 million tonnes, of which Australia contributes 140,000 tonnes or 1.6%, an increase of 90,000 tonnes over 10 years (ABS, 2001).

In 1998/99 the estimated gross value of production was $422.1 million. The farmgate value of citrus production in 1998/99 was $330.6 m, $46.9 m above the previous year (ABS, 2001). Broken down by product, the farmgate value of production was comprised of $237.9 m for oranges, $64.2 m for mandarins, $19.2 m for lemons/limes and $9.3 m for other citrus (ABS, 2001).

Figure 2. Annual citrus production in Australia 1975-2000 ('000 tonnes)

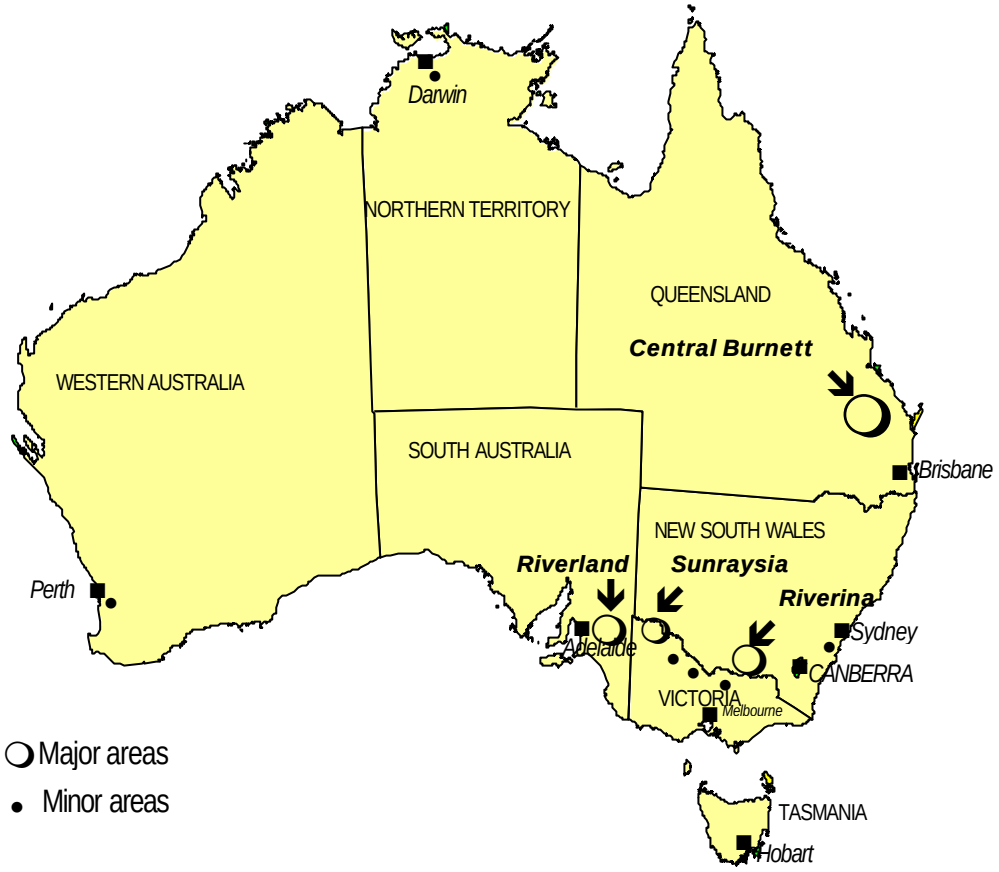


There are approximately 3,000 citrus growers in Australia, collectively cultivating 32,000 ha of orchards. The largest number of growers is concentrated in the Riverland region of South Australia. Of the 1,000 or so citrus holdings in South Australia, 83% are 10 ha or less in size. This is consistent with the general trend in Australia, as most citrus farms are relatively small, mixed fruit growing operations, with an average harvested area of around 18 ha.

The species of citrus grown in Australia on a commercial basis are: *Citrus aurantifolia* (Christman.) Swingle (lime), *C. latifolia* (Yu. Tanaka) Tanaka (Persian or Tahitian lime), *C. limon* (L.) Burman f. (lemon), *C. maxima* (Burm.) Merrill. (pummelo), *C. medica* L. (citron), *C.* x *paradisi* Macfad. (grapefruit), *C. reticulata* Blanco (mandarin, tangerine), *Citrus* x *tangelo* J.W. Ingram & H.E. Moore (*Citrus reticulata* x *C. paradisi*) (tangelo), and *C. sinensis* (L.) Osbeck. (sweet orange). Various *Fortunella* spp. (kumquats) and *Citrus hystrix* DC. (kaffir lime) are grown on a small scale, the latter in north Queensland and the Northern Territory. There are also indigenous Australian citrus relatives from the genera *Microcitrus* and *Eremocitrus* that are harvested for the bush food industry.

Citrus fruit is grown commercially in all states except Tasmania. There are four main production regions in Australia: the "Riverland" in South Australia; "Sunraysia" in the Murray Valley region of Victoria and NSW; the "Riverina" in NSW; and the "Central Burnett" region of Queensland (Figure 3). Three of these regions are located within the inland irrigation areas of south-eastern Australia, and together they comprise the "Tri-State Fruit Fly Free Area", accounting for approximately 90% of Australian citrus production.

Figure 3. Citrus production areas in Australia



Source: http://www.farmwide.com.au/nff/acg/AboutIndustry.htm

New South Wales grows approximately 35% of the total Australian citrus production. South Australia follows with 33%, Victoria 20%, Queensland 10% and Western Australia 2%, with a small but growing industry in the Northern Territory. While oranges account for the largest share of citrus production in the southern irrigation areas, Queensland is the main mandarin growing area, accounting for 64% of total mandarin production. The major mandarin production area in Queensland is the Central Burnett region, comprising the districts of Mundubbera, Gayndah, Maryborough and Bundaberg. Other mandarin production areas in Queensland are located at Emerald in the central part of the state and Mareeba on the Atherton Tablelands in north Queensland. Oranges are the predominant citrus fruit grown in Australia. In 2001/02, Australian production consisted of 81% oranges, 13% mandarins, 4% lemons and limes, and 2% grapefruit (Table 3).

Table 3: Citrus production by State (tonnes/season)

Citrus species	Season	Production (tonnes)						Total
		NSW	Vic	Qld	SA	WA	NT	
Orange	1999-2000	212,000	106,000	24,000	165,000	8,000	-	**515,000**
	2000-2001	236,000	128,000	33,000	221,000	8,000	-	**626,000**
	2001-2002	179,000	79,000	19,000	142,000	8,000	-	**427,000**
	2002-2003*	209,000	148,000	28,000	197,000	9,000	-	**591,000**
Lemon & Lime	1999-2000	6,000	6,000	8,000	10,000	1,000	300	**31,300**
	2000-2001	6,200	3,000	10,000	10,000	1,000	300	**30,500**
	2001-2002	8,100	6,000	8,000	8,000	1,000	300	**31,400**
	2002-2003*	10,000	6,000	11,000	11,000	1,000	-	**39,000**
Mandarin/ Tangelo	1999-2000	5,000	8,000	72,000	13,000	2,000	-	**100,000**
	2000-2001	5,000	8,000	81,000	18,000	3,000	-	**116,000**
	2001-2002	6,200	8,000	47,000	11,000	3,000	-	**75,000**
	2002-2003*	8,000	7,000	85,000	16,000	4,000	-	**120,000**
Grapefruit	1999-2000	1,000	8,000	1,000	3,000	1,000	200	**14,200**
	2000-2001	1,000	8,000	1,000	3,000	1,000	200	**14,200**
	2001-2002	1,200	8,000	1,000	3,000	1,000	200	**14,400**
	2002-2003*	1,000	6,000	1,000	3,000	1,000	-	**12,000**

Source: http://www.farmwide.com.au/nff/acg/AboutIndustry.htm

* Forecast

Export of Australian citrus

Over the past 10 years, fresh citrus exports from Australia have tripled, with a five-fold increase in freight on board (fob) values. In 1988/89, just 5% of national citrus production was exported; by 1998/99 that had risen to 23% (ACGI, 2001). Export volumes have stabilised during the last 4 years. Australia exported approximately 17% of its total citrus production in 1999/2000, accounting for around 1% of world citrus exports. The major export markets for Australian citrus over the last several years have been the USA, Indonesia, New Zealand, Singapore, Malaysia, Hong Kong, Canada, Japan, the United Kingdom and Vietnam (ABS, 2001).

Australia has exported fresh citrus fruit to Japan for more than ten years under conditions requiring mandatory cold disinfestation treatments for Queensland fruit fly (*Bactrocera tryoni*) and Mediterranean fruit fly (*Ceratitis capitata*). Australian producers gained access to Japanese markets for Valencia and Washington Navel oranges from designated production zones in 1983, and Australian lemons were permitted entry in 1992. Export of mandarins to Japan commenced in

1999, with access granted for “Imperial” tangerines, “Ellendale” and “Murcott” tangors and “Minneola” tangelos.

Japan is Australia’s sixth largest export market for citrus products, importing 14,617 tonnes, or 11.1% of the total export volume produced in the 1999/00 season (ABS, 2001). Japan is the largest importer of Australian lemons, consuming almost two-thirds of lemon exports in 1999/00 (ABS, 2001). The export figures for Australian citrus to Japan for the 1998/99 and 1999/00 production seasons are provided in Table 4.

Table 4. Exports of Australian citrus to Japan 1998/99 and 1999/00

Citrus species	1998-1999		1999-2000	
	Quantity (tonnes)	Value ($A, 000)	Quantity (tonnes)	Value ($A, 000)
Oranges	6,353	8,784	10,191	15,561
Mandarins	87	290	1,517	3,174
Lemon/Limes	3,037	4,601	2,908	5,049
Total citrus	**9,477**	**13,676**	**14,617**	**23,784**

Source: Australian Bureau of Statistics (2001)

Unshu mandarin industry in Japan

Japan's major citrus growing prefectures are Kanagawa, Chiba, Saitama, Shizuoka, Wakayama, Hiroshima, Yamaguchi and Kumamoto (MAFF, 2001). Areas of southern Japan experience climatic conditions that are favourable to the production of early ripening Unshu mandarin of high quality and maximum size. MAFF has indicated that Shizuoka prefecture will be the source of Unshu mandarin for export to Australia (Figure 4).

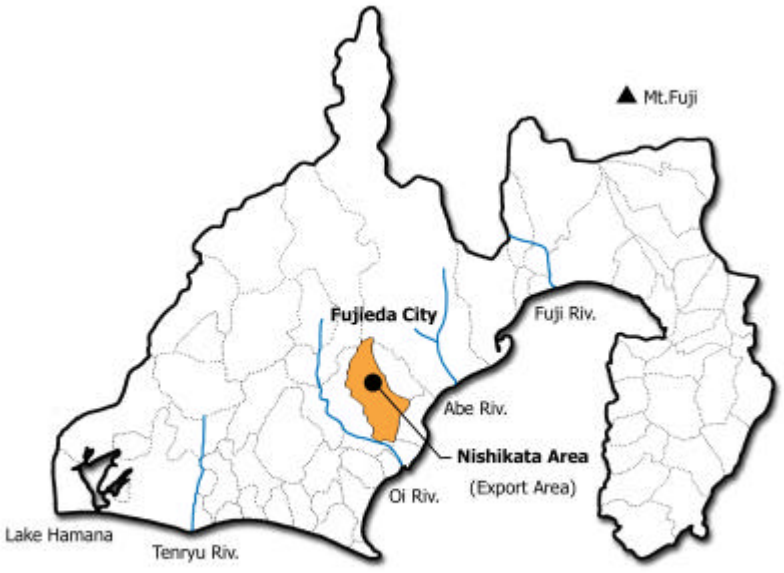
The Unshu mandarin is smaller than an orange, has a more pungent odour, thinner peel and segments separate easily. Through centuries of selection, many different cultivars of Unshu mandarin have been identified. Over a hundred cultivars have now been named and described. The main cultivars currently grown are given in Table 5. In this table, four broad classes of cultivar are listed based on maturity time: very early (goko wase); early (wase); mid-season; and late (Unshu).

Trifoliate orange (*Poncirus trifoliata*) is the predominant rootstock for all citrus cultivars in Japan. Experimentation in Shizuoka with Flying Dragon (*Hiryu trifoliata*) as rootstock has proven to be very successful in controlling tree size.

Most of the citrus orchards in Japan are on steep, terraced hillsides. Land area is the major limiting factor, so high density planting is carried out. Young plantings are usually spaced 2 x 2 metres apart (2,500 trees per hectare), and then progressively thinned as the trees begin to crowd. At 15 years, the density is reduced to 600 trees per hectare (4 x 4 metres). The commercial life of an orchard is estimated to be 30-40 years.

Figure 4. Major growing areas of Unshu mandarin in Japan and the proposed export area in Shizuoka Prefecture.

Major Growing Area of Unshu Orange in Japan



Map of Shizuoka Prefecture

Table 5. Unshu mandarin cultivars with growing area over 1,000 hectares

Season	Cultivar	Area in 1991 (ha)	Time of harvest
Very early	Miyamoto Wase	2,109	Mid-September to early October
	Ueno Wase	2,010	Early October to early November
	Yamakawa Wase	1,175	Late September to early October
Early	Miyagawa Wase	14,013	Late October to late November
	Okitsu Wase	11,196	Mid-October to late November
Mid-season	Nankan No. 20	2,268	Early to mid-November
Late	Aoshima Unshu	6,174	Mid-December to early January
	Hayashi Unshu	4,908	Early December
	Sugiyama Unshu	4,037	Late November
	Nankan No. 4	3,116	Early to mid-December
	Owari Unshu	3,019	Early to late December
	Otsu No. 4	2,343	Mid-December to early January
	Koyama Unshu	1,166	Early to late December

Source: Horticultural Research, New Zealand <sciindix.htm>

In the Mikkabi district, yields for Satsuma mandarins average 15 tonnes per hectare. Only in plantings older than 10 years are yields of 30 tonnes per hectare achieved.

For mid-season cultivars, fruit is stored for up to three weeks before packing. This period is required for citric acid levels in the fruit to decline to acceptable levels. Acidity will reduce by 0.2-0.3% by storing under low humidity (80%). Fruit is typically delivered to the pack-house at 0.8 % acidity.

After packing, fruit is held in low humidity (80%) cool stores at 8°C. Traditionally, this has been done in small storage chambers (20 m^2) in 18 kg boxes, but larger stores that allow forklift access are now used. Tyvek, a Dupont trade name for a very fine, high density, polyethylene fibre, is used to cover boxes in storage, as it does not create the excessive humidity that vinyl covers do. It is a lightweight material that is vapour permeable yet water, chemical, abrasion, puncture and tear resistant. The doors of the storage chambers are only closed after the fruit has lost 3 % of its original weight. This curing process makes rinds thinner and less waste prone (Harty and Anderson, 2000).

In 1963, the area planted to Unshu mandarin in Japan was 87,075 ha with a production of about 875,000 tonnes. This was about 80% of all citrus areas and a third of the fruit produced. A considerable amount of this fruit production is tinned. However the area of land under Unshu production has been steadily falling for the last thirty years (Table 6).

Table 6. Area under Unshu mandarin in Japan ('000 hectares)

Year	1965	1970	1975	1980	1985	1989
Unshu mandarin	115	163	169	140	113	86

Source: Japan Statistical Yearbook 1991. pp 162-165.

Japan's total citrus production in 2000/01 was forecast at 1.3 million tonnes, down 18 % from the 1999/2000 level. Unshu mandarin production in 2000/01 was forecast to account for 93 % of total production and accounts for the drop in total production (<http://www.fas.usda.gov/htp/circular/2001/01-02/citrus.htm>).

Japan exports citrus, including Unshu mandarin to the USA. Quantities of Unshu mandarin exported since 1994 have been small and averaged 240 tonnes per year from 1994 to 1999. The exports cater for a niche market.

Unshu mandarin has been exported from Japan to New Zealand since February 2000 but quantities are small. In all, eight 20 ft containers have been received over two years to February 2002. Only one pest interception, that of a tetranychid mite, has been made.

The latest figures available for production of Unshu mandarin from Shizuoka Province are for 2000 (Table 7).

Table 7. Production and shipment of Unshu mandarin from Shizuoka Province in 2000 and a comparison to 1999 figures.

Variety	Area under fruit trees (ha)	Production (tonnes)	Shipment (tonnes)	Percentage of 1999 figure		
				Fruiting area	Production	Shipment
Unshu (early)	1,860	46,800	42,900	98	84	84
Unshu	4,300	89,800	77,700	100	85	85
Total	**6,160**	**136,600**	**120,600**			

Source: Preliminary Statistical Report www.maff.go.jp/esokuhou/index.html.

PRELIMINARY RESULTS OF PEST CATEGORISATION

PRESENCE OR ABSENCE, REGULATORY STATUS AND ASSOCIATION OF PESTS WITH THE PATHWAY

Pest categorisation involves the following elements: identity of the pest; presence or absence in the PRA area; regulatory status; potential for establishment or spread in the PRA area; and potential for economic consequences (including environmental consequences) in the PRA area. These are discussed in the section entitled 'Elements of Pest Categorisation' on pages 25-26. The first three elements of pest categorisation are reported in this Technical Issues Paper. Appendix 1 lists the occurrence pests and diseases of Unshu mandarin in Japan and their presence or absence in Australia (or present but not widely distributed and being officially controlled). Appendix 2 indicates whether the potential pest or disease occurs on Unshu mandarin fruit, the pathway under consideration in this IRA. Appendix 3 summarises the species that are to be considered in the second stage of the IRA.

Table 8 provides, for each pest type (mites, insects, gastropods, nematodes, bacteria, fungi, viroids and viruses), a summary of the number known to be associated with Unshu mandarin plants in Japan, the number present in Australia and the number associated with the import pathway (i.e. that occur on Unshu mandarin fruit). Many of the pests associated with Unshu mandarin plants in Japan occur in Australia or are not present on the import pathway. These pests do not need to be considered further in the IRA.

Table 8. Summary of pests associated with Unshu mandarin in Japan, their occurrence in Australia and their association with Unshu mandarin fruit

Pest type	Associated with Unshu mandarin in Japan	Australian status			Associated with Unshu mandarin fruit	Consider further
		Present	Under official control	Not present		
Mites	10	8	0	2	2	2
Insects	226	59	2	165	70	70
Snails	3	1	0	2	2	2
Nematodes	11	8	0	3	0	0
Bacteria	4	2	0	2	2	2
Fungi	56	32	0	24	17	17
Viroids	2	2	0	0	0	0
Viruses	11	6	0	5	5	5
Total	**323**	**117**	**2**	**204**	**98**	**98**

Invertebrates

Of the 250 arthropod, mollusc and nematode species known to occur on Unshu mandarin in Japan, 76 also occur in Australia. Of these 76 species that occur in Australia, *Frankliniella occidentalis* and *Thrips palmi* are under official control in some states of Australia (Table 8). Of the 172 species not present in Australia, 74 species are associated with the import pathway and will be considered further. These comprise 2 species of Acarina (mites); 5 species of Coleoptera (beetles); 2 species of Diptera (flies); 38 species of Hemiptera (true bugs); 19 species of Lepidoptera (moths); 3 species of Orthoptera (crickets and grasshoppers), 3 species of Thysanoptera (thrips) and 2 species of Mollusca (snails).

Pathogens

Of 73 disease-causing microorganisms (bacteria, fungi, viroid and viruses) reported on Unshu mandarin in Japan, 42 have been recorded in Australia (Table 8). Citrus canker, *Xanthomonas axonopodis* pv. *citri*, has been eradicated from Australia. Of the 31 pathogen species not present in Australia, 24 species are associated with the import pathway and will be considered further. These include 2 bacteria, 17 species of fungi and 5 viruses

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FURTHER STEPS IN THE IMPORT RISK ANALYSIS PROCESS

The IRA process requires that the following steps be undertaken for an IRA:

- release of the draft IRA paper for stakeholder comment
    - comments to be received within 60 days
- consideration of stakeholder comment on the draft IRA paper
    - further stakeholder consultation as necessary
- preparation of the final IRA paper
- submission of IRA recommendations to the Director of Animal and Plant Quarantine
- consideration of the recommendations by the Director of Animal and Plant Quarantine and final determination
- release of the final IRA paper
    - appeals to be received within 30 days
- consideration of any appeals
- if there are no appeals, or if the appeals are rejected, adoption of appropriate quarantine policy.

Stakeholders will be advised of any significant variations to the process.

Biosecurity Australia is committed to a thorough risk analysis of the proposed importation of Unshu mandarin fruit from Japan. This analysis requires that technical information from a wide range of sources. If you have information relevant to this IRA for Unshu mandarin from Japan, please provide it as quickly as possible.[3]

[3] Contact details for stakeholder contributions are provided in the accompanying Plant Biosecurity Policy Memorandum (PBPB)

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APPENDIX 1. PEST CATEGORISATION FOR UNSHU MANDARIN (OCCURRENCE IN AUSTRALIA)

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
INVERTEBRATA						
ACARI (mites)						
Aculops pelekassi (Keifer, 1959) [Acarina: Eriophyidae]	Pink citrus rust mite	Yes	MAFF (1990)	No	Smith *et al*. (1997)	Yes
Brevipalpus obovatus Donnadieu, 1875 [Acarina: Tenuipalpidae]	Privet mite, scarlet mite	Yes	MAFF (1990)	Yes	Halliday (1998)	No
Bryobia rubrioculus (Scheuten, 1857) [Acarina: Tetranychidae]	Bryobia mite	Yes	MAF NZ (2000)	Yes	Halliday (1998)	No
Eotetranychus kankitus Ehara [Acarina: Tetranychidae]	Citrus yellow mite	Yes	MAFF (1990); Ehara (1964)	No	Halliday (1998)	Yes
Eotetranychus sexmaculatus (Riley, 1890) (synonym: *Eotetranychus asiaticus*) [Acarina: Tetranychidae]	Six-spotted spider mite	Yes	MAFF (1990); Ehara (1964); USDA (1995)	Yes	Halliday (1998); synonomy Halliday (pers. comm.)	No
Panonychus citri (Mc Gregor) [Acarina: Tetranychidae]	Citrus red mite	Yes	MAFF (1990)	Yes	Halliday (1998)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Polyphagotarsonemus latus (Banks, 1904) [Acarina: Tarsonemidae]	Broad mite	Yes	MAFF (1990)	Yes	Halliday (1998)	No
Tetranychus cinnabarinus (Boisduval, 1867) [Acarina: Tetranychidae]	Carmine spider mite	Yes	MAFF (1990); Ehara (1964)	Yes	Halliday (1998)	No
Tetranychus kanzawai Kishida, 1927 [Acarina: Tetranychidae]	Kanzawa spider mite	Yes	MAFF (1990); Ehara (1964)	Yes	Halliday (1998)	No
Tetranychus urticae Koch, 1836 [Acarina: Tetranychidae]	Two spotted mite	Yes	MAF NZ (2000)	Yes	Halliday (1998)	No
INSECTA (insects)						
Coleoptera (beetles)						
Adoretus tenuimaculatus Waterhouse [Coleoptera: Scarabaeidae]	Flower beetle	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Agrilus alesi Oben, 1935 [Coleoptera: Buprestidae]	Ales' flatheaded citrus borer	Yes	MAFF (1990)	No	ABRS (2001)	Yes
Agrilus auriventris Saunders [Coleoptera: Buprestidae]		Yes	MAFF (1990)	No	CABI (1999)	Yes
Amystax satanus Nakane [Coleoptera: Curculionidae]	Weevil	Yes	MAFF (1990)	No	E. Zimmerman (pers. comm.)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Anomala cuprea Hope [Coleoptera: Scarabaeidae]	Cupreous chafer	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Anoplophora malasiaca (Thomson) [Coleoptera: Cerambyicidae]	Whitespotted longicorn beetle	Yes	MAFF (1990)	No	No records found	Yes
Araecerus fasciculatus (Degeer, 1775) [Coleoptera: Curculionidae]	Coffee bean weevil	Yes	MAFF (1990)	Yes	AICN (2001)	No
Aulacophora nigripennis Motschulsky [Coleoptera: Chrysomelidae]	Pumpkin beetle	Yes	MAFF (1990)	No	Present in Taiwan, China, Hong Kong, Siberia, Palau Is (T. Hawkeswood, pers. comm.)	Yes
Blitopertha orientalis (Waterhouse) [Coleoptera: Scarabaeidae]	Oriental beetle	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Callirhopalus bifasciatus (Roelofs 1880) [Coleoptera: Curculionidae]	Gooseberry weevil, two-banded Japanese weevil	Yes	MAFF (1990)	No	Zimmerman (1994)	Yes
Cassida obtusata Boheman, 1854 [Coleoptera: Chrysomelidae]	Flea beetle	Yes	MAFF (1990)	No	Hawkeswood *et al*. (1997)	Yes
Ectinohoplia obducta (Motschulsky, 1857) [Coleoptera: Scarabaeidae]	Scarab	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Epuraea domina Reitter, 1873 [Coleoptera: Nitidulidae]	Sap beetle	Yes	MAFF (1990)	No	J. Lawrence (pers. comm.)	Yes
Epuraea japonica Motsch., 1860 [Coleoptera: Nitidulidae]	Sap beetle	Yes	MAFF (1990)	No	J. Lawrence (pers. comm.)	Yes
Epuraea (Haptoncurina) paulula Reitter, 1873 [Coleoptera: Nitidulidae]	Sap beetle	Yes	MAFF (1990)	No	J. Lawrence (pers. comm)	Yes
Eucetonia pilifera (Motschulsky) [Coleoptera: Scarabaeidae]	Flower beetle	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Eucetonia roelofsi Harold, 1880 [Coleoptera: Scarabaeidae]	Flower beetle	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Glycyphana fulvistemma Motschulsky 1860 [Coleoptera: Scarabaeidae]	Scarab beetle	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Holotrichia kiotonensis Brenske [Coleoptera: Scarabaeidae]	Black chafer	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Holotrichia picea (Motschulsky, 1857) [Coleoptera: Scarabaeidae]	Chafer	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Luperomorpha funesta Baly [Coleoptera: Chrysomelidae]	Mulberry flea beetle	Yes	MAFF (1990)	No	C. Reid (pers. comm.)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Maladera japonica Motschulsky, 1857 [Coleoptera: Scarabaeidae]	Velvety chafer	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Maladera orientalis Motschulsky, 1857 [Coleoptera: Scarabaeidae]	Smaller velvety chafer	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Melanotus annosus Candeze, 1865 [Coleoptera: Elateridae]	Click beetle, wireworm	Yes	MAFF (1990)	No	Calder (1998)	Yes
Melanotus fortnumi Candeze, 1878 [Coleoptera: Elateridae]	Sweet potato wireworm	Yes	MAFF (1990)	No	Calder (1998)	Yes
Mesalcidodes trifidus (Pascoe, 1870) [Coleoptera: Curculionidae]	Weevil	Yes	MAFF (1990)	No	Zimmerman (1994)	Yes
Mesosa myops (Dalman, 1817) [Coleoptera: Cerambycidae]	Sesame-spotted longicorn beetle	Yes	MAFF (1990)	No	No records found	Yes
Monochamus subfasciatus Bates (synonym: *Monochamus subfasciatus* Breuning) [Coleoptera: Cerambycidae]	Longicorn beetle	Yes	USDA (1995)	No	Onagamitsu & Kaneko (1983)	Yes
Oxycetonia jucunda Falderman [Coleoptera: Scarabaeidae]	Citrus flower chafer	Yes	MAFF (1990)	No	Cassis *et al*. (1992)	Yes
Protaetia orientalis (Gory & Pecheron, 1833) [Coleoptera: Scarabaeidae]	May beetle	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Psammoecus triguttatus Reitter, 1874 [Coleoptera: Silvanidae]	Beetle	Yes	MAFF (1990)	No	No records found	Yes
Scepticus insularis Roelofs [Coleoptera: Curculionidae]	Striped gourd-shaped weevil	Yes	MAFF (1990)	No	CABI (1999); Zimmerman (pers. comm.)	Yes
Xyleborus saxeseni (Ratzeburg, 1837) [Coleoptera: Scolytidae]	Saxesen ambrosia beetle	Yes	MAFF (1990)	Yes	AICN (2001)	No
Xylosandrus germanus (Blandford) [Coleoptera: Scolytidae]	Alnus ambrosia beetle	Yes	MAFF (1990)	No	No records found	Yes
Diptera (flies)						
Bactrocera tsuneonis (Miyake, 1919) [Diptera: Tephritidae]	Citrus fruit fly	Yes	MAFF (1990)	No	No records found	Yes
Contarinia okadai (Miyoshi) [Diptera: Cecidomyiidae]	Japanese citrus flower-bud midge	Yes	MAFF (1990)	No	Bugledich (1999)	Yes
Limonia amatrix Alexander, 1922 (synonym: *Libnotes (Libnotes) amatrix* (Alexander, 1922) [Diptera: Tipulidae]	Citrus crane fly	Yes	MAFF (1990)	No	No records found	Yes
Hemiptera [aphids, leafhoppers; mealybugs; psyllids; scales; true bugs; whiteflies]						
Alcimocoris japonensis (Scott, 1880) [Hemiptera: Pentatomidae]	Shield bug	Yes	MAFF (1990)	No	Cassis & Gross (in press)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Aleurocanthus spiniferus (Quaintance, 1903) [Hemiptera: Aleyrodidae]	Citrus spiny whitefly	Yes	MAFF (1990)	Yes	Martin (1999)	No
Aleuroclava aucubae (Kuwana, 1911) (synonym: *Aleurotuberculatus aucubae* (Kuwana)) [Hemiptera: Aleyrodidae]	Aucuba whitefly, coral whitefly	Yes	MAFF (1990)	No	Martin (1999)	Yes
Aleurolobus marlatti (Quaintance) [Hemiptera: Aleyrodidae]	Marlatt whitefly	Yes	MAFF (1990)	Yes	Martin (1999)	No
Anacanthocoris striicornis (Scott) [Hemiptera: Coreidae]	Larger squash bug	Yes	MAFF (1990)	No	No records found	Yes
Andaspis hawaiiensis Maskell, 1895 [Hemiptera: Diaspididae]	Armoured scale	Yes	MAFF (1990)	No	J. Donaldson (pers. comm.)	Yes
Aonidiella aurantii (Maskell, 1878) [Hemiptera: Diaspididae]	California red scale, red scale, orange scale	Yes	MAFF (1990)	Yes	Smith *et al*. (1997)	No
Aonidiella citrina (Coquillett) [Hemiptera: Diaspididae]	Yellow scale	Yes	MAFF (1990)	Yes	AICN (2001)	No
Apheliona ferruginea (Matsumura) [Hemiptera: Cicadellidae]	Citrus leafhopper, jassid	Yes	MAFF (1990)	No	Day & Fletcher (1994)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Aphis spiraecola (Patch, 1914) Incorrectly referred to as *Aphis citricola* van der Goot, 1912 in some Australian literature. *A. citricola* now synonymised with *Aphis fabae* Scopoli,1763 [Hemiptera: Aphididae]	Spiraea aphid, citrus green aphid, apple aphid	Yes	MAFF (1990)	Yes	AICN (2001); M. Carver (pers. comm. 2002)	No
Aphis craccivora Koch, 1854 [Hemiptera: Aphididae]	Cowpea aphid	Yes	MAFF (1990)	Yes	CIE (1983)	No
Aphis gossypii Glover [Hemiptera: Aphididae]	Cotton aphid, melon aphid	Yes	MAFF (1990)	Yes	Smith *et al*. (1997)	No
Aphrophora intermedia Uhler [Hemiptera: Aphrophoridae]	Common spittlebug	Yes	MAFF (1990)	No	Komatsu (1997)	Yes
Aphrophora stictica Matsumura, 1903 [Hemiptera: Aphrophoridae]	Spittlebug	Yes	MAFF (1990)	No	Komatsu (1997)	Yes
Aulacorthum magnoliae (Essig & Kuwana) [Hemiptera: Aphididae]	Aphid	Yes	MAFF (1990)	No	CABI (2000)	Yes
Aulacorthum solani (Kaltenbach, 1843) [Hemiptera: Aphididae]	Foxglove aphid, glasshouse-potato aphid	Yes	MAFF (1990)	Yes	AICN (2001)	No
Bemisia giffardi (Kotinsky) [Hemiptera: Aleyrodidae]	Giffard whitefly	Yes	MAFF (1990)	Yes	Martin (1999)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Bothrogonia japonica Ishihara [Hemiptera: Cicadellidae]	Black-tipped leafhopper	Yes	MAFF (1990)	No	Day & Fletcher (1994)	Yes
Carbula humerigera (Uhler, 1860) [Hemiptera: Pentatomidae]	Shieldbug	Yes	MAFF (1990)	No	Cassis & Gross (in press)	Yes
Ceroplastes ceriferus (Fabricius, 1798) [Hemiptera: Coccidae]	Indian wax scale	Yes	MAFF (1990)	Yes	ScaleNet (2001)	No
Ceroplastes floridensis Comstock, 1881 [Hemiptera: Coccidae]	Florida wax scale	Yes	MAFF (1990)	Yes	ScaleNet (2000)	No
Ceroplastes japonicus Green, 1921 [Hemiptera: Coccidae]	Japanese wax scale	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes
Ceroplastes rubens Maskell, 1893 [Hemiptera: Coccidae]	Red wax scale, pink wax scale	Yes	MAFF (1990)	Yes	ScaleNet (2001)	No
Chrysomphalus bifasciculatus Ferris [Hemiptera: Diaspididae]	False Florida red scale	Yes	MAFF (1990)	No	No records found	Yes
Chrysomphalus dictyospermi (Morgan, 1889) [Hemiptera: Diaspididae]	Spanish red scale, dictyospermum scale	Yes	MAFF (1990)	Yes	J. Donaldson (pers. comm.)	No
Chrysomphalus ficus (Ashmead, 1880) (synonym: *C. aonidum* (Linnaeus, 1758)) [Hemiptera: Diaspididae]	Florida red scale, circular black scale	Yes	MAFF (1990)	Yes	Smith (1978)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Cletus punctiger (Dallas) [Hemiptera: Coreidae]	Squash bug	Yes	MAFF (1990)	No	No records found	Yes
Coccus discrepans (Green, 1904) [Hemiptera: Coccidae]	Soft scale	Yes	MAFF (1990)	No	ScaleNet (2000)	Yes
Coccus hesperidum Linnaeus, 1758 [Hemiptera: Coccidae]	Brown soft scale, soft scale	Yes	MAFF (1990)	Yes	ScaleNet (2000)	No
Coccus longulus (Douglas, 1887) [Hemiptera: Coccidae]	Long brown scale, long soft scale	Yes	MAFF (1990)	Yes	ScaleNet (2000)	No
Coccus pseudomagnoliarum (Kuwana, 1914) [Hemiptera: Coccidae]	Citricola scale	Yes	MAFF (1990)	Yes	ScaleNet (2000)	No
Coccus viridis (Green, 1889) [Hemiptera: Coccidae]	Green coffee scale	Yes	MAFF (1990)	Yes	ScaleNet (2000)	No
Diaspidiotus perniciosus (Comstock, 1990) (synonyms: *Quadraspidiotus perniciosus* (Comstock, 1990); *Comstockaspis perniciosa* (Comstock, 1990)) [Hemiptera: Diaspididae]	San Jose scale	Yes	MAFF (1990)	Yes	ScaleNet (2000)	No
Cryptotympana facialis (Walker, 1858). [Hemiptera: Cicadidae]	Cicada	Yes	MAFF (1990)	No	Moulds (1990)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Dialeurodes citri (Ashmead, 1885) [Hemiptera: Aleyrodidae]	Citrus whitefly	Yes	MAFF (1990)	No	Martin (1999)	Yes
Diaphorina citri Kuwayama, 1908 [Hemiptera: Psyllidae]	Citrus psylla	Yes	MAFF (1990)	No	No records found	Yes
Drosicha corpulenta (Kuwana) [Hemiptera: Margarodidae]	Giant mealybug	Yes	MAFF (1990)	No	CABI (1999)	Yes
Drosicha howardi (Kuwana, 1922) (synonym: *Warajicoccus howardi* Kuwana, 1922) [Hemiptera: Margarodidae]	Margarodid scale	Yes	MAFF (1990)	No	No records found	Yes
Edwardsiana flavescens (Fabricius, 1794) [Hemiptera: Cicadellidae]	Small green leafhopper	Yes	MAFF (1990)	No	Day & Fletcher (1994)	Yes
Empoasca arborescens Vilbaste [Hemiptera: Cicadellidae]	Leafhopper	Yes	MAFF (1990)	No	Day & Fletcher (1994)	Yes
Empoasca onukii Matsuda, 1952 [Hemiptera: Cicadellidae]	Tea green leafhopper	Yes	MAFF (1990)	No	Day & Fletcher (1994)	Yes
Epiacanthus stramineus (Motschulsky) [Hemiptera: Errhomenellidae]	Grape leafhopper	Yes	MAFF (1990)	No	AICN (2001)	Yes
Eucorysses grandis (Thunberg, 1783) [Hemiptera: Pentatomidae]	Shield bug	Yes	MAFF (1990)	No	Cassis & Gross (in press)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Fiorinia proboscidaria Green [Hemiptera: Diaspididae]	Armoured scale	Yes	MAFF (1990)	No	J. Donaldson (pers. comm.)	Yes
Geisha distinctissima (Walker) [Hemiptera: Flatidae]	Green flatid planthopper	Yes	MAFF (1990)	No	No records found	Yes
Geococcus citrinus Kuwana, 1923 [Hemiptera: Pseudococcidae]	Citrus root mealybug	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes
Geocoris (Piocoris) varius (Uhler, 1860) [Hemiptera: Lygaeidae]	Anthocorid bug	Yes	MAFF (1990)	No	G. Cassis, (pers. comm. 2002)	Yes
Glaucias subpunctatus (Walker) [Hemiptera: Pentatomidae]	Polished green stink bug	Yes	MAFF (1990)	No	No records found	Yes
Graptopsaltria nigrofuscata (Motschulsky, 1866) [Hemiptera: Cicadidae]	Large brown cicada	Yes	MAFF (1990)	No	No records found	Yes
Halyomorpha halys (Stal, 1855) [Hemiptera: Pentatomidae]	Brown marmorated stink bug	Yes	MAFF (1990)	No	No records found	Yes
Hemiberlesia rapax (Comstock, 1881) [Hemiptera: Diaspididae]	Greedy scale	Yes	MAFF (1990)	Yes	AICN (2001)	No
Hishimonus sellatus (Uhler) [Hemiptera: Cicadellidae]	Rhombic-marked leafhopper	Yes	MAFF (1990)	No	Day & Fletcher (1994)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Homoeocerus unipunctatus (Thunberg) [Hemiptera: Coreidae]	Coreid bug	Yes	MAFF (1990)	No	No records found	Yes
Howardia biclavis (Comstock, 1883) [Hemiptera: Coccidae]	Mining scale	Yes	MAFF (1990)	Yes	AICN (2001)	No
Hygia opaca (Uhler) [Hemiptera: Coreidae]	Coreid bug	Yes	MAFF (1990)	No	Cassis & Gross (in press)	Yes
Icerya purchasi Maskell, 1879 [Hemiptera: Margarodidae]	Cottony cushion scale, fluted scale, Australian bug	Yes	MAFF (1990)	Yes	CABI (1999)	No
Icerya seychellarum (Westwood, 1855) [Hemiptera: Margarodidae]	Yellow cottony cushion scale	Yes	MAFF (1990)	Yes	Williams & Watson (1990)	No
Kilifia acuminata (Signoret, 1873) [Hemiptera: Coccidae]	Acuminate scale	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes
Kolla atramentaris (Motschulsky) [Hemiptera: Tettigellidae]	Leafhopper	Yes	MAFF (1990)	No	Day & Fletcher (1994)	Yes
Lepidosaphes beckii (Newman, 1869) [Hemiptera: Diaspididae]	Purple scale, mussel scale, citrus mussel scale	Yes	MAFF (1990)	Yes	CABI (1999)	No
Lepidosaphes gloverii (Packard, 1869) [Hemiptera: Diaspididae]	Glover scale	Yes	MAFF (1990)	Yes	Biosecurity Australia (2002)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Leptocorisa acuta (Thunberg) [Hemiptera: Alydidae]	Rice bug, narrow rice bug, paddy bug	Yes	MAFF (1990)	Yes	CSIRO (1991)	No
Leptocorisa chinensis (Dallas) [Hemiptera: Alydidae]	Rice bug	Yes	MAFF (1990)	No	No records found	Yes
Lopholeucaspis cockerelli (Grandpre & Charmoy, 1899) [Hemiptera: Diaspididae]	Armoured scale	Yes	MAFF (1990)	No	No records found	Yes
Lopholeucaspis japonica (Cockerell, 1897) [Hemiptera: Diaspididae]	Pear white scale	Yes	MAFF (1990)	Yes (subspecies var. *darwinensis* Green, 1916)	J. Donaldson (pers. comm.)	No
Megacopta punctatissimum (Montandon) [Hemiptera: Plataspidae]	Bean pentatomid, globular stink bug	Yes	MAFF (1990)	No	No records found	Yes
Meimuna opalifera (Walker, 1850) [Hemiptera: Cicadidae]	Cicada	Yes	MAFF (1990)	No	Moulds (1990)	Yes
Morganella longispina (Morgan, 1889) [Hemiptera: Diaspididae]	Plumose scale	Yes	MAFF (1990)	Yes	AICN (2001)	No
Myzus persicae (Sulzer) [Hemiptera: Aphididae]	Green peach aphid, peach potato aphid, peach curl aphid	Yes	MAFF (1990)	Yes	AICN (2001)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Nezara antennata Scott [Hemiptera: Pentatomidae]	Green stink bug, Oriental green stink bug	Yes	MAFF (1990)	No	No records found	Yes
Nezara viridula (Linnaeus, 1758) [Hemiptera: Pentatomidae]	Southern green stink bug, green vegetable bug	Yes	MAFF (1990)	Yes	Clarke (1992)	No
Nipaecoccus viridis (Newstead) (synonym: *Nipaecoccus vastator* Maskell, 1895) [Hemiptera: Pseudococcidae]	Spherical mealybug, globular mealybug, cotton mealybug, coffee mealybug	Yes	MAFF (1990)	Yes	ScaleNet (2000)	No
Nipponorthezia ardisiae Kuwana, 1916 [Hemiptera: Ortheziidae]	Bladhia scale	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes
Nysius plebejus Distant [Hemiptera: Lygaeidae]	Seed bug	Yes	MAFF (1990)	No	No records found	Yes
Octaspidiotus stountoniae [Hemiptera: Diaspididae]	Armoured scale	Yes	MAFF (1990)	Yes?	No records found	Yes
Orosanga japonicus (Melichar) [Hemiptera: Ricaniidae]	Ricaniid planthopper	Yes	MAFF (1990)	No	No records found	Yes
Parabemisia myricae (Kuwana, 1927) [Hemiptera: Aleyrodidae]	Myrica whitefly, Japanese bayberry whitefly	Yes	MAFF (1990)	No	Martin (1999)	Yes
Paradasynus spinosus Hsiao, 1963 [Hemiptera: Coreidae]	Coreid bug	Yes	MAFF (1990)	No	Cassis & Gross (in press)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Parasaissetia nigra (Nietner, 1861) [Hemiptera: Coccidae]	Nigra scale	Yes	MAFF (1990)	Yes	AICN (2001)	No
Parlatoria cinerea Doane & Hadden, 1909 [Hemiptera: Diaspididae]	Armoured scale	Yes	MAFF (1990)	No	J. Donaldson (pers. comm.)	Yes
Parlatoria pergandii (Comstock, 1881) [Hemiptera: Diaspididae]	Chaff scale	Yes	MAFF (1990)	Yes	Smith *et al*. (1997)	No
Parlatoria proteus (Curtis, 1843) [Hemiptera: Diaspididae]	Cattleya scale, orchid scale	Yes	MAFF (1990)	Yes	AICN (2001)	No
Parlatoria ziziphi (Lucas, 1853) [Hemiptera: Diaspididae]	Black parlatoria scale, black scale, citrus scale, ebony scale, leaf black scale, Mediterranean scale	Yes	MAFF (1990)	No	J. Donaldson (pers. comm.)	Yes
Penthimia nitida Distant 1912 [Hemiptera: Cicadellidae]	Leafhopper	Yes	MAFF (1990)	No	Day & Fletcher (1994)	Yes
Physopelta cincticollis Stål, 1863. [Hemiptera: Largidae]	Largid bug	Yes	MAFF (1990)	No	Cassis and Gross (in press)	Yes
Physopelta gutta (Burmeister) [Hemiptera: Largidae]	Largid bug	Yes	MAFF (1990)	No	No records found	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Pinnaspis aspidistrae (Signoret, 1869) [Hemiptera: Diaspididae]	Fern scale	Yes	MAFF (1990)	Yes	J. Donaldson (pers. comm.), Williams & Watson (1988)	No
Pinnaspis strachani [Hemiptera: Diaspididae]	Hibiscus snow scale	Yes	MAF NZ (2000)	Yes	J. Donaldson (pers. comm.)	No
Piocoris varius (Uhler, 1860) [Hemiptera: Anthocoridae]	Anthocorid bug	Yes	MAFF (1990)	No	G. Cassis (pers. comm. 2002)	Yes
Planococcus citri (Risso, 1813) [Hemiptera: Pseudococcidae]	Citrus mealybug, grape mealybug, common mealybug	Yes	MAFF (1990)	Yes	ScaleNet (2000)	No
Planococcus kraunhiae (Kuwana, 1902) [Hemiptera: Pseudococcidae]	Japanese mealybug	Yes	MAFF (1990)	No	ScaleNet (2000)	Yes
Planococcus lilacinus (Cockerell, 1905) [Hemiptera: Pseudococcidae]	Coffee mealybug, Oriental cacao mealybug, Oriental cacao mealybug	Yes	MAFF (1990)	No	ScaleNet (2000)	Yes
Platypleura kaempferi (Fabricius) [Hemiptera: Cicadidae]	Kaempfer cicada	Yes	MAFF (1990)	No	No records found	Yes
Plautia stali Scott [Hemiptera: Pentatomidae]	Brownwinged greenbug, Oriental stink bug	Yes	MAFF (1990)	No	No records found	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Protopulvinaria pyriformis (Cockerell, 1894) [Hemiptera: Coccidae]	Pyriform scale	Yes	MAFF (1990)	No	Smith *et al*. (1997)	Yes
Pseudaonidia duplex (Cockerell) [Hemiptera: Diaspididae]	Camphor scale	Yes	MAFF (1990)	No	J. Donaldson (pers. comm. 2001)	Yes
Pseudaonidia trilobitiformis (Green) [Hemiptera: Diaspididae]	Trilobite scale	Yes	MAFF (1990)	Yes	J. Donaldson (pers. comm. 2001)	No
Pseudococcus comstocki (Kuwana, 1902) [Hemiptera: Pseudococcidae]	Comstock mealybug	Yes	MAFF (1990)	No	ScaleNet (2000)	Yes
Pseudococcus cryptus Hempel, 1918 (synonym: *Pseudococcus citriculus* Green, 1922) [Hemiptera: Pseudococcidae]	Citrus mealybug, citriculus mealybug, cryptic mealybug, Green's mealybug	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes
Pseudococcus longispinus (Targioni Tozzetti, 1867) [Hemiptera: Pseudococcidae]	Longtailed mealybug	Yes	MAFF (1990)	Yes	ScaleNet (2000)	No
Pulvinaria aurantii Cockerell, 1896 [Hemiptera: Coccidae]	Cottony citrus scale, orange citrus scale	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes
Pulvinaria citricola Kuwana, 1914 [Hemiptera: Coccidae]	Cottony citrus scale	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Pulvinaria okitsuensis Kuwana, 1914 [Hemiptera: Coccidae]	Cottony citrus scale	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes
Pulvinaria polygonata Cockerell, 1905 [Hemiptera: Coccidae]	Cottony citrus scale	Yes	MAFF (1990)	Yes	AICN (2001)	No
Pygomenida bengalensis (Westwood, 1837) [Hemiptera: Pentatomidae]	Shield bug	Yes	MAFF (1990)	No	Cassis & Gross (in press)	Yes
Rhizoecus kondonis Kuwana, 1923 [Hemiptera: Pseudococcidae]	Citrus ground mealybug	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes
Riptortus clavatus (Thunberg) [Hemiptera: Coreidae]	Bean bug	Yes	MAFF (1990)	No	CABI (1999)	Yes
Saissetia citricola (Kuwana, 1909) [Hemiptera: Coccidae]	Soft scale	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes
Saissetia coffeae (Walker, 1852) [Hemiptera: Coccidae]	Hemispherical scale	Yes	MAFF (1990)	Yes	AICN (2001)	No
Saissetia oleae (Olivier, 1791) [Hemiptera: Coccidae]	Black scale, brown olive scale, olive scale, black shield scale, citrus black scale	Yes	MAFF (1990)	Yes	ScaleNet (2001)	No
Takahashia japonica (Cockerell, 1896) [Hemiptera: Coccidae]	String cottony scale	Yes	MAFF (1990)	No	ScaleNet (2001)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Toxoptera aurantii (Boyer de Fonscolombe) [Hemiptera: Aphididae]	Black citrus aphid	Yes	MAFF (1990)	Yes	AICN (2001)	No
Toxoptera citricidus (Kirkaldy) [Hemiptera: Aphididae]	Tropical citrus aphid, brown citrus aphid	Yes	MAFF (1990)	Yes	M. Carver (pers. comm.)	No
Toxoptera odinae (Van der Goot) [Hemiptera: Aphididae]	Udo aphid	Yes	MAFF (1990)	No	M. Carver (pers. comm.)	Yes
Unaspis yanonensis (Kuwana, 1923) [Hemiptera: Diaspididae]	Arrowhead scale	Yes	MAFF (1990)	No	J. Donaldson (pers. comm.)	Yes
Zyginella citri (Matsumura) [Hemiptera: Cicadellidae]	Smaller citrus leafhopper	Yes	MAFF (1990)	No	Day & Fletcher (1994)	Yes
Hymenoptera (ants; bees, wasps)						
Crematogaster nawai Ito, 1914 Onoyama (1998) synonimised *C. nawa*i with *C. laboriosa* Fr. Smith, 1874, which is preoccupied by *C. laboriosus* Fr. Smith, 1860, hence *C. nawai* is the available name for this taxon. [Hymenoptera: Formicidae]	Ant	Yes	MAFF (1990)	No	Taylor & Brown (1985)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Lepidoptera (butterflies; moths)						
Acanthopsyche nigraplaga nigriplaga (Wileman, 1911) [Lepidoptera: Psychidae]	Bagworm moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Adoxophyes sp. [Lepidoptera: Tortricidae]	Smaller tea tortrix	Yes	MAFF (1990)	Uncertain	Nielsen *et al*. (1996)	Yes
Anomis flava (Fabricius, 1775) [Lepidoptera: Noctuidae]	Cotton leaf caterpillar, cotton looper	Yes	MAFF (1990)	Yes	Nielsen *et al*. (1996)	No
Anomis mesogona (Walker, 1858) [Lepidoptera: Noctuidae]	Hibiscus looper, anomis fruit moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Apochima excavata (Dyar, 1905) [Lepidoptera: Geometridae]	Mulberry looper	Yes	MAFF (1990)	No	Nielsen *et al.* (1996)	Yes
Archips breviplicanus Walsingham, 1900 [Lepidoptera: Tortricidae]	Asiatic leafroller	Yes	MAFF (1990)	No	Nielsen *et al.* (1996)	Yes
Artena dotata (Fabricius, 1794) [Lepidoptera: Noctuidae]	Fruit-piercing moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Ascotis selenaria (Denis & Schiffermuller, 1775) [Lepidoptera: Geometridae]	Mugwort looper	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Bambalina sp. [Lepidoptera: Psychidae]	Mulberry bagworm	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Biston robustus robustus Butler, 1879 [Lepidoptera: Geometridae]	Giant geometer	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Chalioides kondonis Kondo, 1822 [Lepidoptera: Psychidae]	Kondo white psychid	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Cleora (Carecomotis) repulsaria (Walker, 1860) [Lepidoptera: Geometridae]	Looper	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Conogethes punctiferalis (Guenée, 1854) [Lepidoptera: Pyralidae]	Yellow peach moth, cone moth	Yes	MAFF (1990)	Yes	Nielsen *et al*. (1996)	No
Cusiara stipitaria (Oberthur, 1880) [Lepidoptera: Geometridae]	Looper caterpillar	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Descoreba simplex Butler, 1878 [Lepidoptera, Geometridae]	Geometrid moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Ectropis excellens (Butler, 1884) [Lepidoptera, Geometridae]	Large brown-striped geometrid, locust looper	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Endoclyta sinensis Moore, 1877 [Lepidoptera: Hepialidae]	Grape tree-borer	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Ercheia umbrosa Butler, 1881 [Lepidoptera: Noctuidae]	Noctuid moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Eudocima salaminia (Cramer, 1777) [Lepidoptera: Noctuidae]	Fruit-piercing moth	Yes	MAFF (1990)	Yes	Nielsen *et al*. (1996)	No
Eudocima tyrannus (Guenée, 1852)* (synonyms: *Adris tyrannus* (Guenée); *Ophideres tyrannus* Guenée; *Othreis tyrannus* (Guenée)) [Lepidoptera: Noctuidae]	Noctuid moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Eumeta japonica (Heylaerts, 1884) [Lepidoptera: Psychidae]	Giant bagworm	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Eumeta minuscula Butler, 1881 [Lepidoptera: Psychidae]	Tea bagworm	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Euproctis pulverea Leech, 1889 [Lepidoptera: Lymantriidae]	Black-dotted yellow tussock moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Homona magnanima Diakonoff, 1948 [Lepidoptera: Tortricidae]	Large tea tortrix, Oriental tea tortrix	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Hydraecia amurensis Staudinger, 1892* (synonyms: *Adris amurensis* Staudinger, 1892; *Eudocima amurensis* Staudinger, 1892) [Lepidoptera: Noctuidae]	Fruit piercing moth	Yes	USDA (1995)	No	Nielsen *et al*. (1996)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Lemyra imparilis (Butler, 1877) (synonym: *Spilosoma imparilis*) [Lepidoptera: Actiidae]	Mulberry tiger moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Lymantria dispar japonica Motschulsky, 1861 [Lepidoptera: Lymantriidae]	Asian gypsy moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Mahasena aurea (Butler, 1881) [Lepidoptera: Psychidae]	Case moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Mamestra brassicae (Linnaeus, 1758) [Lepidoptera: Noctuidae]	Cabbage armyworm	Yes	MAFF (1990)	No	CABI (2000)	Yes
Megabiston plumosaria Leech, 1891 [Lepidoptera: Geometridae]	Tea geometrid	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Oraesia emarginata (Fabricius, 1794) [Lepidoptera: Noctuidae]	Fruit-piercing moth	Yes	MAFF (1990)	Yes	Nielsen *et al*. (1996)	No
Oraesia excavata (Butler, 1878) [Lepidoptera: Noctuidae]	Fruit-piercing moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Papilio helenus nicconicolens Butler [Lepidoptera: Papilionidae]	Red Helen	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Papilio memnon thunbergii von Siebold [Lepidoptera: Papilionidae]	Great mormon	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Papilio polytes polytes (Linnaeus) [Lepidoptera: Papilionidae]	Common mormon	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Papilio protenor demetrius Cramer [Lepidoptera: Papilionidae]	Spangle	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Parallelia maturata (Walker, 1858) (synonym: *Dysgonia maturata* (Walker, 1858)) [Lepidoptera: Noctuidae]	Purplish thick-legged moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Phyllocnistis citrella Stainton, 1856 [Lepidoptera: Gracillariidae]	Citrus leafminer	Yes	MAFF (1990)	Yes	EPPO (1999), Smith *et al*. (1997)	No
Planociampa antipala Prout, 1930 [Lepidoptera: Geometridae]	Looper moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Plusiodonta casta (Butler, 1878) [Lepidoptera: Noctuidae]	Noctuid moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Plusiodonta coelonota (Kollar, 1844) [Lepipoptera: Noctuidae]	Noctuid moth	Yes	MAFF (1990)	Yes	Nielsen *et al*. (1996)	No
Psorosticha melanocrepida Clarke, 1962 [Lepidoptera: Oecophoridae]	Citrus leafroller	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Pylargosceles steganioides (Butler, 1878) [Lepidoptera: Geometridae]	Two-wavy-lined geometrid	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Sarcopolia illoba (Butler, 1878) [Lepidoptera: Noctuidae]	Mulberry caterpillar	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Scythropiodes leucostola (Meyrick 1921) [Lepidoptera: Lecithoceridae]	Tube caterpillar	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Serrodes campana Guenée, 1852 [Lepidoptera: Noctuidae]	Fruit-piercing moth	Yes	MAFF (1990)	Yes	Nielsen *et al*. (1996)	No
Papilio xuthus Linnaeus, 1767 [Lepidoptera: Papilionidae]	Chinese yellow swallowtail	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Spilosoma inaequalis (Butler, 1878) [Lepidoptera: Arctiidae]	Cherry tiger moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Spilosoma lubricipeda (Linnaeus, 1758) (synonym: *Spilosoma lubricipedum* (Linnaeus, 1758)) [Lepidoptera: Arctiidae]	White ermine moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Spodoptera litura (Fabricius, 1775) [Lepidoptera: Noctuidae]	Common cutworm, cluster caterpillar, cotton leafworm	Yes	MAFF (1990)	Yes	AICN (2001)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Stathmopoda auriferella (Walker, 1864) [Lepidoptera: Oecophoridae]	Apple heliodinid	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Telorta acuminata (Butler, 1878) [Lepidoptera: Noctuidae]	Noctuid moth	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Xylena formosa Butler, 1878 [Lepidoptera: Noctuidae]	Cutworm?	Yes	MAFF (1990)	No	Nielsen *et al*. (1996)	Yes
Orthoptera (crickets; grasshoppers; katydids)						
Holochlora japonica Brunner v. Wattenwyl, 1878 [Orthoptera: Tettigoniidae]	Japanese broadwinged katydid, fruit-tree katydid	Yes	MAFF (1990)	No	Orthoptera Species File	Yes
Holochlora longifissa Matsumura & Shiraki, 1908 [Orthoptera: Tettigoniidae]	Bush cricket, katydid	Yes	MAFF (1990)	No	Orthoptera Species File	Yes
Ornebius kanetataki (Matsumura, 1904) [Orthoptera: Gryllidae]	Fruit cricket	Yes	MAFF (1990)	No	R. Farrow (pers. comm.)	Yes
Parapodisma sp. [Orthoptera: Acrididae]	Grasshopper	Yes	MAFF (1990)	No	Orthoptera Species File	Yes
Patanga japonica (Bolivar, 1898) [Orthoptera: Acrididae]	Grasshopper	Yes	MAFF (1990)	No	Orthoptera species File	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Phaulula gracilis [Orthoptera: Tettigoniidae]	Bush cricket, katydid	Yes	MAFF (1990)	No	Orthoptera Species File	Yes
Teleogryllus emma (Ohmachi & Matsumura) [Orthoptera: Gryllidae]	Emma field cricket	Yes	MAFF (1990)	No	CABI (1999); Orthoptera Species File	Yes
Thysanoptera (thrips)						
Frankliniella intonsa (Trybom, 1895) [Thysanoptera: Thripidae]	Taiwan flower thrips	Yes	MAFF (1990)	No	Mound (1996)	Yes
Frankliniella occidentalis (Pergande, 1895) [Thysanoptera: Thripidae]	Western flower thrips	Yes	MAFF (1990)	Yes (under official control)	Mound (1996)	Yes
Haplothrips chinensis Priesner [Thysanoptera: Phlaeothripidae]	Rose thrips	Yes	MAFF (1990)	No	Mound (1996)	Yes
Heliothrips haemorrhoidalis (Bouché, 1833) [Thysanoptera: Thripidae]	Greenhouse thrips, glasshouse thrips, black tea thrips	Yes	MAFF (1990)	Yes	Mound (1996)	No
Megalurothrips distalis (Karny) [Thysanoptera: Thripidae]	Thrips	Yes	MAFF (1990)	No	Mound (1996)	Yes
Scirtothrips dorsalis Hood, 1919 [Thysanoptera: Thripidae]	Yellow tea thrips, chilli thrips, strawberry thrips	Yes	MAFF (1990)	Yes	Mound (1996)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Thrips coloratus Schmutz, 1913 [Thysanoptera: Thripidae]	Thrips	Yes	MAFF (1990)	Yes	Mound (1996)	No
Thrips flavus Schrank, 1776 [Thysanoptera: Thripidae]	Honeysuckle thrips	Yes	MAFF (1990)	No	Mound (1996)	Yes
Thrips hawaiiensis Morgan 1913 [Thysanoptera: Thripidae]	Flower thrips	Yes	MAFF (1990)	Yes	Mound (1996)	No
Thrips coloratus Schmutz (synonym: *Thrips japonicus* Bagnall) [Thysanoptera: Thripidae]	Loquat thrips	Yes	MAF NZ (2000)	Yes	Mound (1996)	No
Thrips palmi Karny, 1925 [Thysanoptera: Thripidae]	Melon thrips	Yes	MAFF (1990)	Yes (under official control)	Mound (1996)	Yes
Thrips tabaci Lindemann, 1888 [Thysanoptera: Thripidae]	Onion thrips, cotton seedling thrips	Yes	MAFF (1990)	Yes	Mound (1996)	No
MOLLUSCA (slugs; snails)						
Acusta despecta sieboldiana (Pfeiffer, 1850) [Mollusca: Eulotidae]	Snail	Yes	MAFF (1990)	No	ABRS (2001)	Yes
Bradybaena similaris (Ferussac) [Mollusca: Helicidae]	White bradybaena snail	Yes	MAFF (1990)	Yes	AICN (2001)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Satsuma pagodula [Mollusca: Camaenidae]	Snail	Yes	MAFF (1990)	No	Smith (1982)	Yes
NEMATODA (nematodes)						
Helicotylenchus dihystera (Cobb, 1893) [Tylenchida: Hopolaimidae]	Cobb spiral nematode	Yes	MAFF (1990)	Yes	http://nematode.unl.edu/tylench/hoplo/helicoty/hdihyst.htm	No
Meloidogyne sp. [Tylenchida: Meloidogynidae]	Root-knot nematode	Yes	MAFF (1990)	Uncertain	McLeod *et al*. (1994)	Yes
Ogma civellae (Steiner) Raski & Luc [Tylenchida: Criconematidae]	Nematode	Yes	MAFF (1990)	Yes	McLeod *et al*. (1994)	No
Paratrichodorus porosus Allen, 1957 [Dorylaimida: Trichodoridae]	Stubby root nematode	Yes	MAFF (1990)	Yes	McLeod *et al*. (1994)	No
Paratylenchus curvitatus Sharma & Sharma [Tylenchida: Paratylenchidae]	South African pin nematode, carnation pin nematode	Yes	MAFF (1990)	Yes	McLeod *et al*. (1994)	No
Pratylenchus coffeae (Zimmermann, 1898) [Tylenchida: Pratylenchidae]	Coffee root-lesion nematode	Yes	MAFF (1990)	Yes	McLeod *et al*. (1994)	No
Pratylenchus loosi Loof [Tylenchida: Pratylenchidae]	Nematode	Yes	MAFF (1990)	Yes	McLeod *et al*. (1994)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Tylenchulus semipenetrans Cobb, 1913 [Tylenchida: Tylenchulidae]	Citrus nematode	Yes	MAFF (1990)	Yes	McLeod *et al*. (1994)	No
Xiphinema bakeri Williams, 1961 [Dorylaimida: Longidoridae]	Dagger nematode	Yes	MAFF (1990)	No	CABI (1999)	Yes
Xiphinema brasiliense Lordello, 1951 [Dorylaimida: Longidoridae]	Dagger nematode	Yes	MAFF (1990)	Yes	McLeod *et al*. (1994)	No
Xiphinema simillimum Loof & Yassim, 1971 [Dorylaimida: Longidoridae]	Dagger nematode	Yes	MAFF (1990)	No	CABI (1999)	Yes
PATHOGENS						
BACTERIA						
Agrobacterium tumefaciens (Smith & Town) Conn	Crown gall	Yes	Bradbury (1986)	Yes	Simmonds (1966); Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989)	No
Liberobacter asiaticum Jagouexi *et al*. 1994	Citrus greening disease	Yes	MAFF (1990)	No	da Graca (1991)	Yes
Pseudomonas syringae pv. *syringae* van Hall	Black pit, citrus blast, bacterial spot	Yes	Bradbury (1986)	Yes	Simmonds (1966); Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989); NCOF (1998)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Xanthomonas axonopodis pv. *citri* (Hasse) Vauterin *et al*. (synonym: *Xanthomonas campestris* pv. *citri* (Hasse) Dye)	Asiatic citrus canker	Yes	MAFF (1990)	No (Eradicated in 1995)	CABI (2000)	Yes
FUNGI						
Alternaria citri Ellis & N. Pierce ['Mitosporic fungi': Hyphomycetes]	Leaf spot, brown spot, black rot, centre rot; ("black rot"; "Shokokuten-byo (Melanose like blemish)"	Yes	MAFF (1990)	Yes	Cook & Dube (1989); Shivas (1989); NCOF (1998); Pitkethley (1998)	No
Armillariella mellea (Vahl:Fr.) P. Kumm. [Basidiomycetes: Agaricales]	Armillaria root rot, mushroom root rot	Yes	MAFF (1990)	Yes	Knorr (1973); Sampson & Walker (1982); Whiteside (1988b)	No
Ascochyta pisi Lib. [Loculoascomycetes: Dothideales]	Freckle	Yes	Whiteside (1988a)	Yes	Simmonds (1966); Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989)	No
Aspergillus niger Tiegh. ['Mitosporic fungi': Hyphomycetes]	Aspergillus rot, fruit rot	Yes	MAFF (1990)	Yes	Cook & Dube (1989); Shivas (1989); Pitkethley (1998)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Athelia rolfsii (Curzi) Tu & Kimbrough (synonym: *Corticium rolfsii* Curzi; anamorph: *Sclerotium rolfsii* Sacc.) [Basidiomycetes: Aphyllophorales]	Damping off, collar rot	Yes	MAFF (1990)	Yes	Shivas (1989); NCOF (1998)	No
Aureobasidium pullulans (de Bary) G. Arnaud ['Mitosporic fungi': Hyphomycetes]	Fruit rot, core rot	Yes	MAFF (1990)	Yes	Simmonds (1966); Washington (1983); Shivas (1989)	No
Botrytis cinerea Pers.:Fr. ['Mitosporic fungi': Hyphomycetes]	Botrytis blight, grey mould, grey spot	Yes	MAFF (1990)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989); NCOF (1998)	No
Capnodium salicinum Mont. [Loculoascomycetes: Dothideales]	Sooty mould	Yes	MAFF (1990)	Yes	Cook & Dube (1989); Mayers & Persley (1993); NCOF (1998)	No
Capnophaeum fuliginodes (Rehn) Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	MAFF (1990)	No	No records found	Yes
Cercospora penzigii Sacc. ['Mitosporic fungi': Hyphomycetes]	Sweet orange leaf spot	Yes	Whiteside (1988a)	No	No records found	Yes
Chaetoscorias vulgaris Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	MAFF (1990)	No	No records found	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Colletotrichum gloeosporioides (Penz.) Penz. & Sacc. In Penz. (teleomorph: *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk) ['Mitosporic fungi': Coelomycetes]	Anthracnose, fruit rot	Yes	MAFF (1990)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989); NCOF (1998); Pitkethley (1998)	No
Cylindrocladium citri (H. Fawc. & L.J. Klotz) Boedijn & Reitsma ['Mitosporic fungi': Hyphomycetes]	Decay of citrus fruit	Yes	Crous & Wingfield (1993)	No	No records found	Yes
Diaporthe citri F.A. Wolf (anamorph: *Phomopsis citri* H.Fawc. non (Sacc.) Traverso & Spessa) [Pyrenomycetes: Diaportales]	Melanose, stem-end rot	Yes	MAFF (1990)	Yes	NCOF (1998); Mayers & Persley (1993)	No
Diaporthe medusaea Nitschke [Pyrenomycetes: Diaportales]	Gummosis, stem-end rot, melanose, microspeck	Yes	MAFF (1990)	Yes	APDD (2002)	No
Dothiorella gregaria Sacc. ['Mitosporic fungi': Coelomycetes]	Dothiorella rot, gummosis	Yes	Menge (1988)	Yes	SBML (2001)	No
Elsinoe fawcetti Bitancourt & Jenk. (anamorph: *Sphaceloma fawcetti* Jenk.) [Loculoascomycetes: Dothideales]	Citrus scab	Yes	MAFF (1990)	Yes (Not all strains)	Whiteside (1988c); NCOF (1998); Pitkethley (1998)	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Erythricium salmonicolor (Berk. & Broome) Burdsall (synonym: *Corticium salmonicolor* Berk. & Broome; anamorph: *Necator decretus* Massee) [Basidiomycetes: Aphyllophorales]	Pink disease, damping off	Yes	MAFF (1990)	Yes	Mayers & Persley (1993)	No
Fusarium oxysporum Schlechtend.:Fr. ['Mitosporic fungi': Hyphomycetes]	Fusarium rot, fruit rot, branch canker	Yes	MAFF (1990)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989)	No
Fusarium solani (Mart.) Sacc. ['Mitosporic fungi': Hyphomycetes]	Collar rot, dry rot, lower trunk canker	Yes	MAFF (1990)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989); NCOF (1998); Pitkethley (1998)	No
Fusarium spp. ['Mitosporic fungi': Hyphomycetes]	Fusarium rot, fruit rot, collar rot	Yes	MAFF (1990)	Uncertain	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989); Pitkethley (1998)	Yes
Ganoderma applanatum (Pers.) Pat. [Basidiomycetes: Aphyllophorales]	Stem heart rot, butt rot	Yes	MAFF (1990)	Yes	Shivas (1989); NCOF (1998)	No
Geotrichum citri-aurantii (Ferraris) E.E. Butler (synonym: *Geotrichum candidum* Link var. *citri-aurantii* (Ferraris) Cif.) ['Mitosporic fungi': Hyphomycetes]	Sour rot, fruit rot	Yes	MAFF (1990)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989); NCOF (1998); Pitkethley (1998)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Guignardia citricarpa Kiely [Loculoascomycetes: Dothideales]	Citrus black spot	Yes	Knorr (1965)	Yes	Sampson & Walker (1982); Shivas (1989); Pitkethley (1998); APDD (2002)	No
Helicobasidium mompa Tanaka [Basidiomycetes: Auriculariales]	Violet root rot	Yes	MAFF (1990)	No	No records found	Yes
Hypocapnodium japonicum (Hara) Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	MAFF (1990)	No	No records found	Yes
Schizothyrium pomi (Mont. & Fr.) Arx (synonym: *Leptothyrium pomi* (Mont. & Fr.) Sacc.) [Loculoascomycetes: Dothideales]	Fly speck	Yes	MAFF (1990)	Yes	Shivas (1989); NCOF (1998)	No
Limacinia harai Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	MAFF (1990)	No	No records found	Yes
Meliola butleri Sydow [Pyrenomycetes: Meliolales]	Sooty mould	Yes	MAFF (1990)	No	No records found	Yes
Mycosphaerella citri Whiteside (anamorph: *Stenella citri-grisea* (F.E. Fisher) Sivanesan) [Loculoascomycetes: Dothideales]	Greasy spot	Yes	Farr *et al*. (1989)	Yes	Singh (1992)	No
Mycosphaerella horii K. Hara [Loculoascomycetes: Dothideales]	Greasy spot, Leaf spot	Yes	MAFF (1990)	No	No records found	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Mycosphaerella pinodes (Berk. & Bloxam) Vestergr. (synonym: *Didymella pinodes* (Berk. & Bloxam) Petr.; anamorph: *Ascochyta pinodes* L.K. Jones) [Loculoascomycetes: Dothideales]	Leaf blight, leaf spot, speckle, freckle	Yes	MAFF (1990); Oda & Yamamoto (1975)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989)	No
Neocapnodium tanakae (Shirai & Hara) Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	MAFF (1990)	No	No records found	Yes
Pellicularia koleroga Cooke [Basidiomycetes: Aphyllophorales]	Thread blight	Yes	C.M.I. (1988)	No	No records found	Yes
Penicillium digitatum (Pers.:Fr.) Sacc. ['Mitosporic fungi': Hyphomycetes]	Green mould	Yes	MAFF (1990)	Yes	Cook & Dube (1989); Shivas (1989); NCOF (1998)	No
Penicillium fructigenum Takeuchi ['Mitosporic fungi': Hyphomycetes]	Fruit rot	Yes	USDA (1995)	No	No records found	Yes
Penicillium italicum Wehmer ['Mitosporic fungi': Hyphomycetes]	Blue mould	Yes	MAFF (1990)	Yes	Cook & Dube (1989); Shivas (1989); NCOF (1998)	No
Phaeosaccardinula javanica (Zimmermann) Yamamoto [Loculoascomyctes: Dothideales]	Sooty mould	Yes	MAFF (1990)	No	No records found	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Phoma erratica (Ellis & Everh.) Hara var. *mikan* Hara ['Mitosporic fungi': Coelomyctes]	Fruit rot	Yes	MAFF (1990)	No	No records found	Yes
Phoma pinodella (L.K. Jones) Morgan-Jones & K.B. Burch (synonyms: *Ascochyta pinodella* L.K. Jones; *Phoma medicaginis* Malbr. & Roum. var. *pinodella* (L.K.Jones) Boerema) ['Mitosporic fungi': Coelomycetes]	Freckle	Yes	Whiteside (1988a); Oda & Yamamoto (1975)	Yes	Simmonds (1966); Bathgate *et al*. (1989); APDD (2002)	No
Phomopsis sp. ['Mitosporic fungi': Coelomycetes]	Stem-end rot, gummosis	Yes	MAFF (1990)	Uncertain	Cook & Dube (1989); Shivas (1989); NCOF (1998)	Yes
Phyllosticta beltranii Penzig ['Mitosporic fungi': Coelomycetes]	Leaf spot	Yes	MAFF (1990)	No	No records found	Yes
Phyllosticta erratica Ellis & Everh. ['Mitosporic fungi': Coelomycetes]	Leaf spot	Yes	MAFF (1990)	No	No records found	Yes
Phyllosticta sp. ['Mitosporic fungi': Coelomycetes]	Leaf spot	Yes	MAFF (1990)	Uncertain	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989)	Yes
Phytophthora cactorum (Lebert & Cohn) J. Schrot. [Oomycetes: Peronosporales]	Collar rot	Yes	SBML (2001)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Phytophthora citrophthora (R.E. Sm. & E. H. Sm.) Leonian [Oomycetes: Peronosporales	Brown rot, fruit rot, foot rot, brown rot	Yes	MAFF (1990)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989); NCOF (1998)	No
Phytophthora nicotianae Breda de Haan [Oomycetes: Peronosporales]	Black shank, root rot, shoot rot	Yes	MAFF (1990)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989); Pitkethley (1998)	No
Rhizoctonia solani Kühn (teleomorph: *Thanatephorus cucumeris* (A.B. Frank) Donk) [Agonomycetes]	Root rot, damping off	Yes	MAFF (1990)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989)	No
Rosellinia bunodes (Berk. & Broome) Sacc. [Pyrenomycetes: Xylariales]	Rosellinia rot, black root rot	Yes	Knorr (1965)	No	No records found	Yes
Rosellinia necatrix Prill. (anamorph: *Dematophora necatrix* R. Hartig) [Pyrenomycetes: Xylariales]	White root rot, dematophora root rot	Yes	MAFF (1990)	Yes	Shivas (1989)	No
Sclerotinia sclerotiorum (Lib.) de Bary [Discomycetes: Helotiales]	Twig blight, seedling stem blight, cottony rot, calyx rot, fruit green rot, shoot blight, stem rot, white mould	Yes	MAFF (1990)	Yes	Sampson & Walker (1982); Cook & Dube (1989); Shivas (1989); NCOF (1998)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Sclerotium citricolum Hara [Agonomycetes]	Phellomyces rot	Yes	MAFF (1990)	No	No records found	Yes
Scorias citrina (Hara) Yamamoto [Loculoascomyctes: Dothideales]	Sooty mould	Yes	MAFF (1990)	No	No records found	Yes
Septobasidium pseudopedicellatum Burt [Basidiomycetes: Septobasidiales]	Felt	Yes	USDA (1995)	Yes	No records found	No
Sporobolomyces roseus Kluyver & Niel ['Mitosporic fungi': Hyphomycetes]	Pseudo greasy spot, Ohan-sho	Yes	MAFF (1990); Miyakawa & Yamaguchi (1981)	Yes	Lamb & Brown (1970)	No
Triposporiopsis spinigera (Hohnel) Yamamoto [Loculoascomyctes: Dothideales]	Sooty mould	Yes	MAFF (1990)	No	No records found	Yes
VIROIDS						
Citrus exocortis viroid	Exocortis, scaly butt	Yes	MAFF (1990)	Yes	Garnsey & Barkley (1988); Cook & Dube (1989)	No
Hop stunt viroid	Hop stunt	Yes	Shikata (1990)	Yes	CABI (1999)	No
VIRUSES						
Citrus leaf rugose *ilarvirus* (synonym: Citrus crinkly leaf *ilarvirus*)	Citrus leaf rugose, lemon crinkly leaf, infectious variegation	Yes	MAFF (1990); C.M.I. (1984)	Yes	Brunt *et al.* (1996)	No

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Citrus mosaic virus (part of Satsuma dwarf complex)	Citrus mosaic	Yes	MAFF (1990)	No	No records found	Yes
Citrus psorosis virus complex	Psorosis A, concave gum psorosis, infectious variegation, Psorosis B, xyloporosis	Yes	CMI (1984)	Yes	Fraser & Broadbent (1979); Cook & Dube (1989)	No
Citrus tatter leaf *capillovirus*	Tatter leaf and citrange stunt, bud-union disorder	Yes	MAFF (1990)	Yes	Brunt *et al.* (1996); NCOF (1998)	No
Citrus tristeza *closterovirus* (CTV)	Stem pitting disease	Yes	MAFF (1990)	Yes	Cook & Dube (1989); Brunt *et al*. (1996); NCOF (1998)	No
Citrus vein enation – woody gall associated *luteovirus*	Vein enation, woody gall	Yes	MAFF (1990)	Yes	Brunt *et al.* (1996)	No
Citrus yellow mottle associated virus	Citrus yellow mottle disease	Yes	MAFF (1990)	No	No records found	Yes
Hassaku dwarf virus (recognised as a form of CTV stem-pitting affecting the pummelo hybrid Hassaku)	Hassaku dwarf	Yes	Garnsey (1988)	Yes	Cook & Dube (1989); Brunt *et al*. (1996); NCOF (1998)	No
Natsudaidai dwarf virus (part of Satsuma dwarf complex)	Natsudaidai dwarf	Yes	MAFF (1990)	No	No records found	Yes

Taxonomic name	Common Name/s	Present in Japan	Reference	Present in Australia	Reference	Consider further
Navel orange infectious mottling virus (part of Satsuma dwarf complex)	Navel orange infectious mottling	Yes	MAFF (1990)	No	No records found	Yes
Satsuma dwarf *nepovirus*	Satsuma dwarf	Yes	Yamada (1950); MAFF (1990)	No	No records found	Yes

Question marks (No? Yes?) denote that further information is required to categorise the species. In these cases of doubt, the species is always included in the next step of categorisation.

* There is considerable confusion in the literature concerning *Eudocima tyrannus* [Lepidoptera: Noctuidae], its subspecies and the species referred to as *Hydraecia amurensis* Staudinger, 1892 (synonym: *Adris amurensis*) [Lepidoptera: Noctuidae]. The species group requires revision. In this document *H. amurensis* is not being considered as a subspecies of *E. tyrannus* until an authoritative revision is available

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APPENDIX 2. PEST CATEGORISATION FOR UNSHU MANDARIN (PATHWAY ASSOCIATION)

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
INVERTEBRATA					
ACARI (mites)					
Aculops pelekassi (Keifer, 1959) [Acarina: Eriophyidae]	Pink citrus rust mite	Yes		McCoy (1996)	Yes
Eotetranychus kankitus Ehara [Acarina: Tetranychidae]	Citrus yellow mite	Yes	Mainly leaves but also fruit	Mizobuchi *et al*. (1995); USDA (1995)	Yes
INSECTA (insects)					
Coleoptera (beetles)					
Adoretus tenuimaculatus Waterhouse [Coleoptera: Scarabaeidae]	Brown chafer, flower beetle	No	Not on fruit.	AQIS (1998); AQIS (1999)	No
Agrilus alesi Oben, 1935 [Coleoptera: Buprestidae]	Ales' flatheaded citrus borer	No	Larvae bore into roots and trunk.	C. Bellamy (pers. comm.)	No
Agrilus auriventris Saunders [Coleoptera: Buprestidae]	Citrus flatheaded borer	No	Larvae bore into roots and trunk.	C. Bellamy (pers. comm.)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Amystax satanus Nakane [Coleoptera: Curculionidae]	Weevil	No	No references found. Generally weevil larvae feed on roots and adults on flowers	None found	No
Anomala cuprea Saunders [Coleoptera: Scarabaeidae]	Cupreous chafer	No		Shiraki (1952); USDA (1995)	No
Anoplophora malasiaca (Thomson) [Coleoptera: Cerambyicidae]	Whitespotted longicorn beetle	No	Pest associated with other plant parts	USDA (1995)	No
Aulacophora nigripennis Motschulsky [Coleoptera: Chrysomelidae]	Pumpkin beetle	No	Larvae and adults feed on leaves	MAFF (1990)	No
Blitopertha orientalis (Waterhouse) [Coleoptera: Scarabaeidae]	Oriental beetle	No	Larvae feed on roots, adults on leaves and flowers	Davidson & Peairs (1966)	No
Callirhopalus bifasciatus (Roelofs 1880) [Coleoptera: Curculionidae]	Gooseberry weevil, the two-banded Japanese weevil	No	Larvae and adults on leaves	Maier (1983, 1986)	No
Cassida obtusata Boheman, 1854 [Coleoptera: Chrysomelidae]	Flea beetle	No	Flowers, leaves	T. Hawkswood (pers. comm.)	No
Ectinohoplia obducta (Motschulsky, 1857) [Coleoptera: Scarabaeidae]	Scarab	No	Adults on flowers	None found	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Epuraea domina Reitter, 1873 [Coleoptera: Nitidulidae]	Sap beetle	Yes	Larvae on decayed fruit	Hayashi (1978)	Yes
Epuraea japonica Motsch., 1860 [Coleoptera: Nitidulidae]	Sap beetle	Yes	Larvae on decayed fruit	Hayashi (1978)	Yes
Epuraea (Haptoncurina) paulula Reitter, 1873 [Coleoptera: Nitidulidae]	Sap beetle	Yes	Larvae on decayed fruit	Hayashi (1978)	Yes
Eucetonia pilifera (Motschulsky) [Coleoptera: Scarabaeidae]	Flower beetle	No	Adults feed on flowers	CSIRO (1991)	No
Eucetonia roelofsi Harold, 1880 [Coleoptera: Scarabaeidae]	Flower beetle	No	Adults feed on flowers	IKIP, 2002	No
Glycyphana fulvistemma Motschulsky 1860 [Coleoptera: Scarabaeidae]	Scarab beetle	No		CSIRO (1991)	No
Holotrichia kiotonensis Brenske [Coleoptera: Scarabaeidae]	Black chafer	No	Adults on shoots, larvae on roots	MAFF (1990)	No
Holotrichia picea (Motschulsky, 1857) [Coleoptera: Scarabaeidae]	Chafer	No	Adults on shoots, larvae on roots	T. Weir (pers. comm.)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Luperomorpha funesta Baly [Coleoptera: Chrysomelidae]	Mulberry flea beetle	No	Leaves, roots	Iba & Inoue (1977)	No
Maladera japonica Motschulsky, 1857 [Coleoptera: Scarabaeidae]	Velvety chafer	No	Roots, leaves; adults attracted to light	MAFF (1990)	No
Maladera orientalis Motschulsky, 1857 [Coleoptera: Scarabaeidae]	Smaller velvety chafer	No	Roots, leaves; adults attracted to light	MAFF (1990)	No
Melanotus annosus Candeze, 1865 [Coleoptera: Elateridae]	Click beetle, wireworm	No	Roots	Kohno & Kegasawa (1990)	No
Melanotus fortnumi Candeze, 1878 [Coleoptera: Elateridae]	Sweet potato wireworm	No	Larvae feed on roots	Matsui & Ueda (1992)	No
Mesalcidodes trifidus (Pascoe, 1870) [Coleoptera: Curculionidae]	Weevil	No	No references found. Generally weevil larvae feed on roots and adults on flowers	None found	No
Mesosa myops (Dalman, 1817) [Coleoptera: Cerambycidae]	Sesame-spotted longicorn beetle	No	On stem	None found	No
Monochamus subfasciatus Bates [Coleoptera: Cerambycidae]	Citrus longhorn	No	Considered quarantinable by MAFF NZ (2000). Larvae on roots	A. Calder (pers. comm.	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Oxycetonia jucunda Falderman [Coleoptera: Scarabaeidae]	Citrus flower chafer	No	Larvae on roots, adults on flowers	MAFF (1990)	No
Protaetia orientalis (Gory & Pecheron, 1833) [Coleoptera: Scarabaeidae]	May beetle	No	Adults on flowers, larvae feed on roots	MAFF (1990)	No
Psammoecus triguttatus Reitter, 1874 [Coleoptera: Silvanidae]	Beetle	No?	Adults may feed on young fruits, on bark, trunk	None found	Yes
Scepticus insularis Roelofs [Coleoptera: Curculionidae]	Striped gourd-shaped weevil	No	Leaves	AQIS (1999)	No
Xylosandrus germanus (Blandford) [Coleoptera: Scolytidae]	Alnus ambrosia beetle	No	Bark, trunk	Osumi & Mizuno (1992)	No
Diptera (true flies; mosquitoes)					
Bactrocera tsuneonis (Miyake, 1919) [Diptera: Tephritidae]	Citrus fruit fly	Yes	fruit	Zhang (1989)	Yes
Contarinia okadai (Miyoshi) [Diptera: Cecidomyiidae]	Japanese citrus flower-bud midge	No	Flowers, buds but considered by MAFF, New Zealand as a risk and classified as a “regulated pest” (IHS 12.i.00)	Kato (1984)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Limonia amatrix Alexander, 1922 [Diptera: Tipulidae]	Citrus crane fly	Yes	Probably detritus feeder but recorded feeding on fruits	MAFF (1999)	Yes
Hemiptera (aphids; leafhoppers; mealybugs; phyllids; scales; true bugs; whiteflies)					
Alcimocoris japonensis (Scott, 1880) [Hemiptera: Pentatomidae]	Shield bug	?	This species does not seem to be common in the south west island of Japan. (Kohno, www), Ryukyu Is., S. China	Awaiting references	Yes
Aleuroclava aucubae (Kuwana, 1911) [Hemiptera: Aleyrodidae]	Aucuba whitefly, coral whitefly	No	Mainly on leaf	USDA (1995)	No
Anacanthocoris striicornis (Scott) [Hemiptera: Coreidae]	Larger squash bug	Yes	Not common on fruit. Species more commonly associated with non-fruit plant parts	USDA (1995); Syoziro *et al*. (1965)	Yes
Andaspis hawaiiensis Maskell, 1895 [Hemiptera: Diaspididae]	Armoured scale	Yes	Damaged both leaves and fruit of citrus in W. Samoa, found on bark and burrows under bark	Williams & Watson (1988); J. Donaldson (pers. comm.)	Yes
Apheliona ferruginea (Matsumura) [Hemiptera: Cicadellidae]	Citrus leafhopper, jassid	Yes		MAFF (1990)	Yes
Aphrophora intermedia Uhler [Hemiptera: Aphrophoridae]	Common spittlebug	No	Leaves, young shoots	AQIS (1999); MAFF (1990)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Aphrophora stictica Matsumura, 1903 [Hemiptera: Aphrophoridae]	Spittlebug	No	Adults on leaves	AQIS (1999); MAFF (1990)	No
Aulacorthum magnoliae (Essig & Kuwana) [Hemiptera: Aphididae]	Aphid	No	Feeds on leaves and young shoots	MAFF (1990)	No
Bothrogonia japonica Ishihara [Hemiptera: Cicadellidae]	Black-tipped leafhopper	Yes	On leaves, suspected vector of disease	Shiozawa & Tsuchizaki (1992)	Yes
Carbula humerigera (Uhler, 1860) [Hemiptera: Pentatomidae]	Shieldbug	No?	Adults and nymphs suck sap, associated with leaves	MAFF (1990)	Yes
Ceroplastes japonicus Green, 1921 [Hemiptera: Coccidae]	Japanese wax scale	No	On branches	Park *et al*. (1992)	No
Chrysomphalus bifasciculatus Ferris [Hemiptera: Diaspididae]	False Florida red scale	No?	Leaves, branches	MAFF (1990); Williams & Watson (1988)	Yes
Cletus punctiger (Dallas) [Hemiptera: Coreidae]	Squash bug	No?	Sucks sap from leaves	MAFF (1999)	Yes
Coccus discrepans (Green, 1904) [Hemiptera: Coccidae]	Soft scale	No	Leaves, branches	ScaleNet (2001)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Cryptotympana facialis (Walker, 1858). [Hemiptera: Cicadidae]	Cicada	No	On roots, branches	Aizu *et al*. (1984); Moulds (1990); Moulds (pers. comm. 2001)	No
Dialeurodes citri (Ashmead, 1885) [Hemiptera: Aleyrodidae]	Citrus whitefly	Yes	Fruits and leaves	Biosecurity Australia (2002)	Yes
Diaphorina citri Kuwayama, 1908 [Hemiptera: Psyllidae]	Citrus psyllid	Yes	Vector of citrus greening disease; flowers, leaves, shoots, stems	Pande (1971)	Yes
Drosicha corpulenta (Kuwana) [Hemiptera: Margarodidae]	Giant mealybug	No	Leaves, twigs, buds	Qu *et al*. (1996)	No
Drosicha howardi (Kuwana, 1922) [Hemiptera: Margarodidae]	Margarodid scale	No	Leaves, twigs, buds	Qu *et al*. (1996)	No
Edwardsiana flavescens (Fabricius, 1794) [Hemiptera: Cicadellidae]	Small green leafhopper	Yes	Mesophyll feeding, potential disease vector	MAFF (1990)	Yes
Empoasca arborescens Vilbaste [Hemiptera: Cicadellidae]	Leafhopper	Yes	Mesophyll feeding, potential disease vector	Takagi (1983); Theron (1974); Baspinar & Uygun (1992)	Yes
Empoasca onukii Matsuda, 1952 [Hemiptera: Cicadellidae]	Tea green leafhopper	Yes		Takagi (1983); MAFF (1990)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Epiacanthus stramineus (Motschulsky) [Hemiptera: Errhomenellidae]	Grape leafhopper	No	Leaves. Possible vector	USDA (1995)	No
Eucorysses grandis (Thunberg, 1783) [Hemiptera: Pentatomidae]	Shield bug	Yes	Adults and juveniles suck sap and adults feed on fruit	MAFF (1990); Yasunaga (pers. comm., 2002)	Yes
Fiorinia proboscidaria Green [Hemiptera: Diaspididae]	Armoured scale	No	On leaves	Williams & Watson (1988)	No
Geisha distinctissima (Walker) [Hemiptera: Flatidae]	Green flatid planthopper	No	On leaves and twigs	MAFF (1990)	No
Geococcus citrinus Kuwana, 1923 [Hemiptera: Pseudococcidae]	Citrus root mealybug	No	On roots	ScaleNet (2001)	No
Geocoris (Piocoris) varius (Uhler, 1860) [Hemiptera: Lygaeidae]	Anthocorid bug	No	Predator although MAFF (1990) records the species as feeding on plant juices	Hirose *et al*. (1999)	No
Glaucias subpunctatus (Walker) [Hemiptera: Pentatomidae]	Polished green stink bug	Yes	On fruit	Teramoto *et al*. (1992)	Yes
Graptopsaltria nigrofuscata (Motschulsky, 1866) [Hemiptera: Cicadidae]	Large brown cicada	Yes	Adults suck fruit	Aizu *et al*. (1984)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Halyomorpha halys (Stal, 1855) [Hemiptera: Pentatomidae]	Brown marmorated stink bug	Yes	Adults suck fruit	AQIS (1997)	Yes
Hishimonus sellatus (Uhler) [Hemiptera: Cicadellidae]	Rhombic-marked leafhopper	No		Kim & Kim (1993)	No
Homoeocerus unipunctatus (Thunberg) [Hemiptera: Coreidae]	Coreid bug	Yes?	Adults and nymphs suck sap		Yes
Hygia opaca (Uhler) [Hemiptera: Coreidae]	Coreid bug	Yes	Adults and larvae suck sap including fruit by inference from Pseudotheraptus wayi	Albrigo & Bullock (1977)	Yes
Kilifia acuminata (Signoret, 1873) [Hemiptera: Coccidae]	Acuminate scale	No	On branches and leaves	Fasulo & Brooks (2001)	No
Kolla atramentaris (Motschulsky) [Hemiptera: Cicadellidae]	Leafhopper	No	On leaves	MAFF (1990)	No
Leptocorisa chinensis (Dallas) [Hemiptera: Alydidae]	Rice bug	No	On flowers, seeds	Yokosuka *et al*. (1991)	No
Lopholeucaspis cockerelli (Grandpre & Charmoy, 1899) [Hemiptera: Diaspididae]	Armoured scale	Yes	Abundant on leaves. Intercepted on citrus by MAFF NZ (pers. comm.)	Williams & Watson (1988)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Lopholeucaspis japonica (Cockerell, 1897) [Hemiptera: Diaspididae]	Pear white scale	Yes	Mainly on branches, twigs, but on fruits in tropics and subtropics	AQIS (1998)	Yes
Megacopta punctatissimum (Montandon) [Hemiptera: Plataspidae]	Bean pentatomid, globular stink bug	Yes	Adults and nymphs may suck fruit juices	Tayutivutikul & Yano (1990)	Yes
Meimuna opalifera (Walker, 1850) [Hemiptera: Cicadidae]	Cicada	No		Moulds 1990; Moulds (pers. comm. 2001)	No
Nezara antennata Scott [Hemiptera: Pentatomidae]	Green stink bug, Oriental green stink bug	Yes	Adults suck fruit sap	AQIS (1998)	Yes
Nipponorthezia ardisiae Kuwana, 1916 [Hemiptera: Ortheziidae]	Bladhia scale	No	Females feed on roots	Kawai & Takagi (1971a)	No
Nysius plebejus Distant [Hemiptera: Lygaeidae]	Seed bug	No	Seed feeder so unlikely to be on fruit	Kim *et al*. (1994)	No
Octaspidiotus stountoniae [Hemiptera: Diaspididae]	Armoured scale	No	O. australiensis recorded feeding on leaves	Williams & Watson (1988)	No
Orosanga japonicus (Melichar) [Hemiptera: Ricaniidae]	Ricaniid planthopper	No	Feeds on leaves and twigs	MAFF (1990)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Parabemisia myricae (Kuwana, 1927) [Hemiptera: Aleyrodidae]	Myrica whitefly, Japanese bayberry whitefly	Yes	Leaves but may occur on young fruits	Biosecurity Australia (2002)	Yes
Paradasynus spinosus Hsiao, 1963 [Hemiptera: Coreidae]	Coreid bug	Yes	Adults and nymphs suck sap, may feed on fruit	MAFF (1990); Yasunaga (pers. comm. 2002); Albrigo & Bullock (1977) (by inference)	Yes
Parlatoria cinerea Doane & Hadden, 1909 [Hemiptera: Diaspididae]	Armoured scale	Yes	Under fruit calyxes, leaves, stems, bark	Williams & Watson (1988)	Yes
Parlatoria ziziphi (Lucas, 1853) [Hemiptera: Diaspididae]	Black parlatoria scale, black scale, citrus scale, ebony scale, leaf black scale, Mediterranean scale	Yes	Fruit and leaves, eggs laid on fruit	Fasulo & Brooks (1997); Jeppson (1989)	Yes
Penthimia nitida Distant, 1912 [Hemiptera: Cicadellidae]	Leafhopper	No	Feeds on leaves		No
Physopelta cincticollis Stål, 1863 [Hemiptera: Largidae]	Largid bug	No	Adults and nymphs suck sap from leaves	MAFF (1990)	No
Physopelta gutta (Burmeister) [Hemiptera: Largidae]	Largid bug	No	Adults and nymphs suck sap from leaves	MAFF (1990)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Piocoris varius (Uhler, 1860) [Hemiptera: Anthocoridae]	Anthocorid bug	?			Yes
*Planococcus kra*unhiae (Kuwana, 1902) [Hemiptera: Pseudococcidae]	Japanese mealybug	Yes	Infests calyces and other plant parts	MAFF (1990)	Yes
Planococcus lilacinus (Cockerell, 1905) [Hemiptera: Pseudococcidae]	Coffee mealybug, Oriental cacao mealybug, Oriental cacao mealybug.	Yes	Infests fruit and other plant parts	MAFF (1990); ScaleNet (2001)	Yes
Platypleura kaempferi (Fabricius) [Hemiptera: Cicadidae]	Kaempfer cicada	No	Nymphs on roots, adults on branches	AQIS (1999)	No
Plautia stali Scott [Hemiptera: Pentatomidae]	Brownwinged greenbug, Oriental stink bug	Yes	Feeds on fruits	AQIS (1999)	Yes
Protopulvinaria pyriformis (Cockerell, 1894) [Hemiptera: Coccidae]	Pyriform scale	No	On leaves	ScaleNet (2001)	No
Pseudaonidia duplex (Cockerell) [Hemiptera: Diaspididae]	Camphor scale	Yes	Second generation nymphs infest fruit	MAFF (1990); http://www.kernag.com/phytotxt/costaric.html	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Pseudococcus comstocki (Kuwana, 1902) [Hemiptera: Pseudococcidae]	Comstock mealybug	Yes	Fruits and branches	Musaev & Bushkov (1977); CABI (1999)	Yes
Pseudococcus cryptus Hempel, 1918 [Hemiptera: Pseudococcidae]	Citrus mealybug, citriculus mealybug, cryptic mealybug, Green's mealybug	No?	Mainly on roots but can infest aerial parts of plants	Scalenet (2001)	Yes
Pulvinaria aurantii Cockerell, 1896 [Hemiptera: Coccidae]	Cottony citrus scale, orange citrus scale	No	On leaves, branches	Cui *et al*. (1997)	No
Pulvinaria citricola Kuwana, 1914 [Hemiptera: Coccidae]	Cottony citrus scale	No	On leaves, branches	Cui *et al*. (1997)	No
Pulvinaria okitsuensis Kuwana, 1914 [Hemiptera: Coccidae]	Cottony citrus scale	No	On leaves	MAFF (1990)	No
Pygomenida bengalensis (Westwood, 1837) [Hemiptera: Pentatomidae]	Shield bug	No?	Grain and seed feeder; also on leaves; preferentially on rice	Yasunaga pers.comm.; CABI (1999) by inference from *Leptocorisa* spp.	No
Rhizoecus kondonis Kuwana, 1923 [Hemiptera: Pseudococcidae]	Citrus ground mealybug	No	Roots	Kawai & Takagi (1971b)	No
Riptortus clavatus (Thunberg) [Hemiptera: Coreidae]	Bean bug	Yes	Feeds on seeds, pods, fruits	CABI (1999)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Saissetia citricola (Kuwana, 1909) [Hemiptera: Coccidae]	Soft scale	No	On leaves, branches	ScaleNet (2001)	No
Takahashia japonica (Cockerell, 1896) [Hemiptera: Coccidae]	String cottony scale	No	On leaves, twigs	ScaleNet (2001); Tomizawa (1922)	No
Toxoptera odinae (Van der Goot) [Hemiptera: Aphididae]	Udo aphid	No	On leaves, shoots	AQIS (1999)	No
Unaspis yanonensis (Kuwana, 1923) [Hemiptera: Diaspididae]	Arrowhead scale	Yes	On leaves, twigs and fruit	Ohkubo (1980); Mizobuchi *et al*. (1995)	Yes
Zyginella citri (Matsumura) [Hemiptera: Cicadellidae]	Smaller citrus leafhopper	Yes	On leaves and fruit	Day & Fletcher (1994)	Yes
Hymenoptera (ants; bees; wasps)					
Crematogaster nawai Ito, 1914 [Hymenoptera: Formicidae]	Ant	No	Nests under stones, in dead wood,		No
Lepidoptera (butterflies; moths)					
Acanthopsyche nigraplaga nigriplaga (Wileman, 191) [Lepidoptera: Psychidae]	Bagworm moth	No		MAFF (1999)	No
Adoxophyes sp. [Lepidoptera: Tortricidae]	Smaller tea tortrix	Yes	Species name required; larva does not stay within fruit	MAFF (1993)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Anomis mesogona (Wlk.) [Lepidoptera: Noctuidae]	Hibiscus looper, anomis fruit moth	Yes?	Adults suck sap	MAFF (1990)	Yes
Apochima excavata (Dyar, 1905) [Lepidoptera: Geometridae]	Mulberry looper	No	Larvae on leaves	MAFF (1990)	No
Archips breviplicanus Walsingham, 1900 [Lepidoptera: Tortricidae]	Asiatic leafroller	Yes	Larvae feed on surface of fruits	AQIS (1998); CABI (1999)	Yes
Artena dotata (Fabricius, 1794) [Lepidoptera: Noctuidae]	Fruit-piercing moth	Yes	Adults suck sap	MAFF (1995); Yoon & Lee (1974)	Yes
Ascotis selenaria (Denis & Schiffermuller, 1775) [Lepidoptera: Geometridae]	Mugwort looper	No	Japanese subspecies unknown; larvae may damage young fruit	MAFF (1990)	No
Bambalina sp. [Lepidoptera: Psychidae]	Mulberry bagworm	No	Feeds on leaves sometimes bark	MAFF (1990)	No
Biston robustus robustus Butler, 1879 [Lepidoptera: Geometridae]	Giant geometer	No	Larvae feed on leaves	MAFF (1990)	No
Chalioides kondonis Kondo, 1822 [Lepidoptera: Psychidae]	Kondo white psychid	No	Leaves	Nakashima & Shimizu (1972)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Cleora (Carecomotis) repulsaria (Walker, 1860) [Lepidoptera: Geometridae]	Looper	No	Leaves	MAFF (1990)	No
Cusiara stipitaria (Oberthur, 1880) [Lepidoptera: Geometridae]	Looper caterpillar	No	Leaves	MAFF (1990)	No
Descoreba simplex Butler, 1884 [Lepidoptera, Geometridae]	Geometrid moth	No	Leaves	MAFF (1990)	No
Ectropis excellens Butler, 1878 [Lepidoptera, Geometridae]	Large brown-striped geometrid, locust looper	No	Larvae feed on leaves	AQIS (1998)	No
Endoclyta sinensis (Moore, 1877) [Lepidoptera: Hepialidae]	Grape tree-borer	No	Larvae bore in trunks and branches	MAFF (1990)	No
Ercheia umbrosa Butler, 1881 [Lepidoptera: Noctuidae]	Noctuid moth	Yes?	Adults may pierce fruit at night	AQIS (1998)	Yes
Eudocima tyrannus (Guenée, 1852) [Lepidoptera: Noctuidae]	Fruit-piercing moth	Yes	Hooks on mouthparts of the genus enable it to pierce fruits	Holloway *et al*. (2001)	Yes
Eumeta japonica (Heylaerts, 1884) [Lepidoptera: Psychidae]	Giant bagworm	Yes	Larvae feed on leaves, twigs and surface of fruits	MAFF (1990)	Yes
Eumeta minuscula Butler, 1881 [Lepidoptera: Psychidae]	Tea bagworm	Yes	Larvae feed on leaves, twigs and surface of fruits	MAFF (1990)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Euproctis pulverea Leech, 1889 [Lepidoptera: Lymantriidae]	Black-dotted yellow tussock moth	Yes?		AQIS (1998); Biosecurity Australia (Unpublished)	Yes
Homona magnanima Diakonoff, 1948 [Lepidoptera: Tortricidae]	Large tea tortrix, Oriental tea tortrix	No?	Larvae feed on leaves	MAFF (1990)	No
Hydraecia amurensis Staudinger, 1892 [Lepidoptera: Noctuidae]	Fruit piercing moth	Yes	Adults suck sap	Lee *et al*. (1970)	Yes
Lemyra imparilis (Butler, 1877) [Lepidoptera: Actiidae]	Mulberry tiger moth	No	On leaves, buds, flowers	Maki (1961); AQIS (1999)	No
Lymantria dispar japonica japonica Motschulsky 1861 [Lepidoptera: Lymantriidae]	Gypsy moth	No	On leaves, egg mass undergoes diapause and tolerates low temperatures	Schaefer *et al*. (1986)	No
Mahasena aurea (Butler, 1881) [Lepidoptera: Psychidae]	Case moth	No	Leaf	Lee *et al*. (1997)	No
Mamestra brassicae (Linnaeus, 1758) [Lepidoptera: Noctuidae]	Cabbage armyworm	Yes	Larvae on leaves, adults fruit piercing	MAFF (1990); Hill (1987)	Yes
Megabiston plumosaria Leech, 1891 [Lepidoptera: Geometridae]	Tea geometrid	No	Larvae on leaves	Minamikawa (1971); Beljaev (1996)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Oraesia excavata (Butler, 1878) [Lepidoptera: Noctuidae]	Fruit-piercing moth	Yes	Adults suck sap	MAFF (1999)	Yes
Papilio helenus nicconicolens Butler [Lepidoptera: Papilionidae]	Red Helen	No	Larvae feed on leaves, adults in flowers	Collins & Morris (1985)	No
Papilio memnon thunbergii von Siebold [Lepidoptera: Papilionidae]	Great mormon	No	Larvae feed on leaves, adults in flowers	Collins & Morris (1985)	No
Papilio polytes polytes (Linnaeus) [Lepidoptera: Papilionidae]	Common mormon	No	Larvae feed on leaves, adults in flowers	Collins & Morris (1985)	No
Papilio protenor demetrius Cramer [Lepidoptera: Papilionidae]	Spangle	No	Larvae feed on leaves, adults in flowers	Collins & Morris (1985)	No
Parallelia maturata (Walker, 1858) [Lepidoptera: Noctuidae]	Purplish thick-legged moth	Yes	Adults suck fruit at night	Yoon & Lee (1974)	Yes
Planociampa antipala Prout, 1930 [Lepidoptera: Geometridae]	Looper moth	No	Larvae feed on leaves	MAFF (1990)	No
Plusiodonta casta Butler, 1878 [Lepidoptera: Noctuidae]	Fruit piercing moth	Yes?	Adults of other genera in this subfamily feed on fruits	CSIRO (1991)	Yes
Psorosticha melanocrepida Clarke [Lepidoptera: Oecophoridae]	Citrus leafroller	Yes?	Larvae said to feed on fruit and shelter in folded leaves during the day	Nasu *et al*. (1999)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Pylargosceles steganioides (Butler, 1878) [Lepidoptera: Geometridae]	Two-wavy-lined geometrid	No	Larvae feed on leaves	MAFF (1990)	No
Sarcopolia illoba (Butler, 1878) [Lepidoptera: Noctuidae]	Mulberry caterpillar	No	Larvae feed on leaves, adults may suck plant juices	MAFF (1990)	No
Scythropiodes leucostola (Meyrick, 1921) [Lepidoptera: Lecithoceridae]	Tube caterpillar	?	Larvae may feed on dead plant material	None found	Yes
Papilio xuthus Linnaeus, 1767 [Lepidoptera: Papilionidae]	Chinese yellow swallowtail, smaller citrus dog	No	Larvae feed on leaves, adults in flowers	Collins and Morris (1985)	No
Spilosoma inaequalis (Butler, 1878) [Lepidoptera: Arctiidae]	Cherry tiger moth	No	Larvae feed on leaves	MAFF (1990)	No
Spilosoma lubricipeda (Linnaeus, 1758) [Lepidoptera: Arctiidae]	White ermine moth, yellow bellow belly black dotted arctiid	No	Larvae feed on leaves	AQIS (1999); Durimanov *et al*. (1961)	No
Stathmopoda auriferella (Walker, 1864) [Lepidoptera: Oecophoridae]	Apple heliodinid	Yes	Possibly feeds on fruits, flowers and buds, can pupate in fruits	AQIS (1997); Park *et al*. (1994)	Yes
Telorta acuminata (Butler, 1878) [Lepidoptera: Noctuidae]	Noctuid moth	Yes?	Adults suck sap	MAFF (1990)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Xylena formosa Butler, 1878 [Lepidoptera: Noctuidae]	Fruit-piercing moth	Yes	Larvae damage fruit	Ikeda & Fukuyo (1985)	Yes
Orthoptera [crickets; grasshoppers; katydids]					
Holochlora japonica Brunner v. Wattenwyl, 1878 [Orthoptera: Tettigoniidae]	Japanese broadwinged katydid, fruit-tree katydid	Yes?	Adults and nymphs may feed on fruit and fruitlets but mainly on leaves and shoots	D. Rentz (pers. comm.)	Yes
Holochlora longifissa Matsumura & Shiraki, 1908 [Orthoptera: Tettigoniidae]	Bush cricket, katydid	Yes?	Adults and nymphs may feed on fruit and fruitlets but mainly on leaves and shoots	D. Rentz (pers. comm.)	Yes
Ornebius kanetataki (Matsumura, 1904) [Orthoptera: Gryllidae]	Fruit cricket	Yes	Feeds on fruits	Kohno & Hashimoto (1976)	Yes
Parapodisma sp. [Orthoptera: Acrididae]	Grasshopper	No	Probably leaves and new growth only	By inference from other Acrididae	No
Patanga japonica (Bolivar, 1898) [Orthoptera: Acrididae]	Grasshopper	No	On buds	MAFF (1990)	No
Phaulula gracilis [Orthoptera: Tettigoniidae]	Bush cricket, katydid	No	Feeds on leaves	MAFF (1990)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Teleogryllus emma (Ohmachi & Matsumura) [Orthoptera: Gryllidae]	Emma field cricket	No	Feeds on foliage	http://home.hanmir.com/~pulmuchi/korthoptera/Teleogryllus-emma.htm	No
Thysanoptera [thrips]					
Frankliniella intonsa (Trybom, 1895) [Thysanoptera: Thripidae]	Taiwan flower thrips	Yes	On young fruit, may lay eggs on mature fruit	CABI (1999)	Yes
Frankliniella occidentalis (Pergande, 1895) [Thysanoptera: Thripidae]	Western flower thrips	Yes	[Under official control] Eggs may be laid in fruit	OEPP/EPPO (1989)	Yes
Haplothrips chinensis Priesner [Thysanoptera: Phlaeothripidae]	Rose thrips	No	On flowers	No reference found	No
Megalurothrips distalis (Karny) [Thysanoptera: Thripidae]	Thrips	No	Adults and nymphs on flowers but also seed pods	Mound (pers. comm.)	No
Thrips flavus Schrank, 1776 [Thysanoptera: Thripidae]	Honeysuckle thrips	No	Sucks plant sap from leaves and shoots	Wen & Lee (1982)	No
Thrips palmi Karny, 1925 [Thysanoptera: Thripidae]	Melon thrips	Yes	[Under official control] On leaves, buds, flowers, lays eggs in fruit	Lewis (1997)	Yes
MOLLUSCA (slugs; snails)					
Acusta despecta sieboldiana	Snail	No?	Could contaminate fruit and survive in	Ahn *et al*. (1991)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
(Pfeiffer, 1850) [Mollusca: Eulotidae]			packing cases		
Satsuma pagodula [Mollusca: Camaenidae]	Snail	No?	Probably can feed on fruit but prefers leaves	?	Yes
NEMATODA (nematodes)					
Meloidogyne sp. [Tylenchida: Meloidogynidae]	Root-knot nematode	No	In soil only, on roots		No
Xiphinema bakeri Williams, 1961 [Dorylaimida: Longidoridae]	Dagger nematode	No	Only on roots	Lee & Han (1976)	No
Xiphinema similimum Loof & Yassim, 1971 [Dorylaimida: Longidoridae]	Dagger nematode	No	Only on roots	Lee & Han (1976)	No
PATHOGENS					
BACTERIA					
Liberobacter asiaticum Jagouexi et al. 1994	Citrus greening disease	Yes	Infects whole tree including leaves, fruit and roots. May cause dieback or defoliation. Transmitted by grafting and *Diaphorina citri*. Bacterium is phloem restricted.	da Graca (1991); Garnsey (1988)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Xanthomonas axonopodis pv. *citri* (Hasse) Vauterin *et al*.	Asiatic citrus canker	Yes	The bacterium infects twigs, leaves and fruit of citrus trees and reproduces in lesions on leaves, stems and fruits.	Schubert *et al*. (2000)	Yes
FUNGI					
Capnophaeum fuliginodes (Rehn) Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	On leaves, fruits and stems. Appears as a superficial black growth, which does not penetrate the tissues.	MAFF (1990)	Yes
Cercospora penzigii Sacc. ['Mitosporic fungi': Hyphomycetes]	Sweet orange leaf spot	No	This fungus causes a leaf spot of sweet orange leaves in Italy, Florida and Japan	Timmer *et al*. (2000)	No
Fusarium spp. ['Mitosporic fungi': Hyphomycetes]	Fusarium rot, fruit rot, collar rot	Yes	Post-harvest rot of fruit in storage	Brown *et al*. (1988)	Yes
Chaetoscorias vulgaris Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	On leaves, fruits and stems. Appears as a superficial black growth, which does not penetrate the tissues.	MAFF (1990)	Yes
Cylindrocladium citri (H. Fawc. & L.K. Klotz) Boedjin & Reitsma ['Mitosporic fungi': Hyphomycetes]	Decay of citrus fruit	No	Only attack rotting fruit. Reproduces by conidia and chlamydospores and transmitted by wind and splash dispersal.	Crous & Wingfield (1993)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Elsinoe fawcetti Bitancourt & Jenk. (anamorph: *Sphaceloma fawcetti* Jenk.) [Loculoascomycetes: Dothideales]	Citrus scab	Yes	The fungus infects fruit, leaves and twigs and scab lesions appear as wart-like growths or as flat scars on the fruit and leaves. Not all strains are present in Australia.	Whiteside (1988c)	Yes
Helicobasidium mompa Tanaka [Basidiomycetes: Auriculariales]	Violet root rot	No	The fungus grows on roots. Spreads by root-to-root contact.	MAFF (1990)	No
Hypocapnodium japonicum (Hara) Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	On leaves, fruits and stems. Appears as a superficial black growth, which does not penetrate the tissues.	MAFF (1990)	Yes
Limacinia harai Yamamoto [Ascomycota: Insertae sedis]	Sooty mould	Yes	On leaves, fruits and stems. Appears as a superficial black growth, which does not penetrate the tissues.	MAFF (1990)	Yes
Meliola butleri Sydow [Ascomycota: Meliolales]	Sooty mould	Yes	On leaves, fruits and stems. Appears as a superficial black growth, which does not penetrate the tissues.	MAFF (1990)	Yes
Mycosphaerella horii Hara [Loculoascomycetes: Dothideales]	Greasy spot, leaf spot	Yes	On leaves and fruits. Small round, brown spots are formed on old wintering leaves. The fungus causes a grey leaf spot of citrus in Japan.	Whiteside (1988a); MAFF (1990)	Yes
Neocapnodium tanakae (Shirai & Hara) Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	On leaves, fruits and stems. Appears as a superficial black growth, which does not penetrate the tissues.	MAFF (1990)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Pellicularia koleroga Cooke [Basidiomycetes: Aphyllophorales]	Thread blight	Yes	Thread blight attacks twigs, fruit and leaves of citrus trees.	Timmer *et al*. (2000)	Yes
Penicillium fructigenum Takeuchi ['Mitosporic fungi': Hyphomycetes]	Fruit rot	Yes	Post-harvest disease. Listed in US as non-actionable	USDA (1995)	Yes
Phaeosaccardinula javanica (Zimmermann) Yamamoto [Loculoascomycetes: Dothideales]	Sooty mould	Yes	On leaves, fruits and stems. Appears as a superficial black growth, which does not penetrate the tissues.	MAFF (1990)	Yes
Phoma erratica (Ellis & Everh.) Hara var. *mikan* Hara ['Mitosporic fungi': Coelomyctes]	Fruit rot	Yes	Post-harvest disease in the late period of storage. Conidia are dispersed by rain splash and infect young leaves and fruit.	MAFF (1990)	Yes
Phomopsis spp. ['Mitosporic fungi': Coelomycetes]	Stem-end rot, gummosis	Yes	Post-harvest rot of fruit	Brown & Eckert (1988)	Yes
Phyllosticta beltranii Penzig ['Mitosporic fungi': Coelomycetes]	Leaf spot	No	This fungus has been recorded on leaves.	Whiteside (1988b)	No
Phyllosticta erratica Ellis & Everh. ['Mitosporic fungi': Coelomycetes]	Leaf spot	No	This fungus has been recorded on leaves	Timmer *et al*. (2000)	No
Phyllosticta spp. ['Mitosporic fungi': Coelomycetes]	Leaf spot	No	This fungus is associated with leaves	Whiteside (1988b)	No

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Rosellinia bunodes (Berk. & Broome) Sacc. [Pyrenomycetes: Xylariales]	Rosellinia rot, black root rot	No	On roots. The causal fungus produces mycelial growth on infected roots.	Stevenson (1975); Timmer (1988)	No
Sclerotium citricolum Hara [Agonomycetes]	Phellomyces rot	Yes	Post-harvest disease in the middle to late period of storage.	MAFF (1990)	Yes
Scorias citrina (Hara) Yamamoto [Loculoascomyctes: Dothideales]	Sooty mould	Yes	On leaves, fruits and stems. Appears as a superficial black growth that does not penetrate the tissues.	MAFF (1990)	Yes
Triposporiopsis spinigera (Hohnel) Yamamoto [Loculoascomyctes: Dothideales]	Sooty mould	Yes	On leaves, fruits and stems. Appears as a superficial black growth that does not penetrate the tissues.	MAFF (1990)	Yes
VIRUSES					
Citrus mosaic virus (part of Satsuma dwarf complex)	Citrus mosaic	Yes	On leaves and fruits. Causes blotching of the fruit rind and leaf curl. Seriologically related to Satsuma dwarf virus. Transmitted by grafting and sap-inoculation.	Garnsey & Koizumi (1988)	Yes
Citrus yellow mottle associated virus	Citrus yellow mottle disease	Yes	Graft-transmissible agent associated with vein-clearing and symptoms similar to ringspot.	Garnsey (1988)	Yes

Taxonomic name	Common name/s	Pathway association			Consider further
		on fruit	comment	reference	
Natsudaidai dwarf virus (part of Satsuma dwarf complex)	Natsudaidai dwarf	Yes	On leaves. Seriologically related to Satsuma dwarf virus. Transmitted by grafting and sap-inoculation.	Garnsey & Koizumi (1988)	Yes
Navel orange infectious mottling virus (part of Satsuma dwarf complex)	Navel orange infectious mottling	Yes	On leaves. Seriologically distinct from Satsuma dwarf virus. Transmitted by grafting and sap-inoculation.	Garnsey & Koizumi (1988)	Yes
Satsuma dwarf virus	Satsuma dwarf	Yes	On leaves. Causes stunting or curling. Transmitted by grafting and sap-inoculation	Garnsey & Koizumi (1988)	Yes

Associations of some pest species with the fruit or other parts of the plant are uncertain and are denoted with a question mark.

Synonyms are given in Appendix 1

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APPENDIX 3. PESTS THAT WILL REQUIRE FURTHER EVALUATION IN THE IRA

Pest	Common name(s)
INVERTEBRATA	
ACARI (mites)	
Aculops pelekassi (Keifer, 1959) [Acarina: Eriophyidae]	Pink citrus rust mite
Eotetranychus kankitus Ehara [Acarina: Tetranychidae]	Citrus yellow mite
INSECTA (insects)	
Coleoptera (beetles)	
Epuraea domina [Coleoptera: Nitidulidae]	Sap beetle
Epuraea japonica [Coleoptera: Nitidulidae]	Sap beetle
Epuraea (Haptoncurina) paulula (Reitter, 1973) [Coleoptera: Nitidulidae]	Sap beetle
Monochamus subfasciatus Bates [Coleoptera: Cerambycidae]	Citrus longhorn
Psammoecus triguttatus Reitter, 1874 [Coleoptera: Silvanidae]	Beetle
Diptera (true flies, mosquitoes)	
Bactrocera tsuneonis (Miyake, 1919) [Diptera: Tephritidae]	Citrus fruit fly
Limonia amatrix Alexander [Diptera: Tipulidae]	Citrus crane fly
Hemiptera (aphids; leafhoppers, mealybugs; phyllids; scales, true bugs; whiteflies)	
Alcimocoris japonensis (Scott, 1880) [Hemiptera: Pentatomidae]	Shield bug
Anacanthocoris striicornis (Scott) [Hemiptera: Coreidae]	Larger squash bug
Andaspis hawaiiensis (Maskell, 1895) [Hemiptera: Diaspididae]	Armoured scale
Apheliona ferruginea (Matsumurua, 1931) [Hemiptera: Cicadellidae]	Citrus leafhopper, jassid
Bothrogonia japonica Ishihara [Hemiptera: Cicadellidae]	Black-tipped leafhopper
Carbula humerigera (Uhler, 1860) [Hemiptera: Pentatomidae]	Shieldbug
Chrysomphalus bifasciculatus Ferris [Hemiptera: Diaspididae]	False Florida red scale
Cletus punctiger (Dallas) [Hemiptera: Coreidae]	Squash bug
Dialeurodes citri (Ashmead, 1885) [Hemiptera: Aleyrodidae]	Citrus whitefly
Diaphorina citri Kuwayama, 1908 [Hemiptera: Psyllidae]	Citrus psylla
Edwardsiana flavescens (Fabricius, 1794) [Hemiptera: Cicadellidae]	Small green leafhopper
Empoasca arborescens Vilbaste, 1968 [Hempiptera: Cicadellidae]	Leafhopper

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Pest	Common name(s)
Empoasca onukii Matsuda, 1952 [Hemiptera: Cicadellidae]	Tea green leafhopper
Epiacanthus stramineus (Matschulsky) [Hemiptera: Errhomenellidae]	Grape leafhopper
Eucorysses grandis (Thunberg, 1783) [Hemiptera; Pentatomidae]	Shield bug
Glaucias subpunctatus (Walker) [Hemiptera: Pentatomidae]	Polished green stink bug
Graptopsaltria nigrofuscata (Motschulsky, 1866) [Hemiptera: Cicadidae]	Large brown cicada
Halyomorpha halys (Stal, 1855) [Hemiptera: Pentatomidae]	Brown marmorated stink bug
Homoeocerus unipunctatus (Thunberg) [Hemiptera: Coreidae]	Coreid bug
Hygia opaca (Uhler) [Hemiptera: Coreidae]	Coreid bug
Lopholeucaspis cockerelli (Grandpre & Charmoy, 1899) [Hemiptera: Diaspididae]	Armoured scale
Lopholeucaspis japonica (Cockerell, 1897) [Hemiptera: Diaspididae]	Pear white scale
Megacopta punctatissimum (Montandon) [Hemiptera: Plataspidae]	Bean pentatomid, globular stink bug
Nezara antennata Scott [Hemiptera: Pentatomidae]	Green stink bug, oriental green stink bug
Parabemisia myricae (Kuwana, 1927) [Hemiptera: Aleyrodidae]	Myrica whitefly, Japanese bayberry whitefly
Paradasynus spinosus Hsiao, 1963 [Hemiptera: Coreidae]	Coreid bug
Parlatoria cinerea Doane & Hadden, 1909 [Hemiptera: Diaspididae]	Armoured scale
Parlatoria ziziphi (Lucas, 1853) [Hemiptera: Diaspididae]	Black parlatoria scale, black scale, citrus scale, ebony scale, leaf black scale, Mediterranean scale
Piocoris varius (Uhler, 1860) [Hemiptera: Anthocoridae]	Anthocorid bug
Planococcus kraunhiae (Kuwana, 1902) [Hemiptera: Pseudococcidae]	Japanese mealybug
Planococcus lilacinus (Cockerell) [Hemiptera: Pseudococcidae]	Coffee mealybug, Oriental cacao mealybug
Plautia stali Scott [Hemiptera: Pentatomidae]	Brownwinged greenbug, oriental stink bug
Pseudaonidia duplex (Cockerell) [Hemiptera: Diaspididae]	Camphor scale
Pseudococcus comstocki (Kuwana, 1902) [Hemiptera: Pseudococcidae]	Comstock mealybug

Pest	Common name(s)
Pseudococcus cryptus Hempel, 1918 [Hemiptera: Pseudococcidae]	Citrus mealybug, Citriculus mealybug, cryptic mealybug, Green's mealybug
Riptortus clavatus (Thunberg) [Hemiptera: Coreidae]	Bean bug
Unaspis yanonensis (Kuwana, 1923) [Hemiptera: Diaspididae]	Arrowhead scale
Zyginella citri (Matsumura) [Hemiptera: Cicadellidae]	Smaller citrus leafhopper
Lepidoptera (butterflies; moths)	
Adoxophyes sp. [Lepidoptera: Tortricidae]	Smaller tea tortrix
Anomis mesogona (Walker, 1858) [Lepidoptera: Noctuidae]	Hibiscus looper, anomis fruit moth
Archips breviplicanus Walsingham, 1900 [Lepidoptera: Tortricidae]	Asiatic leafroller
Artena dotata (Fabricius, 1794) [Lepidoptera: Noctuidae]	Fruit-piercing moth
Ercheia umbrosa Butler, 1881 [Lepidoptera: Noctuidae]	Noctuid moth
Eudocima tyrannus Guenée 1852 [Lepidoptera: Noctuidae]	Fruit piercing moth
Eumeta japonica (Heylaerts, 1884) [Lepidoptera: Psychidae]	Giant bagworm
Eumeta minuscula Butler, 1881 [Lepidoptera: Psychidae]	Tea bagworm
Euproctis pulverea (Leech, 1888) [Lepidoptera: Lymantriidae]	Black-dotted yellow tussock moth
Hydraecia amurensis Staudinger, 1892 [Lepidoptera: Noctuidae]	Fruit piercing moth
Mamestra brassicae (Linnaeus, 1758) [Lepidoptera; Noctuidae]	Cabbage armyworm
Oraesia excavata (Butler, 1878) [Lepidoptera: Noctuidae]	Fruit-piercing moth
Plusiodonta casta (Butler, 1878) [Lepidoptera: Noctuidae]	Fruit piercing moth
Parallelia maturata (Walker, 1858) (Moore, 1882). [Lepidoptera: Noctuidae]	Purplish thick-legged moth
Psorosticha melanocrepida Clarke [Lepidoptera; Oecophoridae]	Citrus leafroller
Scythropiodes leucostola (Meyrick 1921) [Lepidoptera: Lecithoceridae]	Tube caterpillar
Stathmopoda auriferella (Walker, 1864) [Lepidoptera: Oecophoridae]	Apple heliodinid
Telorta acuminata (Butler, 1878) [Lepidoptera; Noctuidae]	Noctuid moth
Xylena formosa (Butler, 1878) {Lepidoptera; Noctuidae]	Fruit piercing moth
Orthoptera (crickets; grasshoppers; katydids)	
Holochlora japonica Brunner von Watternwyl, 1878 [Orthoptera: Tettigoniidae]	Japanese broadwinged katydid, fruit-tree katydid

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Pest	Common name(s)
Holochlora longifissa Matsumura & Shiraki, 1908 [Orthoptera: Tettigoniidae]	Bush cricket, katydid
Ornebius kanetataki (Matsumura, 1904) [Orthoptera: Gryllidae]	Fruit cricket
Thysanoptera (thrips)	
Frankliniella intonsa (Trybom, 1895) [Thysanoptera: Thripidae]	Taiwan flower thrips
Frankliniella occidentalis (Pergande, 1895) [Thysanoptera: Thripidae]	Western flower thrips
Thrips palmi Karny, 1925 [Thysanoptera: Thripidae]	Melon thrips
MOLLUSCA (snails; slugs)	
Acusta despecta sieboldiana (Pfeiffer, 1850) [Mollusca: Eulotidae]	Snail
Satsuma pagodula [Mollusca: Camaenidae]	Snail
PATHOGENS	
BACTERIA	
Liberobacter asiaticum Jagouexi *et al*. 1994	Citrus greening disease
Xanthomonas axonopodis pv. *citri* (Hasse) Vauterin *et al*.	Asiatic citrus canker
FUNGI	
Capnophaeum fuliginodes (Rehn) Yamamoto	Sooty mould
Chaetoscorias vulgaris Yamamoto	Sooty mould
Elsinoe fawcetti Bitancourt & Jenk. (anamorph: *Sphaceloma fawcetti* Jenk.]	Citrus scab
Fusarium spp.	Fusarium rot, fruit rot
Hypocapnodium japonicum (Hara) Yamamoto	Sooty mould
Limacinia harai Yamamoto	Sooty mould
Meliola butleri Sydow	Sooty mould
Mycosphaerella horii Hara	Leaf spot
Neocapnodium tanakae (Shirai & Hara) Yamamoto	Sooty mould
Pellicularia koleroga Cooke	Thread blight
Penicillium fructigenum Takeuchi	Fruit rot
Phaeosaccardinula javanica (Zimmermann) Yamamoto	Sooty mould
Phoma erratica (Ellis & Everhart) Hara var. *mikan* Hara	Fruit rot
Phomopsis spp.	Stem-end rot, gummosis
Sclerotium citricolum Hara	Phellomyces rot
Scorias citrina (Hara) Yamamoto	Sooty mould

Pest	Common name(s)
Triposporiopsis spinigera (Hohnel) Yamamoto	Sooty mould
VIRUSES	
Citrus mosaic virus	Citrus mosaic
Citrus yellow mottle associated virus	Citrus yellow mottle disease
Natsudaidai dwarf virus	Natsudaidai dwarf
Navel orange infectious mottling virus	Navel orange infectious mottling
Satsuma dwarf virus	Satsuma dwarf