Ministry for Primary Industries
Manatū Ahu Matua

Risk Management Proposal:

Fresh Zucchini and Scallopini (*Cucurbita pepo*) for Consumption from the Kingdom of Tonga

28 January 2015

New Zealand Government

Growing and Protecting New Zealand

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DISCLAIMER

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SUBMISSIONS

The Ministry for Primary Industries (MPI) invites comment from interested parties on the proposed new import health standard (IHS) for fresh zucchini and scallopini (*Cucurbita pepo*) for consumption which is supported by this document. The meaning of an IHS is defined in section 22(1) of the Biosecurity Act 1993 as 'An import health standard specifies requirements to be met for the effective management of risks associated with importing risk goods, including risks arising because importing the goods involves or might involve an incidentally imported new organism". MPI therefore seeks comment on the requirements (including measures) in the proposed new IHS. Submitters may also like to comment separately on other aspects of the IHS and MPI will respond to these in due course.

The following points may be of assistance in preparing comments:

- Wherever possible, comment should be specific to a particular section/paragraph in the IHS.
- Where possible, reasons, data and relevant published references to support comments are requested.
- The use of examples to illustrate particular points is encouraged.

MPI encourages respondents to forward comments electronically. Please include the following in your submission:

- The title of the consultation document in the subject line of your email;
- Your name and title (if applicable);
- Your organisation's name (if applicable); and
- Your address.

Send submissions to: plantimports@mpi.govt.nz.

However, should you wish to forward submissions in writing, please send them to the following address:

Plant Imports
Plants, Food & Environment
Ministry for Primary Industries
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The closing date for submissions is 5:00 pm, Thursday 26th February, 2015.

Submissions received by the closure date will be considered during the development of the final draft IHS. Submissions received after the closure date may be held on file for consideration when the issued IHS is next revised/reviewed.

OFFICIAL INFORMATION ACT 1982

Please note that your submission is public information and it is MPI policy to publish submissions and the review of submissions on the MPI website. Submissions may also be the subject of requests for information under the Official Information Act 1982 (OIA). The OIA specifies that information is to be made available to requesters unless there are sufficient grounds for withholding it, as set out in the OIA. Submitters may wish to indicate grounds for withholding specific information contained in their submission, such as the information is commercially sensitive or they wish personal information to be withheld. Any decision to withhold information requested under the OIA is reviewable by the Ombudsman.

Contents

PURPOSE

1. The purpose of this risk management proposal (RMP) is to provide information about the proposed measures for zucchini and scallopini from the Kingdom Of Tonga (Tonga) contained in the draft import health standard (IHS) for “Fresh Zucchini and Scallopini (*Cucurbita pepo*) for Consumption”.

2. The purpose of the consultation is to seek feedback on the measures proposed to manage pests on zucchini and scallopini from Tonga.

3. The draft IHS also incorporates existing, unchanged measures from the current IHSs for zucchini and scallopini from Australia and New Caledonia. These have been incorporated as part of the newly formatted IHS.

4. This document and the new IHS format is not the subject of consultation but MPI will accept comments and suggestions in order to improve future consultation. Feedback on the measures for zucchini and scallopini from Australia and New Caledonia is not sought because the measures have not changed.

SCOPE

5. This document provides the rationale for the proposed measures contained in the draft import health standard (IHS) for Fresh Zucchini and Scallopini (*Cucurbita pepo*) for Consumption. It includes:

    - pests (hazards) identified that may be associated with the importation of fresh zucchini and scallopini into New Zealand from Tonga;
    - an assessment of the general requirements for managing pests associated with fresh zucchini and scallopini from Tonga;
    - identifying specific pests or pest groups requiring additional phytosanitary measures; and
    - an assessment of risk management options considered for specific pests.

6. This document is in two parts.

    - Part 1 provides the background and context used to inform the decision-making process identifying the strength of measures required to manage regulated pests identified on the pathway covered by the scope.
    - Part 2 lists the information sources and the assessment for the proposed measures to manage risks associated with zucchini and scallopini from Tonga.

PART 1: RISK MANAGEMENT DECISION-MAKING

CONTEXT

INTERNATIONAL

7. Where possible, phytosanitary import requirements are aligned with international standards, guidelines, and recommendations as per New Zealand's obligations under Article 3.1 of the World Trade Organisation (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) (SPS-Agreement, 1995), and section 23(4)(c) of the (Biosecurity Act, 1993).

8. The WTO and SPS Agreements set in place rules that protect each country's sovereign right to take the measures necessary to protect the life or health of its people, animals and plants while at the same time facilitating trade. It embodies and promotes the use of science-based risk assessments in managing the risks associated with the international movement of goods.

9. "The SPS Agreement will continue to guide how New Zealand sets standards and makes decisions related to biosecurity. In particular, it will be important to maintain the standards of transparency and scientific rigour required by the SPS Agreement, and to make decisions as quickly as possible. This will encourage other countries to comply with the rules of the SPS Agreement, and also demonstrate that New Zealand's strict controls are justified to countries that challenge them" (Balance in Trade).

10. IHSs are developed in accordance with the Biosecurity Act. In keeping with New Zealand's obligations under the WTO SPS Agreement and the International Plant Protection Convention (IPPC), phytosanitary measures must:
    - be justified and can only be for regulated pests;
    - be commensurate with the risk;
    - must not discriminate unfairly between countries or between imported and domestically produced goods; and
    - are to be based on international standards wherever possible, but WTO members can adopt a measure that is more stringent than an international standard, provided the measure is scientifically justified.

11. Note that international standards guidelines or recommendations referred to in the WTO agreement are those of Codex, World Organisation for Animal Health (OIE) and IPPC.

12. As a member of the Asia Pacific Plant Protection Commission (APPPC) New Zealand also recognises regional phytosanitary standards developed by APPPC.

DOMESTIC

13. The New Zealand biosecurity system is regulated through the Biosecurity Act 1993. Section 22 of the Act describes the meaning of an IHS and requires all risk goods (including plants and plant products) entering New Zealand to be covered by one.

14. The Ministry for Primary Industries (MPI) is the government authority responsible for maintaining biosecurity standards for the effective management of risks associated with the importation of risk goods into New Zealand (Part 3, Biosecurity Act 1993).

15. MPI is committed to the principles of transparency and evidence-based technical justification for all phytosanitary measures, new and amended, imposed on importing pathways.

NEW ZEALAND'S BIOSECURITY SYSTEM

16. Fresh product can only be imported subject to an IHS and from a country where the National Plant Protection Organisation (NPPO) has provided evidence of national systems, programmes and standards for regulatory oversight of the export industry in accordance with International Standard for Phytosanitary Measures (ISPM) 7: *Phytosanitary certification system* (Food and Agriculture Organisation, 2011) to the satisfaction of a Chief Technical Officer (CTO). The export system is subject to audit by MPI.

17. The export system must contain (at least) the systems and procedures for the following elements based on ISPM 7 and ISPM 12: *Phytosanitary certificates* (Food and Agriculture Organisation, 2011)

    - recognition of the competent authority;
    - registration of export production sites;
    - standard commercial agronomic practice;
    - monitoring and oversight;
    - inspection for the pests and disease specified in Part 3 of the relevant IHS;
    - operational requirements for disease monitoring;
    - registration of packing stations;
    - disinfection treatment (where appropriate) at packing stations and prevention of contamination after disinfection;
    - traceability system (including labelling);
    - freedom from trash;
    - prevention of contamination in storage, transport and handling;
    - phytosanitary inspection and certification;
    - post inspection product security; and
    - audit arrangements.

18. If the commodity has associated pests that require targeted or specified measures to be applied, an export plan based on an MPI pathway assessment visit and identifying how those measures will be applied will be negotiated with MPI. The export plan is subject to audit by MPI.

19. The export plan must contain (at least) the systems and procedures for the following elements:

    - competent/trained personnel;
    - records completion and maintenance;
    - procedures for the application of measures specified in Part 3 of the relevant IHS;
    - product security following the application of measures;
    - monitoring and oversight of the measures;
    - pest security during packing and storage; and
    - NPPO inspection and phytosanitary certification.

20. Managing pest risks on imported commercial consignments of plants and plant products occurs at several layers operating as an integrated system to provide a high level of phytosanitary security.

21. The objective of the system is to reduce to an acceptable level the likelihood of entry and establishment of new pests (including pests, diseases and weeds).

22. No biosecurity system is capable of reducing risk to zero.

23. The phytosanitary system is focused on ensuring that the most significant pests, for example economically important fruit flies, are unlikely to ever establish in New Zealand. However the system aims to manage risk associated with all regulated pests.

24. New Zealand operates a biosecurity system for which the phytosanitary aspect (covering plant health) is a key part. The system has seven main components covering:

- international standards;
- trade agreements and bilateral arrangements;
- risk assessment and IHS development;
- border interventions;
- surveillance;
- readiness and response; and
- pest management.

25. The components of the phytosanitary system are implemented to reduce the likelihood of pests entering and establishing, or to provide effective management should they establish.

26. The focus of the IHS for plant-based goods is to manage any phytosanitary risk associated with an import before it arrives at the New Zealand border; the expectation is that commercial consignments of plants and plant products meet New Zealand's phytosanitary import requirements on arrival. Phytosanitary measures that must be applied before risk goods can be given clearance into New Zealand are contained in IHSs.

27. MPI monitors the pathway performance related to each IHS to ensure they provide the expected level of protection. MPI monitors the pathway to ensure that hazards identified in the IHS are effectively managed by the measures, and that the measures are applied correctly. This is achieved through inspection at the border (and where possible, identification of pests detected) and audits of the export systems and critical points contained in the export plans.

28. The phytosanitary system also includes verification, inspection and monitoring activities when a commercial consignment of plants and plant products arrives at the New Zealand border.

29. The decision to inspect (or not) a sample of the consignment and the action selected on detection of live pests will depend on a number of factors including:

- the overall risk assessed for the commodity and country;
- previous non-compliances on the pathway;
- risk assessment of any detected live pest;
- changing risk profile in the country of export.

30. A sample of each consignment on a high risk pathway (for example, fruit fly host material) will in almost all cases be inspected.

31. MPI will inspect documentation and may inspect a sample of fresh produce consignments on arrival in New Zealand. A 600 unit randomly selected sample may be drawn from each lot and inspected for live regulated pests. A nil detection of live regulated pests in a 600 unit sample provides (approximately[1]) that with 95%

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[1] The actual level of confidence depends on a number of factors including the efficacy of inspection in detecting the pest, and the distribution of the pest on the consignment

confidence no less than 99.5% of the units are free of regulated pests. Clearance will only be given to those lots where no detections of live regulated pests (unless irradiation was used as the treatment[2]) are found and all other requirements have been met.

32. Detection of live regulated pests associated with a commodity on arrival in New Zealand will result in one of the following actions to be taken:

- reshipment of the consignment;
- destruction of the consignment; or
- treatment of the consignment.

33. In addition, detection of certain significant pests of concern (for example, economically important fruit flies), and repeated interceptions of certain high risk pests (for example *Thrips palmi*) may result in the pathway being suspended pending a full traceback and remedial action.

RISK ANALYSIS

SUMMARY OF THE RISK ANALYSIS PROCESS

34. Before attempting to describe the New Zealand biosecurity system as it relates to the management of risks related to trade, it is important that the four terms that result in most confusion are defined: risk, risk assessment, risk management, and risk analysis.

   a. *Risk:* the likelihood of the occurrence and the likely magnitude of the consequences of an adverse event.

   b. *Risk assessment*: the evaluation of the likelihood, and the biological and economic consequences, of entry, establishment, or exposure of an organism or disease.

   c. *Risk management*: the process of identifying, selecting and implementing measures that can be applied to reduce the level of risk.

   d. *Risk analysis*: the process comprising hazard identification, risk assessment, risk management and risk communication."

PEST RISK ASSESSMENT

35. A description of the pest risk assessment (PRA) process for quarantine pests can be found in the ISPM 11: *Pest risk analysis for quarantine pests* (Food and Agriculture Organisation, 2013).

36. More information on MPI's risk analysis process and procedures can be found at: http://www.mpi.govt.nz/document-vault/2031.

37. The risk assessment identifies pests (termed 'hazards') associated with the commodity according to IPPC criteria.

38. MPI's risk assessment process provides qualitative information about the:

- likelihood of a pest entering as a result of its association with a commodity;
- likelihood of a pest being exposed to a suitable host in New Zealand;
- likelihood of a pest establishing; and the
- likelihood of spread of a pest within New Zealand.

[2] Note: irradiation does not cause mortality but inhibits development of pests to the next lifestage (for example, larvae to pupae). Hence live pests may be detected following irradiation but because development is arrested, the risk is managed.

39. It also includes an assessment of the likely economic, environmental, socio-cultural and human health consequences the pest may have if it were to establish and spread in New Zealand as the result of its association with a pathway.

40. The risk assessment also documents the key assumptions made when assessing likelihoods and any specific uncertainties.

PEST EVALUATION

41. New Zealand categorises organisms associated with the commodity into:

- regulated pests (quarantine pests and regulated non-quarantine pests[3], ISPM 5 (2002): *Glossary of phytosanitary terms* (Food and Agriculture Organisation)), and
- non-regulated pests.

42. Organisms are included on the regulated pest list for a commodity if they are:

- absent from New Zealand or under official control, and
- likely to be present on the pathway if risk was unmanaged, and
- known to be associated with the commodity, and
- hosted by species present in New Zealand, and
- climatically able to establish in New Zealand, and
- likely to cause unacceptable economic, environmental or human health impacts to New Zealand.

43. Targeted or specified measures are required where the likelihood of introduction of pests is unacceptable or where the impact of establishment of the pest is very significant.

44. Often, due to uncertainties with the information on which a risk assessment is based, the risk assessment cannot identify a specific level of impact or likelihood of entry and establishment. Rather a range of potential impacts or likelihoods are identified.

45. In such cases MPI takes a precautionary approach during its risk management assessment of the strength of measure required. If additional information is provided at some future date, this stringency can be reviewed.

PEST RISK MANAGEMENT

46. Pest risk management involves identifying and implementing the best option(s) for reducing or eliminating the likelihood of the risk occurring (Article 5, (SPS-Agreement, 1995)).

47. Pest risk management evaluates and selects options (measures) to reduce the likelihood of introduction (encompassing entry, exposure, establishment and spread) of a regulated pest for New Zealand to an acceptable level while recognising it is not possible to completely eliminate all risk.

48. Measures are applied to effectively manage the risks. If a significant risk cannot be effectively managed, MPI will not issue an IHS. A measure applied to a specific pest will in many circumstances effectively manage other pests for which no separate measure has been identified.

49. The selection of appropriate measures is made considering both the likelihood and impacts of introduction against the following criteria:

[3] Note: New Zealand does not use the concept of "regulated non-quarantine pest", hence regulated pest means the same as quarantine pest

- technically justified;
- effectiveness of the management option at reducing the risk to an acceptable level;
- risk management is not more stringent than necessary;
- risk management is feasible and practical;
- measures are consistent with previous decisions;
- measures are consistent with measures proposed on New Zealand exports (where appropriate); and
- cost effectiveness.

50. MPI selects measures where the strength of the measure is proportionate with the risk. The strength of the measure chosen depends on the likelihood of introduction and the likely magnitude of impacts of introduction.

51. "Strength of measures" is a concept found in the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement).

52. (Food and Agriculture Organisation, 1998) discusses "strength of measures" as follows:
    - "The strength of measures for regulated pests should be based on the risk associated with the pest as determined by PRA. Stronger measures may be justified where risk is greatest."
    - "Pest risk assessment necessarily precedes consideration of the strength of measures."
    - "The level of pest risk and the strength of measures used to manage the pest risk are visualized as a sliding scale where the strength of measures corresponds to the level of risk."; and
    - "A regulated pest may not require measures (action) if the results of PRA indicate that the level of risk is acceptable, measures are not possible, feasible, or cost effective, or where particular circumstances do not warrant action which may be taken based on the risk posed by the pest under other conditions (e.g. consumption versus propagation)."

53. The concept is also reflected explicitly in the New Revised Text of the IPPC (1997) where, in Article II (Use of Terms), pest risk analysis is defined as "... the process of evaluating biological or other scientific and economic evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it" (IPPC 1997).

54. Amongst other things, MPI considers previous decisions on measures to guide its selection of measures because these have been previously assessed by technical experts as being sufficient to effectively manage risks in other country/commodity combinations and the same pests, and were consulted with stakeholders.

55. The measures defined in the IHS target the risks assessed for regulated pests associated with a commodity and the strength of the measure required depends on the risk the pest poses to New Zealand. For example, high impact pests such as fruit fly require measures with higher level of stringency than pests of lesser impact. In such cases, a pre-export treatment or an equivalent measure (specified by New Zealand) may be required to manage the risk.

56. For lower impact pests the combination if commercial production with packhouse grading of export fruit, official inspection and certification, and inspection on arrival in New Zealand is often sufficient to reduce the level of infestation by regulated

pests to an acceptable level because damaged or infested/infected product would not meet commercial grade requirements.

57. New Zealand export production systems are used as a template to identify commercial practices that may be considered appropriate measures to act against regulated pests. For example, New Zealand relies on industry practices (for example, IPM) to manage pests on exported products identified as regulated but of lower concern to importing countries.

58. Acceptance of industry practice to manage pests of lower concern is an important plank in New Zealand's horticulture export system and is used to support New Zealand's market access requests. New Zealand argues strongly that these measures are sufficient to manage these pests, and that more stringent measures (treatments or Official Assurance Programmes (OAPs)) are required only for significant pests. Usually standard pest management used during commercial production, and official inspection and certification are sufficient to manage most pests.

59. To ensure New Zealand can have confidence in the commercial production and export systems in export countries, and pathway assessment visit will be conducted for new commodity/country combinations. Pathway assessments will be in addition to any systems audits.

60. Depending on the outcome of a pathway assessment, measures are identified to provide an appropriate level of protection to New Zealand. These will often be consistent with those negotiated for similar pests by New Zealand for market access to certain export markets.

61. Once trade has begun, MPI will also conduct pathway assurance visits to ensure compliance with the negotiated export plan.

DESCRIPTION OF THE STRENGTH OF MEASURES

62. In broad terms there are three options available for pest risk management based on the risk of introduction and the potential impact the pest poses to New Zealand:

   i. Phytosanitary inspection and certification by the exporting NPPO (minimum requirement for all products);

   ii. Targeted Measures (in addition to phytosanitary certification and inspection); and

   iii. Specified Measures (in addition to phytosanitary certification and inspection).

PHYTOSANITARY CERTIFICATION AND INSPECTION

Pre-export inspection and phytosanitary certification

63. Pre-export inspection and phytosanitary certification of all commercially produced fresh produce for export to New Zealand is required.

64. A minimum sample of 600 randomly selected fruit must be inspected using official procedures and at 10x magnification for cryptic or small pests. Consistent with international practice, the inspected sample must be free from regulated pests.

65. Where any live regulated pest is found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot must be rejected for export to New Zealand.

Inspection on arrival in New Zealand

66. MPI will inspect documentation and may inspect a sample of the consignment on arrival in New Zealand as described in the section on New Zealand's biosecurity system in this document.

67. When a consignment is found to be infested with live regulated pests on arrival in New Zealand, one of the following risk management activities will be applied:

- reshipment of the consignment;
- destruction of the consignment; or
- treatment of the consignment

TARGETED MEASURES

68. Where regulated pests are assessed by New Zealand as presenting a higher likelihood of establishment and spread, or a higher impact, MPI requires measures to be applied that target those pests ('Targeted Measures', TM). The pests requiring targeted measures are listed in Part 3 of the IHS.

69. Targeted measures may be proposed by the exporting country and must be negotiated with MPI. MPI will consider the proposed measures to ensure they are sufficient to manage the risk. Alternative measures may be proposed by MPI.

70. The details of any targeted measure will be incorporated into the export plan. The export plan must include (as a minimum):

- in-field monitoring by competent people;
- pest control activities effective against specified pests*;* and
- post harvest inspection conducted by appropriately trained personnel.

71. Examples of risk management options for targeted measures are listed below:

- Testing;
- Pest Free Area (country, place or production site) verified by official survey (where appropriate);
- approved systems approach;
- in-field monitoring and controls;
- preventing or reducing infestation during production (for example, fruit bagging);
- non-preferred host status;
- washing and brushing;
- enhanced inspection;
- pre-conditioning (e.g. removal of plant parts such as crown, calyx, skin, peduncle);
- restricted variety/hybrids.

72. The measures selected depend on the pest being managed, characteristics of the commodity and the systems and practices in the export country.

73. Selection of an appropriate targeted measure is based on qualitative information, expert judgement and experience, and quantitative data (where available).

74. The phytosanitary certificate must be endorsed with the details of any treatment in the 'treatments' section. Appropriate documentation or an additional declaration must be included in or accompany the phytosanitary certificate (for example, a treatment certificate).

75. The application of a targeted measure may also be effective against non-target pests.

SPECIFIED MEASURES

Measures specified by New Zealand for identified high risk or high impact pests

76. Where regulated pests are assessed by New Zealand as presenting the highest likelihood of establishment and spread, or highest impact, MPI will specify the measures that must be applied to manage those pests ('Specified Measures', SM). These pests and the specified measures will be listed in Part 3 of the IHS.

77. The details of any specified measure must be incorporated into the export plan. The export plan must include (as a minimum):

- oversight (supervision) of the application of the measure by competent people;
- official oversight by the NPPO;
- procedures for the application of the measure*;*
- identification of records required;
- traceability;
- post treatment security; and
- post treatment inspection conducted by appropriately trained personnel.

78. The phytosanitary certificate must be endorsed with the details of the treatment in the 'treatments' section. Appropriate documentation or an additional declaration must be included in or accompany the phytosanitary certificate (for example, a treatment certificate).

79. Examples of risk management options for specified measures are listed below:

- Testing;
- end point treatments (heat, cold, chemical, irradiation);
- non-host status;
- winter window;
- Pest Free Area (country, place or production site) verified by official survey (where appropriate);
- approved systems approach.

80. The specified measure(s) selected depend on the pest being managed, commodity characteristics and the systems and practices in the export country.

81. Selection of an appropriate specified measure is based largely on quantitative data that supports a high level of phytosanitary assurance. Quantitative data may be supported by qualitative information especially with respect to approval of a systems approach. A specified measure may also be effective against non-target pests.

PART 2: PEST RISK MANAGEMENT FOR ZUCCHINI AND SCALLOPINI FROM TONGA

COMMODITY DESCRIPTION

82. “Fresh zucchini and scallopini for consumption” is defined as the commercially produced export grade immature and white fleshed individual fruits of *Cucurbita pepo* harvested with soft green or yellow skin trimmed at the point where the stem meets the peduncle and excluding any stem, leaves or flowers; cleaned, packed and transported to New Zealand for consumption.

83. “Commercially produced” is defined as the production of export grade fruit sourced from production sites that produce fruit for export under standard cultivation, pest-management, harvesting, disinfestation and packing activities. Infested, infected or damaged fruit must be discarded prior to packing.

84. Private consignments and products produced through non-commercial systems (for example, ‘backyard’ production) are not covered by this IHS.

85. The National Plant Protection Organisation (NPPO) must provide sufficient oversight to ensure that assurances provided on a phytosanitary certificate meet the minimum requirements indentified in ISPM 7 and additional items in the negotiated export plan. The oversight (systems and procedures) is subject to audit by MPI.

BACKGROUND

86. There are existing IHS’s in place for zucchini and scallopini from Australia and New Caledonia (MPI 2013). Once the proposed draft IHS has been issued, these IHSs will be revoked.

87. Imports of zucchini and scallopini from Australia are only imported between 1 May and 1 September (MPI 2014a). This restricted import period aligns with the New Zealand “winter window” ensuring that if fruit fly (*Bactrocera cucumis*) were associated with the imported commodity they would be unable to establish in New Zealand due to low ambient temperatures.

88. Zucchini and scallopini from Australia have previously had the option of in-field control programmes in combination with a post-harvest dip with dimethoate as a fruit fly phytosanitary measure. However, this option is currently suspended by Australian authorities for commodities exported to New Zealand.

89. The Government of Tonga requested access to New Zealand for zucchini and scallopini (*Cucurbita pepo*) for consumption and the pathway has the potential to introduce regulated pests into New Zealand requiring therefore a risk management assessment to be done to determine appropriate measures to manage that risk.

90. Twenty four pests (appendix 1) have been identified as being associated with zucchini and scallopini from Tonga.

PROPOSED MEASURES

91. The following is a summary of the regulated pests identified as being associated with fresh zucchini and scallopini for consumption from Tonga. These pests have been evaluated to determine the appropriate measures needed to manage them based on

their biological characteristics and potential impact if they established in New Zealand.

92. Proposed measures are selected based on the assessed risk and impact (from other country/commodity pathways where available), and the biology of the pest.

ARMOURED SCALES (DIASPIDIDAE)

93. The armoured scales considered in this assessment are:
    - *Chrysomphalus aonidum*
    - *Pinnaspis strachani*
    - *Pseudaulacaspis pentagona*

BIOLOGY

94. *Chrysomphalus aonidum* and *Pseudaulacaspis pentagona* were assessed in the IRA for *Spondias dulcis* and *Abelmoschus manihot* from Fiji, Samoa, Cook Islands, Vanuatu including Tonga therefore will be used as examples for the scales on zucchini and scallopini from Tonga.

95. The organisms in this group are small and not very conspicuous. The detection of organisms from this group can be difficult and visual inspection could need optical enhancement (MPI 2015b).

96. All life stages (except males and crawlers) are immobile. Mixed life stages are commonly detected on zucchini and scallopini imported into New Zealand (MPI Interception Database, accessed 2015a).

97. Reproduction is mainly sexual, although asexual reproduction can occur. The first instar crawlers are the dispersal stage, but become non-mobile once they settle at a feeding site. The crawlers can also move via wind, animals, other insects or movement of infested plant material. Once the crawlers settle they become sessile. *P. pentagona* lays about 100 eggs which hatch between 3-14 days (temperature dependant) while *C. aonidum* lays about 50-150 eggs.

98. All three species of scale are highly polyphagous. *P. pentagona* primarily infests trunks and branches but is known to infest fruit including beans, citrus, Cucurbita species, stonefruit, pears, kiwifruit, grapes etc. *C. aonidum* primarily infests leaves but will infest fruit (apples, asparagus, avocado, Cucurbita pepo, citrus etc). *P. strachani* usually infests twigs, branches and trunks but is occasionally found on leaves and fruit (asparagus, capsicum, citrus, *Cucurbita* spp., tomato etc).

99. All three species could establish in greenhouses.

100. These scales do not secrete honeydew and are therefore not associated with sooty mould or honeydew feeders such as ants. The adult male scales are winged and can fly, but are short-lived and do not feed (MPI 2015b).

101. These scales feed on the plant sap and damages occur through loss of yield as the plant weakens from loss of nutrients. Infestation of the fruit affects the quality and some fruit are not marketable.

102. *P.pentagona* has been intercepted alive at the New Zealand border (females and eggs) on squash from Tonga (MPI 2013). *P. strachani* has been intercepted at the New Zealand border on the fruits of coconut, banana and watermelon from Oceanic countries, as well as leaves.

ASSESSMENT

103. The peduncle and blossom end of the fruit are likely to be removed when being processed for consumption. Although scale can attach to any part of the fruit, they are more likely to be found on the peduncle.

104. A proportion of zucchini (usually both ends of the fruit which includes a small piece of peduncle) is likely to be exposed to the environment, giving scale crawlers

opportunity to move to new hosts. The likelihood is low as crawlers walk only short distances and for those carried by air currents survival is low.

105. The biology of the scales and previous risk assessments indicate that establishment of *C. aonidum* and *P. strachani* would be low in limited areas of New Zealand.

106. The biology and interception data (cold treatment tolerance) indicate *P. pentagona* would have a moderate likelihood of establishment in most of New Zealand.

107. The host plants of economic concern to New Zealand indicate economic consequences of *C. aonidum* and/or *P. strachani* establishing would be low; and economic consequences of *P. pentagona* establishing would be moderate.

108. The specialised biology of the diaspidids suggests that the likelihood of successful introduction of these insects will be limited by the exposure step given their limited mobility (MPI 2015b).

RISK MANAGEMENT

109. The following risk management measures are proposed to manage the assessed risk from this pest.

Pre-export inspection and phytosanitary certification

110. Pre-export inspection (using 10x magnification) and phytosanitary certification of commercially produced zucchini and scallopini fruit is considered appropriate to manage the risk from armoured scales.

111. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures.

112. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from regulated armoured scale species.

113. Where any regulated live armoured scale species is found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot rejected for export to New Zealand.

BUGS (HEMIPTERA)

114. The bugs included in this assessment are:

- *Brachylybas variegatus*
- *Leptoglossus gonagra*

BIOLOGY

115. *Brachylybas variegatus* was assessed with another coreid bug by DAFF (Department of Agriculture, Fisheries and Forestry, Australia) in the IRA for Abelmoschus manihot from Fiji, Samoa, Cook Islands, Vanuatu including Tonga and *Legtoglossus gonagra* was assessed in the IRA for Citrus from Samoa (MAF 2008). It is assumed that since *B. variegatus* is a coreid bug, it will be similar in its biology to *L.gonagra*. There is information available on *L.gonagra* and this species will be used as the example for the two bugs.

116. *L. gonagra* eggs are laid in rows of 12-14, on varied substrates not just host plants. Approximately 62 eggs can be laid in lifetime.

117. *L. gonagra* becomes sexually mature 4-11 days after last moult. Females have a pre-oviposition period of 10-40 days. Males live up to 70 days while females up to 77 days. Adults are winged and it's assumed that they can fly reasonable distances, at the least between crops. *L. gonagra* in Brazil has been shown to carry *Phytomonas sp*. (plant parasites) in their salivary glands and digestive tract (Mitchell 2000). Adults and nymphs can also transmit the fungal pathogen *Nematospora coryli* to citrus fruit.

118. Adult coreids can overwinter in temperate zones, and in some species the eggs can also overwinter (Mitchell 2000). Coreid bugs are predominantly tropical and subtropical species, but may spread into temperate areas where hosts are abundant.

119. Hosts for *L. gonagra* include pumpkin, squash, cultivated cucurbits, oranges, grapefruit, tangerines, passionfruit, corn, watermelon, guava, and mango. The bug possesses piercing-sucking mouth parts which puncture the fruit rind and suck the juices from underlying juice vesicles which often causes premature colour break and fruit drop as well as providing access for various fungal diseases and insects (Fasulo and Stansly 2001).

120. *B. variegatus* is reported to feed on tomatoes, cucurbits, pumpkin, taro and giant passionfruit.

ASSESSMENT

121. The entry, exposure and establishment for *Legtoglossus gonagra* entering on citrus from Samoa was assessed as being very low, high and low-restricted to climatically suitable areas of New Zealand. *L. gonagra* and *B. variegatus* is assessed similarly on zucchini.

122. Economic impacts were assessed as low on citrus from Samoa and it is likely to be similar to zucchini and scallopini.

RISK MANAGEMENT

123. The following risk management measures are proposed to manage the assessed risk from this pest.

Pre-export inspection and phytosanitary certification

124. Pre-export inspection and phytosanitary certification of commercially produced zucchini and scallopini fruit is considered appropriate to manage the risk from coreid bugs.

125. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures.

126. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from regulated coreid bug species.

127. Where any regulated live coreid bugs are found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot rejected for export to New Zealand.

MEALYBUGS

128. The mealybugs considered in this assessment are:
    - *Dysmicoccus brevipes*
    - *Ferrisia virgata*
    - *Maconellicoccus hirsutus*
    - *Planococcus minor*

BIOLOGY

129. The biosecurity risk from this group of organisms was assessed using *Maconellicoccus hirsutus* on the fresh produce pathway (MPI 2015b) and *Ferrisia virgata* on citrus from Samoa (MAF 2008).

130. *M. hirsutus* is a highly polyphagous pest predominantly occurring in tropical and subtropical areas, and infests the leaves, shoots and fruit of host plants. *M. hirsutus* like all mealybugs secretes honeydew.

131. Most life stages of *M. hirsutus* are stated to be readily detectable (MPI 2015b). *M. hirsutus* usually forms dense colonies suggesting that it would probably be detected during harvest or packaging. However, low level infestations may be missed, particularly since crawlers tend to settle in cracks and crevices of the host plants.

132. *F. virgata* is one of the most highly polyphagous mealybugs known, attacking plant species belonging to some 160 genera in over 70 families (Ben-Dov *et al*. 2010) with many of the host species belonging to the Leguminosae and Euphorbiaceae families, with zucchini (courgette) and scallopini considered a host.

133. Climate may be a limiting factor for *F. virgata* as this species is largely found in tropical to subtropical climates.

ASSESSMENT

134. The likelihood of entry of these mealybugs on the fresh produce pathway is considered to be negligible to moderate depending on the species.

135. The likelihood of exposure is considered to range from negligible to low depending on the species (MPI 2015b). The specialised biology of mealybugs means that the likelihood of successful introduction of these insects will be limited by the exposure step given their limited mobility (MPI 2015b).

RISK MANAGEMENT

136. The following risk management measures are proposed to manage the assessed risk from this pest.

Pre-export inspection and certification

137. Pre-export inspection (using 10x magnification) and phytosanitary certification of commercially produced zucchini and scallopini fruit is considered appropriate to manage the risk from mealy bug.

138. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures.

139. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from regulated live mealybugs.

140. Where any regulated live mealybugs are found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot rejected for export to New Zealand.

MOTHS (LEPIDOPTERA)

141. The moth considered in this assessment is:

- *Diaphania indica*

BIOLOGY

142. *Diaphania indica* is polyphagous but is mainly known to infest Cucurbitaceae (particularly in warmer regions) although it has also been recorded from other plant families, notably Leguminosae (*Glycine max*) and Malvaceae (*Gossypium herbaceum*) (CPCI 2005). *D. indica* eggs are laid singly or in groups (vary for different hosts and at different times of year) on the underside of leaves and incubation usually takes 2-3 days. On hatching the young larvae cluster around the main veins, folding or binding leaves together. The larval period lasts for 3-4 weeks. *D. indica* larvae pupate within a leaf fold and incubate for 8-12 days for adult eclosion (CPCI 2005). Duration of the life cycle is 20-40 days and varies with the host plant and temperature.

143. *D. indica* damage is most serious in the early stages of fruit formation, when it feed on and punctures the skin of young fruit, particularly where they touch leaves or the soil (CPCI 2005).

ASSESSMENT

144. The Pest Risk Analysis for *D. indica* on squash from Tonga (MPI 2005b) concluded that there was a low likelihood of entry due to the larval stage being external feeders of a reasonable size (~18-25mm long) (CPCI 2005). When fully grown *D. indica* should be able to establish in most parts of New Zealand.

145. The potential economic impact from *D. indica* is considered from negligible to moderate.

RISK MANAGEMENT

146. The following risk management measures are proposed to manage the assessed risk from this pest.

Pre-export inspection and certification

147. Pre-export inspection and phytosanitary certification of commercially produced zucchini and scallopini fruit is considered appropriate to manage the risk from regulated moths.

148. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures.

149. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from regulated live moths (all life stages).

150. Where any regulated live moths (all life stages) are found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot rejected for export to New Zealand.

BEETLES AND WEEVILS

151. The beetles and weevil considered in this assessment are:

- *Aulacophora indica*
- *Aulacophora quadrimaculata*
- *Sphaerorhinus* spp.

BIOLOGY

152. *Aulacophora indica* (red pumpkin beetle) and *A. quadrimaculatus* are small beetles (6-8mm long) collectively referred to as cucurbit beetles.

153. *A. indica* has reddish coloured elytra (wing cases) and *A. quadrimaculata* is reported to have large black marks on yellowish elytra.

154. The adult beetles tend to feed in groups, severely damaging individual leaves of host plants while leaving others untouched, and may feed on flowers and fruit (CPC 2014).

155. Females can produce as many as 500 eggs over several months, laid in small clusters on dead leaves or moist soil under host plants. Eggs hatch in about 10 days (Hely et al 1982).

156. *A. indica* larvae have 4 instars and reach 10mm long and the head can reach 0.8mm wide. (Tsatsia and Jackson 2011). They live in the soil and are very injurious to cucurbit plants by feeding on roots and lower stem (CPC 2014). Pupation occurs in the soil and lasts between 7-20 days before adult emergence (Tsatsia and Jackson 2011).

157. CPC (2014) states "*A. indica* larvae could be carried across international borders in infested cucurbit fruits as they sometimes tunnel under the rind."

158. Distribution for *A. indica* is tropical, subtropical (Pacific, SouthEast Asia) and colder regions; including most of China, Afghanistan, Mongolia, Pakistan, Nepal, Japan and Siberia (CPC 2014).

159. In cooler regions *A. indica* can overwinter as eggs or adults, the latter hibernating under loose bark or sheltered places (Hely *et al.* 1982; Waterhouse and Norris 1987). It is uncertain if *A. quadrimaculatus* and *Sphaerorhinus* spp. have this ability.

160. Cucurbit beetles are strong fliers, with good dispersal ability, so spread from region to region is facilitated (CPC 2014).

161. *Sphaerorhinus* is a genus of weevils of approximately 6-10mm (Henderson & Crosby, 2012), that is assumed to be of a similar feeding habit to the beetles *Aulacophora indica* and *A. quadrimaculata*. *Sphaerorhinus aberrans,* for instance,appears greyish-brown with reddish legs. This species does not have wings (Henderson & Crosby, 2012), but is mobile by walking/running.

162. *Sphaerorhinus* spp. are known to be associated with *C. pepo* (Ecoport, 2015). Information on other hosts has not been found

163. There have been several interceptions of adult beetles and weevils on cucurbits and sometimes quite conspicuous (by size or colour) and/or highly mobile organisms are intercepted (e.g. *Coccinella transversalis*).

ASSESSMENT

164. The following assessment for *Aulacophora indica, A. quadrimaculata and Sphaerorhinus* spp. is based on biological and interception data.

165. Entry: The likelihood of entry for all three species is expected to be negligible tolow. Damage by larvae should be readily detectable andadults are likely to be somewhat conspicuous given their size and colouring.

166. Exposure: The risk of exposure is expected to be moderate for adult beetles because of they are strong fliers and have several hosts, but is expected to be very low to moderate for an adult weevil because it is flightless therefore likely to travel shorter distances and there is uncertainty regarding the host range (other than *C. pepo*)..

167. Establishment: The likelihood of establishment is expected to be low to moderate in areas of New Zealand where *C. pepo* are grown.

168. Economic consequences: The economic consequences are expected to be low, given the known host range.

RISK MANAGEMENT

169. The following risk management measures are proposed to manage the assessed risk from these pests.

Pre-export inspection and certification

170. Pre-export inspection and phytosanitary certification of commercially produced zucchini and scallopini fruit is considered appropriate to manage the risk from regulated beetles and weevils.

171. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures.

172. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from regulated live beetles and weevils (all life stages).

173. Where any regulated live beetles and weevils (all life stages) are found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot rejected for export to New Zealand.

WHITEFLY

174. The whitefly considered in this assessment is:

- *Bemisia tabaci*

BIOLOGY

175. *B. tabaci* is widespread throughout most warmer regions of the world (CPCI 2005). It is important to note that *B. tabaci* is present in new Zealand, as certain ‘biotypes’ and there are ‘biotypes’ which are not reported from New Zealand. The issues is complex and has not been fully addressed. These biotypes are morphologically indistinguishable from each other and therefore not identifiable at the border. Additionally, it is known that *B. tabaci* can vector at least 60 viruses some of which are not present in New Zealand.

176. *B. tabaci* lays up to 160 eggs on the underside of leaves and hatching occurs after 5-9 days at 30^0C depending on host species, temperature and humidity. The first instar is the only mobile larval stage which upon hatching is able to move very small distances to a feeding site where it will settle and feed until ready to pupate. Adults are winged and mobile. Both adults and nymphs excrete honeydew which is a fertile growing medium for sooty moulds.

177. *B. tabaci* can acquire and transmit a range of plant viruses which produce a variety of different symptoms on susceptible plant species. Although plants can become infected from migratory feeding of *B.tabaci*, plants infected with *B. tabaci*-transmitted viruses are often indicative of *B. tabaci* colonization. (CPCI 2004)

178. The species is highly polyphagous with over 500 known hosts including Cucurbitaceae, Brassicaceae (cruciferous crops), Fabaceae (leguminous plants), capsicum, cucumber, lettuce, tomato, potato, eggplants (CPC 2014). There are sufficient hosts for *B.tabaci* in urban and rural areas of New Zealand.

179. Most whiteflies actively disperse as crawlers and flying adults. Crawlers usually move a few millimetres from their hatch site (Gerling 1990), but can be caught by air currents and then carried some distance. Adult whiteflies can disperse over distances of several kilometres by air currents (Costa 1975 quoted in Gerling 1990).

180. Zucchini plants are a reported host for *B. tabaci* (McAuslane 2009), and interception data (MPI Interception Database 2014) shows that fruit can carry Bemisia species including *B. tabaci* in trade.

ASSESSMENT

181. *B. tabaci* was grouped in the IRA for *Abelmoschus manihot* from Fiji, Samoa, Cook Islands, Vanuatu including Tonga and *Aleurodicus disperses* was assessed. The likelihood of entry was determined to be low as its mainly on foliage, establishment and spread moderate and consequences low to high (MAF 20012).

182. The likelihood of entry for *B. tabaci* on zucchini and scallopini is assessed as moderate. *B.tabaci* is an important vector for plant viruses hence targeted measures are justified.

RISK MANAGEMENT

183. The following risk management measures are proposed to manage the assessed risk from this pest. The measures proposed are in equivalent to those proposed in the currently approved zucchini pathway from Australia and New Caledonia.

Pest management activities detailed in the negotiated export plan

184. The details of the production system with reference to the management of *B.tabaci* must be negotiated with MPI and incorporated into the export plan. The export plan must include (as a minimum) procedures for the following activities;

- in-field monitoring for *B. tabaci* by competent people;
- targeted measures effective against *B. tabaci* (if detected);
- post harvest inspection conducted by competent people;
- pest control activities effective against *B. tabaci;* and
- training and evaluation for competence as above.

Pre-export inspection and certification

185. In addition to pest management activities, pre-export inspection (using 10x magnification) and phytosanitary certification of commercially produced zucchini and scallopini fruit is considered appropriate to manage the risk from whitefly.

186. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures.

187. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from regulated live whitefly (all life stages).

188. Where any regulated live whitefly (all life stages) is found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot rejected for export to New Zealand.

MUSCID FLIES

189. The muscid fly considered in this assessment is:

- *Atherigona orientalis*
- *Atherigona poesilopda*
- *Atherigona hendersoni*

BIOLOGY

190. The biosecurity risk from this group of organisms was assessed using *Atherigona orientalis* on the fresh produce pathway.

191. *A. orientalis* is primarily a saprophagous insect that mostly feeds on damaged or rotting material. Recent evidence suggests that *A. orientalis* is sometimes effectively phytophagous. Fruit should be examined for signs of rot and exit holes (CPC 2014).

192. *A. orientalis* has a pantropical distribution and is considered unlikely to become established in temperate areas (Cahill 1992).

ASSESSMENT

193. Based on the characteristics of the pest and pathway *A. orientalis* was assessed as an organism with a low likelihood of establishment and spread in New Zealand due to it being associated with damaged or rotten fruit. The potential economic impact of *A. orientalis* has been assessed as low because it is associated with damaged fruit.

RISK MANAGEMENT

194. The following risk management measures are proposed to manage the assessed risk from this pest.

Pre-export inspection and certification

195. Pre-export inspection (using 10x magnification) and phytosanitary certification of commercially produced zucchini and scallopini is considered appropriate to manage the risk from muscid flies.

196. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures.

197. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from regulated live muscid flies (all life stages).

198. Where any regulated live muscid flies (all life stages) are found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot rejected for export to New Zealand.

MITES

199. The mites considered in this assessment are:

- *Tetranychus neocaledonicus*

BIOLOGY

200. *Tetranychus neocaledonicus* is highly polyphagous and has been reported from over 400 plant species. *Solanum melongena* (aubergine) is the main host (CPCI 2010) and other hosts of economic importance include green beans, lettuce, mango, watermelon, peach, and ornamentals chrysanthemum and hibiscus (Martin & Mau 1991).

201. Reproduction of *T. neocaledonicus* is both parthenogenetic and sexual (biparental). Fertilised females overwinter on secondary hosts, move to cultivated hosts, usually cucurbits and breed rapidly (MAF 2008).

202. A female of *T. neoclaedonicus* can lay about 90 eggs in her lifetime; lifecycle can be as little as 10 days, and under ideal conditions can be up to 32 generations per year can occur. It is mobile and can disperse on air currents.

203. *T. neocaledonicus* may not be easily detected with the naked eye as adults are less than 0.5 mm long. Magnification may be needed for detection.

204. *T. neocladonicus* is cosmopolitan in tropical and subtropical areas (Flechtmann & Knihinicki 2002), and has been reported from Asia, Africa, and USA, Central and South America, Australia and parts of the Pacific region (Migeon & Dorkeld 2006).

ASSESSMENT

205. *Tetranychus neocaledonicus* has been assessed from the IRA on Citrus from Samoa (MAF 2008).

206. Live *Tetrancychus* females, adults and larvae have been intercepted on zucchini from Australia and *Tetranychus sp*. have been intercepted on cucurbits from Tonga (2012). Zucchini have ridges and depressions in the peduncle that can afford shelter for tiny invertebrates and this indicates that there would be a low to moderate likelihood for *T.neocaledonicus* entering New Zealand on zucchini, depending on the degree of association with the fruit. There is some uncertainty regarding the preference of *T.neocaledonicus* for immature fruit.

207. The peduncle and blossom ends of zucchini are likely to be removed for food preparation, and damaged zucchini will be disposed of. A proportion of waste fruit will be exposed to the environment. Tetranychids are very mobile and can be dispersed via air currents. *T. neocaledonicus* is highly polyphagous so will find new hosts readily. *This indicates that the likelihood of exposure would be moderate.*

208. The likely temperature tolerances, the ability to enter diapause and that the species is also able to reproduce parthenogenetically indicates *T. neocaledonicus* would have a moderate likelihood of establishing in the warmer parts of New Zealand and within greenhouses.

209. *T. neocaledonicus* has a wide host range but it is likely to have a limited distribution within NZ. This indicates the economic consequences would be low.

RISK MANAGEMENT

210. The following risk management measures are proposed to manage the assessed risk from these pests

Pre-export inspection and phytosanitary certification

211. In addition to pest management activities, pre-export inspection and phytosanitary certification of commercially produced zucchini and scallopini fruit is considered appropriate to manage the risk from mites.

212. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures at 10x magnification.

213. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from regulated mites.

APHIDS

214. The aphids considered in this assessment are:

- *Aphis fabae*

BIOLOGY

215. *Aphis fabae* was assessed in the IRA for *Abelmoschus manihot* from Fiji, Cook Islands, Vanuatu and Samoa including Tonga (MAF 2011).

216. *A. fabae* consists of a complex of close related host-plant-associated forms (Tosh *et*. al 2004).

217. *A. fabae* is known to feed on zucchini (Blackman & Eastop 2000) and highly polyphagous on secondary hosts including crop plants, affecting buds, shoots and other aerial parts of plants and are often attended by ants (Blackman & Eastop 2000). Migrant adults disperse readily and colonize a wide range of secondary hosts.

218. The damage caused by *A. fabae* is from direct feeding causing wilting and collapse, and honeydew excretion reducing the host plants photosynthesis capability (Cammell 1981).

219. *A. fabae* can vector more than 30 plant viruses of beans, peas, crucifers, cucurbits, potatoes, tomatoes, dahlia and tulips, which are non-persistent (van Emden and Harrington 2007).

220. *A. fabae* also vectors the "persistent Bean lef roll virus (Ortiz et al 2005), Beet yellow net virus and potato leaf roll virus" (van Emden and Harrington 2007). It is considered to be "usually of only minor importance in transmitting plant virus diseases" (Cammell 1981).

ASSESSMENT

221. In the *Abelmoschus manihot* IRA, *A. fabae* was assessed as having a negligible likelihood of entry for eggs; a low likelihood of entry for juveniles and adults; and low to moderate likelihood of exposure depending on time of the year; a moderate likelihood of establishment and spread.

222. *A. fabae* is assessed similarly for zucchini from Tonga.

RISK MANAGEMENT

223. The following risk management measures are proposed to manage the assessed risk from this pest.

Pre-export inspection and certification

224. Pre-export inspection and phytosanitary certification of commercially produced zucchini and scallopini fruit is considered appropriate to manage the risk from aphids.

225. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures.

226. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from regulated aphids (all life stages).

227. Where any regulated live aphids (all life stages) are found in the inspected lot, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot rejected for export to New Zealand.

FRUIT FLIES

228. The fruit flies considered in this assessment are:

- *Bactrocera kirki*
- *Bactrocera xanthodes*

BIOLOGY

229. Tephritidae fruit flies are of economic importance due to their threat to fruit and vegetable production and trade worldwide.

230. *Bactrocera kirki* is a medium sized fruit fly; about 8mm long, body is black, abdomen has a light stripe each side of the midline which run the length of it. It has been assessed on the IRA for Citrus from Samoa (MAF 2008).

231. *B. kirki* lays eggs (approx. 0.8mm x 0.2mm) inside the fruit and has the potential to cross international borders in this manner. It is highly fecund and highly mobile.

232. Bactrocera eggs hatch within a day or slightly longer. Bactrocera larvae go through three instars, feeding for 10-35 days in the fruit. Pupation occurs in the soil and may last between 10-30 days. Adults occur throughout the year and begin mating 1-2 weeks after emergence (Waterhouse, 1993; CPC, 2007; Christenson and Foote 1960). They may live several months depending on temperatures (Christenson and Foote 1960).

233. *B. kirki* is reported from American Samoa, French Polynesia (but not the Marquesas), Niue, Rotuma Island and Wallis & Futuna (Pacifly database 2002). In Tonga, *B.kirki* is present throughout the whole country (Heimoana et al. 1997a). It has been recorded from 49 host species in 32 genera and 22 families (Pacifly databse, 2002).

234. Adult dacine fruit flies insert their eggs beneath the skin of ripening or ripe fruits and vegetables (Christenson & Foote, 1960), although immature or green fruit can be also used (e.g. Dominiak 2007; SPC 2001; Mau & Martin Kessing 1991; Mau and Martin 1992).

235. *Bactrocera xanthodes* has also been assessed on the IRA for Citrus from Samoa (MAF 2008). It's a polyphagous, multivoltine tropical/subtropical fruit fly (Waterhouse, 1993; Tunupopo et al. 2002) known to attack 40 host plant species in 30 genera and 22 families including soursop, breadfruit, jackfruit, papaya, pomelo, mango, eggplant tropical almond (Pacifly 2007).

236. *B. xanthodes* whole life cycle from egg to egg at 26± 1^0C (under laboratory rearing conditions) is a minimum of 35 days (Clare 1997). It is assumed adults have a life span of 1-5 months (possibly longer in some cases), with females capable of laying about 1000-1300 eggs during their lifetime (Cowley et al. 1993).

237. If temperatures in winter prevent breeding then it is assumed *B. xanthodes* would behave similarly to *B. cucurbitae* and remain relatively inactive in sheltered refuges until spring temperature increases. However, Baker and Cowley (1991) record *B. xanthodes* continued to bred in Tonga when minimum temperatures fell to 9^0C in 1986.

238. *B. xanthodes* adults are active fliers and it is assumed they can cover similar distances to *B.cucurbitae*. Melon fly has been recorded covering distances of 34-56km (Kawai et al. 1978) and one sterile male was recorded at a distance of 200km from his release site (Miyahara and Kawai 1979). However, dispersal seems to be limited if host availability is plentiful (Fletcher 1989).

239. *B. xanthodes* is only found between 13-21^{0}S in the following countries; American Samoa, Austral Islands of French Polynesia, Cook Islands, Fiji, Nauru, Niue, Samoa, Tonga, Wallis & Futuna (Tunupopo Laiti *et* al. 2002; Heimoana *et* al. 1997; Purea *et* al. 1997). In Tonga, *B.xanthodes* is present throughout the whole country (Heimoana *et* al.1997).

240. Brown (1998) stated that eggs of most fruit fly species, with the exception of *B. musae*, will not hatch if laid in hard green bananas. Female fruit flies are less likely to deposit eggs in hard, immature fruit than softer, ripe fruit although immature fruit may become infested if the skin is split or broken. Host-specific information below (240 and 241) underpins this general observation for *B. kirki* and *B. xanthodes*.

241. The host testing of zucchini for *B. kirki* was not undertaken in Tonga, but was carried out in Western Samoa (Heimoana *et* al. 1997b). The laboratory cage testing (LCT) gave a positive result, however there is no report of a LCT or field cage testing (FCT) using punctured fruit, thus it is concluded it was not done indicating that the requirements of MAF Standard 155.02.02 have not been met therefore zucchini would need to be considered a host of *B. kirki*.

242. The host testing of zucchini for *B. xanthodes* was carried out in Tonga (Heimoana *et* al. 1997b). The LCT gave a positive result, but there was no FCT or LCT with unpunctured fruits conducted. This indicates that the requirements of MAF Standard 155.02.02 have not been met. Tonga Ministry of Agriculture, Food, Fisheries and Forests (2012) indicated that zucchini is a poor host for *B.xanthodes*. If zucchini is a poor host for *B. xanthodes*, then it is still considered a host. The LCT of zucchini for *B. xanthodes* gave a positive result and there was no follow up FCT, therefore zucchini would need to be considered a host of *B.xanthodes*.

243. Fruit fly is a very significant pest of concern for New Zealand.

ASSESSMENT

244. *B. kirki* and *B. xanthodes* were assessed previously on Citrus from Samoa (MAF 2008b) risk analysis as having a medium likelihood of entry and exposure, and establishment and likelihood for economic consequences high and therefore specified measures are justified.

RISK MANAGEMENT

245. A range of specified measures was considered to determine the appropriate measures as listed in Table 1.

246. MPI accepts the use of irradiation, vapour heat treatment, high temperature forced air, cold treatment, non-host status, and chemical dips as being effective against fruit flies for certain commodities.

247. The use of non-host status for zucchini and scallopini from Tonga was the only measure requested and the information submitted was assessed further. At the completion of the assessment by MPI, zucchini was considered to be a host of *Bactrocera kirki* and *Bactrocera xanthodes*.

248. The following risk management measures are proposed to manage the assessed risk from these pests.

Table 1: Measures considered for Fruit Flies

Measures considered	Comment
Endpoint treatments	
a. Methyl bromide fumigation	Currently limited data available to support efficacy of methyl bromide fumigation against fruit flies associated with zucchini and scallopini
b. Irradiation	A 400 Gy dosage is likely to be sufficient to manage fruit flies and other regulated pests of concern. This option has not been requested and therefore not considered further.
c. Vapour heat treatment	Zucchini and scallopini fruit does not withstand the treatment without fruit quality being affected. This option has not been requested and therefore not considered further.
d. High Temperature Forced Air	Zucchini and scallopini fruit does not withstand the treatment without fruit quality being affected. This option has not been requested and therefore not considered further.
e. Cold treatment	Limited efficacy data available. This option has not been requested and therefore not considered further.
f. Chemical dips (e.g. dimethoate)	This option has not been requested but has been proposed to Tonga based on the outcome of the dimethoate testing undertaken on zucchini in Australia.
Non-host status	Zucchini is considered a host to *Bactrocera kirki* and *Bactrocera xanthodes*.
Winter window	Information available for *Bactrocera cucumis* only. This option has not been requested and therefore not considered further.
In-field pest control	Used as part of the routine pest management during commercial production.
Pest free area (PFA)	Must meet ISPM 4 for recognition by MPI. Country/area specific. This option has not been requested and therefore not considered further.
Pest free place of production (PFPP)	Must meet ISPM 10 for recognition by MPI. Country/area specific. This option has not been requested and therefore not considered further.
Systems Approach	This option has not been requested and therefore not considered further.

Pest management activities detailed in the negotiated export plan

249. Pest risk management activities specified by New Zealand for the control of *B. kirki and B. xanthodes* must be used during the production of zucchini and scallopini for export to New Zealand.

250. The pest management activities must be detailed in the export plan.

251. Zucchini and scallopini fruit must be harvested as soft green or yellow skin trimmed at the point where the stem meets the peduncle and excluding any stem, leaves or flowers.

Pre-export inspection and phytosanitary certification

252. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures. Fruit showing signs or symptoms of pests or disease must be excluded from lots for export to New Zealand.

253. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from pest or disease.

Treatment

254. MPI consider an end-point treatment is necessary to manage residual risk, especially from internally feeding arthropods, such as fruit fly.

255. The option proposed for fruit flies associated with zucchini from Tonga is an end-point treatment with dimethoate dip at 400ppm for 1 minute.

Treatment efficacy

256. To date there are no specific studies on the efficacy of dimethoate against *B. xanthodes* or *B. kirki* associated with zucchini from Tonga. However, information supporting the efficacy of dimethoate dip (400ppm for 1 minute) against fruit flies is:

- Dimethoate has been successfully used as both a pre- and post-harvest measure against pests on Australian fruit and vegetable commodities exported to New Zealand for the last two decades.
- Dimethoate is a broad-use systemic organophosphate which kills insects and mites on contact and can be used against a broad range of arthropods such as thrips, aphids, mites and whiteflies (UC 2014).
- Dimethoate has a high level of efficacy against *Bactrocera* fruit flies associated with zucchini, watermelon, tomato and capsicum (Table 3).
- The studies summarised in Table 3 have focussed on the efficacy of dimethoate on both the eggs and larvae of *B. tryoni* and *B. cucumis*, which are the most likely stages to be present on the zucchini import pathway (Table 3). The study on *B. tryoni* on capsicums tested different life stages to find the most tolerant life stage prior to the larger scale efficacy trials (Heather *et al*. 1999) (Table 3). This was determined to be third instar larvae (Heather *et al*. 1999).

Table 3. Summary of studies on the efficacy of dimethoate on fresh produce and fruit fly species relevant to the risk management assessment for zucchinis from Tonga. In all of the studies, the dose of dimethoate was 400 mg/l for 1 minute. Corrected efficacy was calculated using the method in Couey and Chew (1986) and FAO (2013).

Pest Species	Commodity	Life stage	Corrected Efficacy at the 95% confidence level	Dimethoate Application Method	Reference
Bactrocera tryoni, Queensland fruit fly (Qfly)	Tomatoes	eggs	99.9910	Spray	Heather *et al.* 1987
		larvae	99.9576-99.9905*		
		eggs	99.9957	Dipping	Corcoran 2001
		larvae	99.9934		
		eggs	99.9750	Spray	
		larvae	99.9735		
	Capsicum	eggs	99.985	Spray	Heather *et al.* 1999
Bactrocera cucumis, Cucumber fly	Zucchini	eggs	99.9950 (no survivor in 19,869 eggs treated)	Dipping	Heather *et al.* 1992
		Larvae (3rd instar)	99.9707 (no survivors in 3,418 larvae treated)		
	Rockmelon	eggs	99.9833 (no survivors in 6,001 eggs treated)		
		Larvae (3rd instar)	99.9909 (no survivors in 11,011 larvae treated)		

- It is evident from Table 3 that the dimethoate treatments penetrated tomato, capsicum, rockmelon and zucchini in sufficient concentrations to ensure internally feeding larvae would receive an adequate dose.

- The results from studies on tomatoes indicate that dip-applied dimethoate had a higher efficacy than spray-applied dimethoate for both eggs and larvae of *B. tryoni.*
- A dip treatment of dimethoate is appropriate as a post-harvest end point treatment. Spray applications of dimethoate are more feasible as an in-field pre-harvest treatment which may be applied on multiple occasions during fruit maturation.

Post-treatment procedures

257. Following dimethoate treatment, zucchinis will be packed manually into insect-proof (non-vented) packaging.

258. The above activities provide another opportunity for visual inspection following treatment and the removal of any damaged and diseased fruit. Visual inspection is considered an appropriate risk management option for regulated pests such as mealybugs and scale insects as they are detectable on the surface of zucchini.

259. Treated, inspected and certified zucchini will be transferred from the treatment facility to the point of export under an approved and documented system to maintain the phytosanitary status of the export consignment. The details must be fully outlined in the export plan.

Inspection on-arrival

260. MPI will inspect documentation and may inspect a sample of the consignment on arrival in New Zealand as described in the section on New Zealand's biosecurity system in this document.

261. If a fruit fly of significant concern is detected the pathway will be immediately suspended and a full review conducted before exports can resume.

PATHOGENS

262. The pathogen considered in this assessment is:

- *Choanephora cucurbitarum*

BIOLOGY

263. *C. cucurbitarum* has been assessed in the MAF (2011) IRA for *Abelmoschus manihot* from Fiji, Samoa, Vanuatu, Cook Islands including Tonga.

264. *C. Cucurbitarum* has been reported as a pathogen on 48 plant species belonging to 37 genera within 17 families causing disease on all plant stages: flowering, fruiting, post-harvest, pre-emergence, seedling and vegetative growing and all plant parts; pods, growing points, inflorescence, leaves, seeds, stems and whole plant

265. It is favoured by warm, wet weather and is most aggressive under conditions of high temperature and humidity and when plants are under stress. *C.cucurbitarum* is a weak parasite; it colonises dead or drying tissue before it actively invades living tissue (Cerkaukas 2004). *C. cucurbitarum* rot first attack blossoms and then progresses into the developing fruit causing a wet rot at the blossom end.

266. The pathogen usually sporulates profusely when there is heavy rainfall, temperatures over 10-14.40C and maximum relative humidity reaching about 87.3%, on the diseased part of the plant, especially on stems or fruits, appearing as spines with dark heads on the tissue surface.

267. The spores released by these species are airborne and may therefore be carried over long distances to infect host species nearby. It's polyphagous nature increases it's probability of exposure.

268. Wind, splashing water, movement of plants, physical contact with human hands and insects are known to be the major ways by which the spores are spread (Black 2001). Early infection on fruit just harvested may not be readily detectable at shipment.

ASSESSMENT

269. In the IRA for *Abelmoschus manihot*, *Choanephora cucurbitarum* was assessed as having a moderate likelihood of entry, exposure and establishment.

270. Zucchini are likely to be packaged differently to *Abelmoschus manihot* which may slightly lower the likelihood of entry. It is likely that zucchini would be assessed similarly to *Abelmoschus manihot*, but with low-moderate likelihood for entry.

271. The economic impacts for *C. cucurbitarum* were assessed in *Abelmoschus manihot* as low to moderate for the affected areas and this is likely to be the same for zucchini.

RISK MANAGEMENT

272. The following risk management measures are proposed to manage the assessed risk from this pest.

Pre-export inspection and certification

273. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures. Fruit showing signs or symptoms of disease must be excluded from lots for export to New Zealand.

274. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample must be free from pathogens.

275. Where any diseased fruit are found in the inspected lot the lot must be rejected for export to New Zealand.

HITCHHIKER PESTS

276. The pests considered in this assessment are not pests of the fruit, but can be found associated with the commodity:

- *Anoplolepsis gracilipes* (ant)
- *Solenopsis geminata* (ant)

BIOLOGY

277. *Anoplolepsis gracilipes* has been previously assessed in IRA for citrus from Samoa (MAF 2008) and *Solenopsis geminata* assessed in IRS for *Abelmoschus manihot* from Fiji, Samoa, Vanuatu, Cook Islands including Tonga (MAF 2012).

278. Both ants are considered hitchhiker species since they have no direct association with a particular plant species and will occur to a greater or lesser degree with various plant species.

279. Both ant species are omnivorous with a broad and varied diet (e.g. grain, seed, vegetation, arthropods, small animals).

280. Both species of ant are known to tend honeydew excreting hemipterans such as aphids or mealybugs. *A. gracilipes* is known to spray formic acid which can irritate sensitive tissues.

281. *S. geminata* colonies can be multi-queened and they are able to colonise most types of soil and media, particularly disturbed habitats of varying types.

282. *A. gracilipes* queens lay about 700 eggs/year; colonies are often multi-queened and they are capable of invading of invading both disturbed and undisturbed habitats including tropical urban areas, savannah, rainforest, woodland, grassland and plantations.

283. Both species tend towards a tropical to sub-tropical distribution, though *S. geminata* appears to have more tolerance of temperate conditions-a nest was discovered in Mount Maunganui ditch near a container yard in June 2003 and subsequently eradicated; also it is more likely to seek shelter in buildings.

284. Establishment of either species could only occur by the arrival of a nest containing a queen and workers or by the arrival of a healthy, mated queen. However, a single *S. geminata* worker is of concern given its ability to deliver a painful sting, forming obvious welts which can become severe for some people.

285. *A. gracilipes* has been reported to be associated with plants such as citrus, mango, coffee and cinnamon while *S. geminata* with cabbage, citrus, strawberry, tomato, cucumber, sweet potato, avocado, aubergine, corn and numerous weeds that are present in New Zealand.

ASSESSMENT

286. In the IRA for citrus from Samoa (MAF 2008), *A. gracilipes* was assessed to have a high likelihood of entry, a moderate likelihood of exposure and a low likelihood of establishment

287. The biology of this ant, interception data and knowledge of the commodity indicates that the likelihoods for zucchini would be very similar to those assessed for citrus from Samoa.

288. In the IRA for *Abelmoschus manihot* from the Pacific including Tonga, entry, exposure and establishment for *S. geminata* was assessed as moderate, high and low-moderate respectively. The biology of this ant, interception data and knowledge of the

commodity indicates that the likelihoods for zucchini would be very similar to those assessed for *Abelmoschus manihot* from the Pacific.

289. The economic consequences of *A. gracilipes* establishing would be assessed as low while *S. geminata* would be assessed as moderate in restricted localities. There are likely human health consequences associated with potential establishment of both species.

RISK MANAGEMENT

290. The following risk management measures are proposed to manage the assessed risk from hitchhiker pests.

Pre-export inspection and certification

291. Pre-export inspection and phytosanitary certification of commercially produced zucchini and scallopini combined with inspection on arrival in New Zealand is considered appropriate to manage the risk from hitchhiker pests.

292. Zucchini and scallopini fruit for export to New Zealand must be sampled and inspected using official procedures.

293. A minimum of randomly selected 600 units from each lot must be inspected by appropriately trained personnel. The inspected sample and packaging must be free from regulated pests.

Where any regulated live hitchhiker pests (all life stages) are found in the inspected lot or packaging, an appropriate measure must be applied (for example fumigation with an efficacious chemical) or the lot rejected for export to New Zealand.

SUMMARY

294. 24 pests were identified as being present and associated with zucchini and scallopini from Tonga.

295. Two pests (*Bactrocera kirki* and *B. xanthodes*) require measures specified by MPI to be applied during production, harvesting and post harvest before consignments are exported to New Zealand.

296. One pest, *Bemisia tabaci* requires targeted measures to be applied that target the pest during production and post harvest activities.

297. MPI requires that zucchini and scallopini for export to New Zealand are commercially produced with export grade immature and white fleshed individual fruits harvested with soft green or yellow skin trimmed at the point where the stem meets the peduncle and excluding any stem, leaves or flowers; cleaned, packed and transported to New Zealand.

298. The measures for *Bactrocera kirki* and *B. xanthodes* must be detailed in the negotiated export plan.

299. A phytosanitary certificate produced by the NPPO must be endorsed with a declaration that these measures have been applied as identified in the negotiated export plan for zucchini and scallopini from Tonga.

300. A phytosanitary certificate produced by Tonga NPPO must be endorsed with a declaration that these measures have been applied as detailed in the negotiated export plan for zucchini and scallopini from Tonga.

301. The remaining pests are effectively managed through standard commercial production methods, pre-export inspection and certification, and inspection and actions (if any) on arrival in New Zealand.

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APPENDIX 1 – TONGA PEST LIST FOR ZUCCHINI

	Scientific name	Organism type	Common name
1	*Anoplolepsis gracilipes*	Insect	yellow crazy ant
2	*Aphis fabae*	Insect	black bean aphid
3	*Atherigona hendersoni*	Insect	fly
4	*Atherigona orientalis*	Insect	pepper fly
5	*Atherigona poecilopoda*	Insect	fly
6	*Aulacophora indica*	Insect	red melon beetle
7	*Aulacophora quadrimaculata*	Insect	pumpkin beetle
8	*Bactrocera kirki*	Insect	fruit fly
9	*Bactrocera xanthodes*	Insect	pacific fruit fly
10	*Bemisia tabaci*	Insect	sweet potato whitefly
11	*Brachylybas variegatus*	Insect	brown coreid bug
12	*Choanephoraceae cucurbitarium*	Fungi	blossom end rot
13	*Chrysomphalus aonidum*	Insect	Florida red scale
14	*Diaphania indica*	Insect	melon moth
15	*Dysmicoccus brevipes*	Insect	pineapple mealybug
16	*Ferrisia virgata*	Insect	striped mealybug
17	*Leptoglossus gonagra*	Insect	squash bug
18	*Maconellicoccus hirsutus*	Insect	mealy bug
19	*Pinnaspis strachani*	Insect	hibiscus snow scale
20	*Planococcus minor*	Insect	Pacific mealybug
21	*Pseudaulacaspis pentagona*	Insect	white peach scale
22	*Solenopsis geminata*	Insect	fire ant
23	*Sphaerorhinus sp.indet.*	Insect	weevil
24	*Tetranychus neocaledonicus*	Insect	vegetable spider mite