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Apple & Pear Australia

4 July 2011

Dr. Colin Grant
Chief Executive
Biosecurity Australia
GPO Box 858
CANBERRA ACT 2601
AUSTRALIA

Dear Dr. Grant

RE: Draft report for the non-regulated analysis of existing policy for apples from New Zealand

Apple and Pear Australia Limited rejects wholly and absolutely, the non-regulated analysis and its recommendations in regard to the importation of apples from New Zealand.

Apple and Pear Australia Limited also dismisses Biosecurity Australia's conclusion, as documented within the "Draft report of the non-regulated analysis of the existing policy for apples from New Zealand" (Draft Report) that:

> *{W}hen the New Zealand apple industry's standard commercial practices for production of export grade fruit are taken into account, the unrestricted risk for all three pests assessed achieves Australia's appropriate level of protection (ALOP). Therefore, no additional quarantine measures are recommended, though New Zealand will need to ensure that the standard commercial practices detailed in this review are met for export consignments.*

It is extremely disappointing that Biosecurity Australia has now come to a position that effectively unravels the efforts that your organization provided as part of the Australian Government response to New Zealand's actions within the World Trade Organisation in regard to the SPS measures established for three pests of concern – fire blight, European Canker and Apple Leaf Curling Midge. Over the 2007 to 2010 period the Australian Government invested considerable time, effort and resources to justify:

- The processes employed and the science used to determine the phytosanitary measures established in the 2006 policy; and,
- Australia's right to establish an Appropriate Level of Protection.

Apple and Pear Australia Limited believe that the recommendations contained within the Draft Report in regard to fire blight, European Canker and Apple Leaf Curling Midge are arbitrary and are based on an irrational and an unreasonable set of conclusions. Specifically, the Draft Report is seriously flawed because:

- The downgrading of the risks posed by the three aforementioned pests and diseases is not based on scientific evidence;

- The proposed measures to manage the risks presented by the three pests and diseases cannot achieve an Appropriate Level of Protection for Australia;
- The process used to derive the proposed measures and the proposed measures themselves are not supported by scientific evidence nor transparent reasoning;
- There is a lack of transparency in the analysis underpinning the Draft Report;
- The employment of a non-regulated review rather than a proper Import Risk Assessment denies stakeholders procedural fairness;
- Biosecurity Australia fails to properly consider or utilise protocols/measures that have been implemented by New Zealand and/or Australia which represent appropriate 'equivalence' measures;
- The failure to provide stakeholders a copy of the New Zealand Integrated Fruit Production manual upon which the Draft Report relies severely compromises our ability to address claims made by Biosecurity Australia;
- From a statement made by the Minister, Biosecurity Australia has not sighted the full Integrated Fruit Production manual. Making recommendations on the basis of an incomplete document is irresponsible and a dereliction of duties.

These concerns are broadly outlined below. For a fuller analysis of the 2011 Review I refer you to the attached Technical Response to the Draft Report commissioned by Apple and Pear Australia Limited.

Downgrading of Risks Posed

The Draft Report provides an assessment that the unrestricted entry of apples from New Zealand would pose a very low risk for fire blight and negligible risk for European canker and Apple Leaf Curling Midge. This is a considerable downgrading of the risks established in the 2006 analysis (Table 1).

Likelihood of entry, establishment and spread	**2006 Final Report**	**2011 Draft Report**
- Fireblight	Very low	Extremely low
- European canker	Low	Extremely low
- ALCM	High	Very low
Consequences – European canker	Moderate	Low
Unrestricted risk – whole of Australia		
- Fireblight	Low	Very low
- European canker	Low	Negligible
- ALCM	Low	Negligible

The Technical Response commissioned by Apple and Pear Australia Limited clearly demonstrates that there is no scientific evidence cited in the Draft Report which could support any of those changes.

Apple and Pear Australia Limited undertook an extensive analysis of the additional science referenced in the 2011 assessment compared to the previous 2006 Import Risk Analysis. From our analysis there is no scientific evidence to indicate that any of the three pests and diseases of concern are less dangerous than previously concluded or more manageable than previously concluded. To the contrary, the additional or new science referenced in the 2011 Draft Report clearly shows that the bacterial disease, Fire Blight, can be more unpredictable or take on new forms. Similar conclusions can be reached with regard to European canker and Apple Leaf Curling Midge.

Biosecurity Australia has continued to ignore the science concerning 'viable but non culturable' (VBNC) states. Experts at the World Trade Organisation hearings clearly identified VBNC as a risk that was not taken into account in the 2006 analysis. Combined with the new scientific evidence confirming the potential risks of VBNC, Biosecurity Australia once again ignores this risk and proposes no measures to minimise this risk.

It is our view that the singular driver of the changed assessments of unrestricted risk of each of the pests is the change to a purely qualitative risk assessment method which uses a single "wrapped up" assessment of the likelihood of importation and of distribution of each pest in issue. In each case change to the assessed level of unrestricted risk derives solely from the method used to assess the likelihood of importation and distribution of the pest in Australia; and not from any change to the substantive assessments of those likelihoods.

Biosecurity Australia has failed to:

- Provide any scientific reasoning that is capable of supporting any downgrading of the risk assessments.
- Provide any reason for the change in risk assessment method that is employed;
- Demonstrate that it has the authority to employ the significantly more opaque and arbitrary method of analysis.

A sceptic could conclude that the process was undertaken to arrive at a pre-determined answer.

The Integrated Fruit Production System is not a phytosanitary measure

In the 2006 Review, Biosecurity Australia correctly acknowledged that the Integrated Fruit Production (IFP) system (then referred as the Integrated Pest manual) is:

> "only a management tool and may not always reduce the opportunities for establishment of pests, for in some seasons no matter what IPM program was in place, if environmental conditions were conducive, pests would occur."

Biosecurity Australia now reject this view and recommend in the 2011 Draft Report that the Integrated Fruit Production (IFP) system will provide adequate measures to manage the unrestricted risks posed by fire blight, European Canker and Apple Leaf Curling Midge. This recommendation is flawed on a number of grounds.

First, Biosecurity Australia has not substantiated why they now disagree with their earlier finding. This is surprising because Apple and Pear Australia Limited is confident that no responsible scientist would disagree with the 2006 view that the IFP system is only a management tool that cannot always reduce the opportunities for pests to establish. Without substantiation the decision to now accept the IFP is both irrational and unreasonable.

Second, Apple and Pear Australia Limited also believes that the reliance on the IFP system as adequate to meet Australia's Appropriate Level of Protection is also irrational and unreasonable. Biosecurity Australia has given no scientific support to their conclusion that the standard orchard practices as established through the implementation of the Integrated Fruit Production manual meets the terms of the SPS Agreement as a 'measure' and/or meets Australia's Appropriate Level of Protection.

Third, based on the analysis provided Biosecurity Australia there appears to be no difference the standard orchard practices employed within New Zealand under the current IFP and that employed under the IFP in place when the 2006 Review was conducted. There is, therefore, no credibility in the assumption by Biosecurity Australia that the implementation of latest version of the Integrated Fruit Production Manual has reduced the threat of Fire Blight, Apple Leaf Curling Midge or European Canker to a level that meet Australia's Appropriate Level of Protection.

Indeed, the IFP system demonstrates that New Zealand has not found a way to control or eliminate fire blight or prevent serious outbreaks of the disease. New Zealand authorities and the pipfruit industry do not pretend that they have. But under the recommendations made by Biosecurity Australia, fruit will, at times, be harvested from orchards with severe outbreaks of fire blight.

This fruit will be heavily infested with the Fire Blight bacteria. The on line treatment required will not contact or eradicate the bacteria in the calyx and the fruit will arrive with high levels of bacteria in undiluted consignments. There is no measure proposed which would prevent that fruit being imported and distributed very shortly after harvest.

With a disease such as Fire Blight that Biosecurity Australia itself identifies as one of the most serious diseases of apples, fruit should at the very least be guaranteed to come from a Pest Free Place of Production. While Biosecurity Australia recognises this requirement for the less dangerous and complex insect (Codling moth) for West Australia, it fails to apply the same principle to the much more serious disease Fire Blight.

The same scenario also occurs in regard to European canker and Apple Leaf Curling Midge.

Fourth, the 2011 Review has not made any assessment of the capacity of the IFP system to deliver management of the risks of fire blight, European canker and Apple Leaf Curling Midge. Failure of the New Zealand system during a period when Integrated Fruit Production was a standard orchard practice is well documented. Whether these failures have arisen because the IFP system is not a true SPS measure as argued above or simply because the IFP does not take into account the impact of human error, human abuse, changing climatic conditions, orchard design and canopy and the occurrence of pests and diseases on properties which do not operate under the IFP, is not known. In either case, Biosecurity Australia has an obligation to audit past failures and identify how it intends to prevent these failures into the future.

Insufficient inspection for Trash

Trash is scientifically recognised as a high risk carrier of Fire Blight and European Canker. At present there is no known process that ensures that all trash is removed or excluded in the grading and packing process. It is common for trash that is dislodged from fruit during the grading process to end up in the carton. Equally trash included in the harvesting process is mechanically transferred by the grading process and also ends up in the carton. The risk of an incidence of trash in cartons increases with the use of tray fillers which are used extensively in NZ.

Apple and Pear Australia therefore seeks that upon arrival inspections include 600 randomly selected cartons per lot to ensure that trash is not present and exported to Australia. This is in addition to inspections of the fruit itself.

The 2011 review fails to address the concerns expressed by the WTO

The World Trade Organisation (WTO) found that the 2006 Import Risk Analysis conducted by Biosecurity Australia did not provide sufficient scientific justification for Australia's quarantine measures because (i) some measures were supported by neither scientific evidence nor transparent reasoning and (ii) there was a lack of transparency in the 2006 risk analysis.

Apple and Pear Australia Limited's review concludes that the 2011 Review fails to address the concerns expressed by the WTO. The Draft Report falls well short of the required standards – the analysis and processes are not supported by science or by transparent reasoning. It is also far less transparent than the 2006 Analysis which it purportedly reviews. Consequently Biosecurity Australia has produced an arbitrary, irrational and unreasonable set of conclusions.

Moreover, Biosecurity Australia proposes a range of 'measures' which are the same 'measures' which New Zealand proposed in the World Trade Organisation dispute. The World Trade Organisation Appellate Panel ruled that those 'measures' did not meet Australia's Appropriate Level of Protection. Yet Biosecurity Australia does not heed that counsel.

Equivalence

Apple and Pear Australia Limited believe that there are a number of examples of protocols and SPS measures that have been implemented by New Zealand and/or Australia which represent appropriate 'equivalence' measures. Biosecurity Australia has failed in its 'duty of care' in not considering and/or utilising some of the appropriate 'equivalent' measures.

Human Health

As one of the criteria for a risk analysis is to protect human health, the acceptance by Biosecurity Australia that a proportion of the fruit imported by New Zealand will be treated with antibiotics without assessing the human health consequences is in conflict with this important obligation.

Procedural Fairness

A request to obtain a copy of the New Zealand Pipfruit Integrated Fruit Production Manual has been denied by Biosecurity Australia based on the confidentiality rating placed on the document by Pipfruit New Zealand. As a result Apple and Pear Australia Limited and other stakeholders have been unable to analyse it and comment in an informed manner. This significantly impacts on stake-holders ability to respond to the Draft Report and denies any level of procedural fairness.

Furthermore, Apple and Pear Australia Limited understand that Biosecurity Australia itself has been denied access to the complete documentation that supports the Integrated Fruit Production System. That Biosecurity Australia has based its analysis and formed its recommendations upon incomplete documentation suggests that Biosecurity Australia was derelict in their responsibilities.

Measures required to meet Australia's Appropriate Level of Protection

Apple and Pear Australia Limited's assessment of the "new science" concludes that the following measures are required, as a MINIMUM to ensure that Australia maintains its Appropriate Level of Protection:

For managing European canker:-

- Banning of apples from the high risk areas for European canker (eg., Auckland), and
- Orchard inspection with the elimination of an orchards for the season with an outbreak of European Canker, and
- Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent,
- Inspection of 600 randomly selected cartons per lot and
- A maximum pest limit of zero.

For managing Apple Leaf Curling Midge:-

- Implementation of 'pest free place of production' (an accepted SPS process), or
- Fumigation of apples before export, and
- Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent, and
- Inspection of 600 randomly selected cartons per lot and
- A maximum pest limit of zero.

For managing Fire Blight:-

- Pre harvest orchard inspection with the elimination of an orchards for the season with an outbreak of Fire Blight, and
- Test of apples to prove freedom from Fire Blight, and
- Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent for trash.
- Inspection of 600 randomly selected cartons per lot and

For managing leafrollers and mealybugs:-

- Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent for trash.

For managing coddling moth into WA:-

- Establishment of pest free areas, or areas of low pest prevalence for codling moth, or fumigation with methyl bromide.

For managing all fruit imported into Australia from New Zealand:

- Fruit treated with antibiotics should be excluded from export;
- Testing to ensure that only mature fruit is exported to Australia
- Maintenance of sanitary conditions in dump tank water
- High pressure water washing and brushing of fruit in the packing house

I urge you to revise the recommendations in your Draft Report to reflect more appropriate measures as recommended by Apple and Pear Australia.

Yours sincerely

Darral Ashton
Chairman

Apple & Pear Australia Ltd.

TECHNICAL RESPONSE

TO

BIOSECURITY AUSTRALIA

“DRAFT REPORT FOR THE NON-REGULATED ANALYSIS OF EXISTING POLICY FOR APPLES FROM NEW ZEALAND” (MAY 2011)

Commissioned by

APPLE & PEAR AUSTRALIA LTD

39 O’CONNELL ST

NORTH MELBOURNE VIC 3051

JULY 2011

Fire Blight

European Canker on Apple

Apple Leaf Curling Midge

QUOTES:

Extract from the Ministers Media Release dated 24th June 2011.

> ***"The Australian Government understands the concerns raised by Apple producers following the release of Biosecurity Australia Draft Report.***
>
> ***Australia's biosecurity system is in place to protect Australian primary producers, and the environment, from pests and diseases.***
>
> ***In order to do that, the Government needs to have access to the best available science.***
>
> ***Anyone with scientific evidence that supports the notion of different quarantine measures than those recommended in the review to should make that evidence available to Biosecurity Australia.***
>
> ***The WTO found that Australia's quarantine measures in this case, based on a 2006 risk assessment relating to three pests and diseases that could be associated with apples proposed for export to Australia from New Zealand were not scientifically justified."***

Minister for Agriculture, Fisheries and Forestry, Senator Joe Ludwig.

Response from Biosecurity Australia to an apple grower

> ***"Contrary to media reports, the draft report does not recommend the importation of apples from New Zealand without quarantine restrictions. The draft report has recommended that New Zealand apples can be imported only if they have been produced to export-quality standard and, in to addition in-field controls for quarantine pest, if specific processing practices have been employed, including high pressure washing and brushing of the fruit, maintaining wash-water sanitation and excluding damaged fruit."***

Dr Vanessa Findlay, General Manager, Plant Biosecurity - Horticulture

Assessment of Fire Blight

“Because of the inoculum potential and the ability of new inoculum to be repeatedly dispersed throughout an orchard by wind, splashing rain, and insects, it has been said that There is no such thing as a "little bit" of fire blight when dealing with this disease.”

Dr Sharon M. Douglas, Department of Plant Pathology and Ecology, Connecticut Agricultural Experimental Station, Connecticut, USA

New Zealand industry reporting on the finding of Codling moth in apples exported to Taiwan.

“There are procedures to ensure that this doesn't happen but the system's not 100 per cent full-proof so every now and again you're going to get a system failure of some sort."

Mr Peter Beaven, Chief Executive of Pipfruit New Zealand.

Recent findings on the viable but nonculturable state in pathogenic bacteria

“Regardless of the role that the VBNC state plays, it is clear that a large number of non-spore-forming bacteria, most notably a large number of human pathogens, are capable of entering this state, maintaining cellular structure and biology and continuing significant gene expression while otherwise nonculturable by ‘standard’ laboratory methods. That they can exit from this state, and become culturable again, is also undeniable. Finally, it can no longer be questioned that the VBNC state plays a critical role in the survival of important human (and other) pathogens, and possibly in their ability to produce disease.”

James D Oliver, Department of Biology, University of North Carolina, North Carolina, USA

CONTENTS:

‘A SNAPSHOT’

Biosecurity Australia, at a meeting with representatives of Apple and Pear Australia Limited indicated that the ‘measures proposed in the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand” were based on the following major points:-

a) 100% of export fruit goes through the New Zealand Pipfruit Integrated Fruit Production program, and

b) 100% adoption of high pressure treatment of apples within the packing facilities, and

c) 99% of the fruit went through sanitisation, and

d) New research on the Quarantine pests, and

e) New predictive models for Fire Blight.

Having considered all the information within the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand” it is obvious that:

Biosecurity Australia

- Proposes a range of ‘measures’ which are the same ‘measures’ which New Zealand proposed in the World Trade Organisation dispute. The World Trade Organisation Appellate Panel ruled that those measures did not meet Australia’s Appropriate Level of Protection;
- Proposes the utilisation of Standard Orchard Practices as ‘measures’ even though these practices, which were introduced in New Zealand in 1996, were considered within the 2006 Import Risk Analysis and have been known to Biosecurity Australia and the Australian apple industry for over two decades;
- Denied industry access to one of the major pillars of their measures – the Integrated Fruit Production Manual;
- Proposes the use of High Pressure treatment as a ‘measure’ even though that does not remove pests/diseases from the calyx of apples;
- Indicates that 99% of exported fruit will be sanitised yet the information supplied by New Zealand contradicts this in that sanitation of apples is not required by other New Zealand export markets, is not part of industry best practice and does not achieve the 99%;
- Has built the proposed ‘measures’ for the New Zealand industry by visiting 6 apple orchards and 5 packing facilities in a 6 day trip in March 2011- not during the major pest/disease period of blossom;
- Has utilised models that were implemented in 2007 and failed to consider aspects like clustering; extreme outbreaks of pests and disease and extreme climatic events;

- Has proposed the inspection of 600 pieces of fruit per consignment (even though a consignment may have multiple 'lots' of fruit from multiple packing facilities and represent thousands of cartons of fruit);
- Has failed to offer any new science to reduce the threat of the bacteria - fire blight, the fungus – European canker, and an insect – Apple Leaf Curling Midge, and
- Has consistently failed to give due recognition to the concept of Fire Blight going into dormancy, and 'waking up' from this state and then 'sending out scouts' to 'test the environment' for its suitability for growth of the entire population when many in the scientific community accept the undeniable fact that bacteria can exit from this state, and become culturable again.

Measures required to meet Australia's Appropriate Level of Protection

Apple and Pear Australia Limited's assessment of the "new science" concludes that the following measures are required, as a MINIMUM to ensure that Australia maintains its Appropriate Level of Protection:

For managing Fire Blight:-

- Pre harvest orchard inspection to be undertaken by AQIS with the elimination of a block / orchard for the season with an outbreak of Fire Blight, and
- Disease latency infection test on each lot before export to prove freedom from Fire Blight, and
- Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent, and
- Inspection of 600 randomly selected cartons per lot for trash

For managing European canker:-

- Banning of apples from the high risk areas for European canker (eg., Auckland), and
- Orchard inspection with the elimination of a block / orchard for the season with an outbreak of European canker, and
- Disease latency infection test on each lot before export, and
- Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent
- Inspection of 600 randomly selected cartons per lot,, *and*
- A maximum pest limit of zero.

For managing Apple Leaf Curling Midge:-

- Implementation of 'pest free place of production' (an accepted SPS process), *or*
- Fumigation of apples before export, *and*

- Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent, *and*
- Inspection of 600 randomly selected cartons per lot, *and*
- A maximum pest limit of zero.

For managing Leafrollers and Mealybugs:-

- Withdrawal of export lots or Methyl Bromide fumigation of export lots found to be infested
- Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent, and
- Inspection of 600 randomly selected cartons per lot for trash

For managing Coddling Moth into WA:-

- Establishment of pest free areas, or areas of low pest prevalence for codling moth, or fumigation with methyl bromide.
- Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent, and
- Inspection of 600 randomly selected cartons per lot for trash

For managing all apple fruit imported into Australia from New Zealand:

- Fruit treated with antibiotics should be excluded from export;
- Testing to ensure that only mature fruit is exported to Australia
- Maintenance of sanitary conditions in dump tank water
- High pressure water washing and brushing of fruit in the packing house

OVERVIEW:

The issues raised by Apple and Pear Australia Limited in this submission lead to the unescapable conclusions that Biosecurity Australia has conducted its review of the 2006 import risk analysis without support of scientific information or expressed reasons. As a result, the 2011 Review fails to correct the errors identified by the World Trade Organisation. The 2011 Review fails to meet acceptable standards of risk analysis.

The 2011 Review does not address major risks and as such fails to ensure that Australia's Appropriate Level of Protection is achieved.

Apple and Pear Australia Limited, as a stakeholder, have had to respond to Biosecurity Australia's analysis without access to critical information that Biosecurity Australia has used to support its conclusions. The lack of a public file, as a pre requisite for an Import Risk Analysis, has also denied Apple and Pear Australia Limited the ability to respond in a fully informed manner.

A brief précis of these matters is as follows.

1. WTO REQUIREMENTS

The World Trade Organisation (WTO) did not find that Australia's quarantine measures for apples for New Zealand were not scientifically justified.

It found that the 2006 Import Risk Analysis conducted by Biosecurity Australia did not provide sufficient scientific justification for Australia's quarantine measures because:

(a) Some measures were supported by neither scientific evidence nor transparent reasoning expressed in the 2006 risk analysis; and

(b) there was a lack of transparency in the 2006 risk analysis in the way some events which were assessed as unlikely ever to occur were allocated a quantitative likelihood range of a uniform distribution of $0 – 10^{-6.}$

The only adverse findings from the World Trade Organisation were that Australia's measures were maintained inconsistently with articles 5.1 and 5.2 of the SPS Agreement. These 2 articles are concerned with the standards for the conduct of risk analysis and not with the substance of the measures identified as required through conduct of such an analysis.

It is accepted that NZ will not question the way in which this outcome is reached or the lack of compliance with the SPS Agreement or the World Trade Organisation ruling.

This does not absolve Biosecurity Australia from its obligations and responsibilities in undertaking risk analysis to appropriate standards, including in accordance with our World Trade Organisation obligations. Apple and Pear Australia Limited's review concludes that the 2011 Review falls short of those standards – it is not supported by science or reasoning, is less transparent than the 2006 Analysis which it purportedly reviews and has consequently produced an arbitrary, irrational and unreasonable set of conclusions.

2. THE 2011 REVIEW METHOD

Biosecurity Australia has published a draft of its review of Australia's quarantine measures. The scope of that review is a reconsideration of the 2006 risk analysis. The Draft Report describes itself as:

> *"A science based review of the import risk analysis for New Zealand apples."*[1]

Through that review of the 2006 Analysis, the Draft Report proposes to change the assessments of unrestricted risk for the three pests in issue as follows:

Likelihood of entry, establishment and spread	**2006**	**2011**
- Fire Blight	Very low	Extremely low
- European canker	Low	Extremely low
- ALCM	High	Very low
Consequences – European canker	Moderate	Low
Unrestricted risk – whole of Australia		
- Fire Blight	Low	Very low
- European canker	Low	Negligible
- ALCM	Low	Negligible

As this submission demonstrates, there is no scientific evidence cited which could support any of those changes; and there is no reasoning contained in the Draft Report capable of supporting any of them.

Rather, the singular driver of the changed assessments of unrestricted risk of each of the pests is the change to a purely qualitative risk assessment method

[1] Draft report paragraph 1.2.1.

which uses a single wrapped up assessment of the likelihood of importation and of distribution of each pest in issue. In each case change to the assessed level of unrestricted risk derives solely from the method used to assess the likelihood of importation and distribution of the pest in Australia; and not from any change to the substantive assessments of those likelihoods.

The Draft Report, and Biosecurity Australia, is completely silent on any reason for that change in risk assessment method.

In the 2006 Analysis distribution had been addressed on the basis that distribution within Australia would vary widely between orchard wholesalers, urban wholesalers, retailers, food services and consumers; and that the assessment of the likelihood of distribution required consideration of the proximity of each of those distribution modalities to commercial fruit crops, nursery plants, household and garden plants and wild and amenity plants.[2]

The 2011 Review on the other hand allocates a simple, singular, qualitative descriptor to the likelihood of distribution of each pest. In doing so, the 2011 Review simply excludes from further consideration the differences in likelihood of distribution that flow from those various distribution modalities and their proximity to possible points of infection or infestation. The 2011 Review contains no scientific information and no reasoning which could support putting aside an analysis based on those different modalities and proximity points.

Further, the 2006 Analysis expressly addressed the increased likelihoods of distribution and establishment that flow from clustering. The 2011 Review ignores the issue.

The WTO's findings on the Uniform Distribution of 0 – 10^{-6} obviously required adjustments to the 2006 model – but provided no reason for its wholesale abandonment in favour of a significantly more opaque and arbitrary method of analysis.

Having adopted that approach to the assessments of likelihoods, Biosecurity Australia has adopted a set of decision rules[3], apparently without authority.[4]

[2] See the analysis in the 2006 IRA at pages 80ff.

[3] See pages 8 and 9

[4] If a document containing such authority exists it is "operational information" within the meaning of s.8A of the *Freedom of Information Act 1982*. No such document has been published as required by that Act. Further, on 15 June 2011 Minter Ellison advised Hall & Wilcox that *"all relevant information is referenced within the draft report which is publicly available"*. No such document is referenced in the draft report.

In each case the changed assessments in the Draft Report of the probability of entry, establishment and spread of the pests in issue flows directly from one of those decision rules, the "*Matrix of rules for combining qualitative likelihoods*"[5] set out at table 2.2 on page 9 of the 2011 Review.

That change of method, combined with the complete absence of any discussion in the Draft Report or elsewhere of reasons for it, invites the inference that the method was chosen because it would produce the outcome. Consequently, without a cogent explanation for the change of method, any decision based on that changed method risks fundamentally undermining Biosecurity Australia's claim to have a science based system of risk analysis.

3. SCIENCE

Apple and Pear Australia Limited have undertaken an analysis of the additional science referenced in the 2011 analysis compared to the previous Import Risk Analysis. As it is obvious that the conclusions and protocols in the 2011 report vary significantly from the 2006 report, the reasons should be identifiable. As risk analysis has to be science based under the World Trade Organisation agreements, the new science supporting any changes should be identifiable.

Apple and Pear Australia Limited's analysis of the additional science referenced in the 2011 report clearly shows that while the science indicates that the bacterial disease, Fire Blight, can be more unpredictable or take on new forms, there is no new science to indicate that it is less dangerous than previously concluded or more manageable than previously concluded. This is similarly the case with European canker and Apple Leaf Curling Midge.

Rather, as set out above the changes in 2011 flow not from new science or new analysis but rather from an unexplained and unjustified change to risk analysis methodology.

Fire Blight

The change in the 2011 Review's assessed unrestricted risk of fire blight from low to very low arises solely from the assessed change in the likelihood of entry, establishment and spread of that pest. The assessment that the likelihood of entry, establishment or spread will change is not based on any scientific information cited in the 2011 Review and there is no reasoning set out in the 2011 Review which supports that change. Rather that changed assessment of the likelihood of importation, establishment and spread arises from the abandonment

[5] Table 2.2 on page 9.

of the semi-quantitative method of risk analysis used in the 2006 IRA and its replacement by the qualitative method with the decision rules set out at page 9 of the 2011 Review.

Thus in 2006 the IRA assessed that 3.9% of all apples imported from New Zealand would be infested with the fire blight bacteria. There is no scientific information and no reasoning in the 2011 Review which questions that conclusion. Rather the 2011 Review concludes:

> *"I summary, considering a significant volume of trade, the evidence shows that E. amylovora has the potential to be associated with fruit from major export areas in New Zealand, but that the proportion of infested fruit will be small and the bacterial populations in low numbers per fruit."*

That reasoning can only rationally support the conclusion that "the event [that is the importation of the pest] would be very likely to occur". An accurate application of the decision rules set out on pages 8 and 9 of the 2011 Review would result in the allocation of a qualitative likelihood of "high" to the importation of fire blight. The statement in the 2011 Review that "the evidence supports a rating of "moderate" for the importation of *E. amylovora* is irrational and unreasonable.

The primary driver of the change in the assessed risk of fire blight is the use of the qualitative assessment that the likelihood of distribution of the pest in Australia is extremely low in 2011.

The analysis, purportedly reviewed in 2011, which was undertaken in 2006 proceeded on the basis that distribution within Australia would vary widely between orchard wholesalers, urban wholesalers, retailers, food services and consumers; and that the assessment of the likelihood of distribution required consideration of the proximity of each of those distribution modalities to commercial fruit crops, nursery plants, household and garden plants and wild and amenity plants.[6] The allocation of the simple qualitative descriptor of "extremely low" to the likelihood of distribution in the 2011 Review simply ignores those various distribution modalities and their proximity to possible points of infection. The 2011 Review contains no scientific information and no reasoning which could support putting aside the analysis based on those different modalities and proximity points.

However it is the arbitrary allocation of the qualitative descriptor "extremely low" to that stage of the analysis which completely determines that the 2011 Review

[6] See the analysis in the 2006 IRA at pages 80FF.

would conclude that the probability of entry, establishment and spread of fire blight was extremely low. That conclusion does not flow from any scientific information or reasoning. Rather it flows from the "matrix of rules for combining qualitative likelihoods" set out at table 2.2 on page 9 of the 2011 Review.

It was the conclusion that the probability of entry establishment and spread of fire blight would now be qualitatively described as "extremely low" that determined the result that the unrestricted risk was "very low".

It is the change in the method of risk assessment between 2006 and 2011 as it concerns the distribution of fire blight which drives the change in the assessed level of unrestricted risk of fire blight. That change is not based on any scientific information or reasoning. The making of that change is irrational and unreasonable.

European Canker

The 2011 conclusions with respect to the importation and distribution of European canker are that each of those events has a qualitative likelihood of very low. The application of the decision matrix at table 2.2 results in the inevitable conclusion that the overall probability of entry, establishment and spread will be described qualitatively as extremely low.

There is nothing in the scientific information or reasoning contained in the 2011 Review which in any way departs from the conclusions on the likelihood of importation and distribution of the 2006 IRA. Once again it is the change to a qualitative methodology from the semi-quantitative methodology used in 2006 which results in the change in the level of unrestricted risk. That change is unsupported by any scientific evidence or reasoning. It is irrational and unreasonable.

The conclusion that the probability of entry establishment and spread of European Canker would now be qualitatively described as "extremely low" was sufficient to determine that the unrestricted risk was within Australia's ALOP. That conclusion was based on the change in risk assessment method and not on any scientific information or reasoning.

In addition the 2011 Review involves a change in the assessed consequences for European canker. In 2006 the IRA had concluded that the direct consequences on plant life of the pest were expected to be minor at the national level and significant at the regional level.

In 2011 the review concludes that the impact would be minor at the regional level and significant at the district level.

That change is based solely upon the work of Beresford and Kim 2011. While that work assessed Tasmania as marginal for European canker it did not cover other areas of Australia. The reduced assessment of the consequences of European canker relies solely upon the earlier work of Beresford and Kim 2008 which came to no firm conclusion on other apple growing regions of Australia. The reliance on Beresford and Kim 2008 is misplaced.

Apple Leaf Curling Midge

In the case of Apple Leaf Curling Midge the 2006 Import Risk Analysis concluded that 4.1% of all apples imported to Australia would be infested with the pest.

There is nothing in the scientific information or reasoning in the 2011 Review which provides any basis for departing from that assessment.

To the contrary the 2011 Review concludes that:

> *"The information presented indicates that there is potential for some consignments of apples from New Zealand to contain apple leaf curling midge pupae that are viable and remain undetected during the minimal on arrival quarantine processes at the Australian border. Recognising that there is potential for this event to occur, though not with certainty in all consignments or in all years, …"*

Just like for fire blight, that analysis supports the conclusion that "the event [that is the importation of the pest] would be very likely to occur". The reasoning supports a rating of "high". The allocation of "moderate" meaning "the event would occur with an even probability" is inconsistent with the scientific evidence and the reasoning. It is irrational and unreasonable.

As with fire blight, so with Apple Leaf Curling Midge the change in the assessed level of unrestricted risk in the 2011 Review is driven solely by the change in the method for assessing the likelihood of distribution.

In the case of Apple Leaf Curling Midge the assessment of the likelihood of distribution depends centrally on the assessment of a mating pair of the pest being within sufficient proximity to each other and to a suitable host to result in transfer.

The 2006 Import Risk Analysis assessed the likelihood of that scenario by taking into account the different distribution modalities and proximity points referred to above with respect to fire blight. It also specifically took into account the impact of clustering.[7]

By departing from the 2006 methodology, without citing any scientific information or reasoning to do so, the 2011 Review has allocated the qualitative likelihood of “very low” for the likelihood of entry of Apple Leaf Curling Midge.

Again it is the matrix of rules for combining qualitative likelihoods[8] which determines that the overall probability of entry, establishment and spread of Apple Leaf Curling Midge cannot be higher than very low. That in turn determined the outcome of the unrestricted risk assessment undertaken in 2011 would be that that risk was within Australia’s Appropriate Level of Protection.

That change is not supported by scientific evidence or by reasoning and is irrational and unreasonable.

4. PROPOSED MEASURES - PEST MANAGEMENT SYSTEM

The most obvious change in Biosecurity Australia’s conclusions is its reliance on New Zealand’s Integrated Fruit Production/Pest Management System.

The 2006 IRA in dealing with Integrated Pest Management programs (IPM) correctly and cogently acknowledged:

> *“That IPM is only a management tool and may not always reduce the opportunities for establishment of pests, for in some seasons no matter what IPM program was in place, if environmental conditions were conducive, pests would occur.”*

The 2011 Review is silent on whether its authors now disagree with that finding in 2006. Yet, it is irrational for the 2011 Review to adopt the conclusions of the Draft Report unless its authors now disagree with the earlier finding. Apple and Pear Australia Ltd is confident that no responsible scientist would disagree with that earlier finding. As a result, the 2011 Review’s conclusions based on New Zealand’s IPM are irrational and unreasonable.

New Zealand has not found a way to control and/or eliminate Fire Blight or prevent serious outbreaks of the disease and does not pretend that it has.

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[7] So for example at page 333 the 2006 IRA recorded that “after extensive discussion with Biosecurity Australia entomologists and team members it was decided that it would allow clearer consideration of the risks from arthropods to calculate estimates of the number of infested apples in each exposure point per week”.

[8] Table 2.2 on page 9

Very clearly, under the recommendations made by Biosecurity Australia, fruit will, at times, be harvested from orchards with severe outbreaks of fire blight. This fruit will be heavily infested with the fire blight bacteria. The on line treatment required will not contact or eradicate the bacteria in the calyx and the fruit will arrive with high levels of bacteria in undiluted consignments. There is no measure proposed which would prevent that fruit being imported and distributed very shortly after harvest.

The 2011 Review accurately recorded that:

> *"Ultimately, economic factors and market access opportunities will determine the market window for New Zealand apple exports to Australia."*

No doubt it was on that basis that the review in 2011 preceded on the assumption that the bulk of exports would be from February until August each year.

The 2011 Review's allocation of the likelihood of "extremely low" to the distribution stage, without taking into account the incidence of hail or wind storms or other events causing damage to Australian orchards sufficient to render them highly susceptible to infection, fundamentally undermines the analysis in the 2011 Review.

With a disease such as fire blight that Biosecurity Australia itself identifies as one of the most serious diseases of apples, fruit should at the very least be guaranteed to come from a Pest Free Place of Production. While Biosecurity Australia recognises this requirement for the less dangerous and complex insect (Codling moth) for West Australia, it fails to apply the same principle to fire blight.

The same scenario outlined will also occur with the other pests and diseases identified.

Further, there is nothing "new" in New Zealand's IFP systems, as far as they have been disclosed to the Australian industry.

APAL's submission to Biosecurity Australia dated 2004 concerning New Zealand's IFP approaches is reproduced in Appendix C to this submission. Those approaches had been implemented by 2000 and were central to the analysis in the 2006 IRA.

As far as the Australian industry can discern, in its 2011 Review Biosecurity Australia has relied on the same IFP systems as were considered in the 2006 analysis in the 2011 Review as a basis to depart from the 2006 analysis. If that is what has been done, the 2011 Review is demonstrably spurious and the conclusion that the New Zealand IFP systems provide a reason to depart from the conclusions of the 2006 IRA is irrational and unreasonable.

On the other hand if there is something about those IFP systems which is known to Biosecurity Australia and which is not dealt with in Appendix C and which provides a basis to change the outcome of the risk analysis, the 2011 Review has been conducted in a manner denying the Australian industry basic procedural fairness. Such a scenario implies a process whereby the central conclusions of the 2011 Review are based on unpublished data. Not only would such a process be unscientific, it would be unfair because it would prevent any analyst other than the authors from assessing the conclusions reached.

5. EXCLUSION OF TRASH

The scientific community is in agreement that trash is a high risk carrier of fire blight.

There are 2 ways that trash could arrive in Australia from New Zealand with apples. The first way is by being attached to individual apples.

The second and most likely way that trash will arrive in a consignment is as debris in cartons. Trash enters cartons as part of the mechanical process of grading and packing and the risks are increased with the use of tray fillers. Tray fillers are a common component of graders in New Zealand.

The 2011 Review does not mention any statistically verifiable inspection system to ensure that trash is excluded from cartons. As such, Australia will be exposed to a risk well in excess of what is acceptable. It is of note that the level of trash in a fruit bin is determined by the quality and experience of the picker. As such, any criteria have to take into account extremes, as these will occur.

6. ADDITIONAL TECHNICAL MATTERS

a. Antibiotics

As one of the criteria for a risk analysis is to protect human health, the acceptance by Biosecurity Australia that a proportion of the fruit imported by New Zealand will be treated with antibiotics without assessing the human health consequences is in conflict with this important obligation.

b. Viable But Not Culturable (VBNC)

VBNC was a risk clearly identified by experts at the World Trade Organisation hearing as a risk that was not taken into account in the 2006 analysis.

Combined with the new scientific evidence confirming the potential risks of VBNC, Biosecurity Australia has continued to ignore this risk and proposes no measures to minimise this risk.

7. PROCEDURAL FAIRNESS

Apple and Pear Australia Limited and other stake holders have been prejudiced by their inability to access critical information that Biosecurity Australia has used in its risk analysis.

Stake holders at the outset were informed that this analysis would be undertaken to the same standards as an import risk assessment. Those standards included transparency and a public file.

Apple and Pear Australia Limited has been advised there is no public file and as such have been put in the position of having to second guess Biosecurity Australia. We have no way of testing or making informed comment on the information that Biosecurity Australia used in making its decision.

The inability of stake holders to access the New Zealand Integrated Fruit Production/ Pest Management Manual has precluded Apple and Pear Australia Limited from making fully informed comments and providing advice on the most critical component of Biosecurity Australia's assessment. As this manual and it's purported efficacy relates to the technical side of fruit growing, Apple and Pear Australia Limited believes it is in a better position than Biosecurity Australia to test and comment on the manual's ability to achieve the outcomes found by Biosecurity Australia.

Biosecurity Australia's insistence on upholding New Zealand's request that manual remain confidential is unsustainable. The 2011 Review was conducted according to the standards of an IRA. Those standards include the provision, by an import proponent, of information on its production and processing methods.[9] Biosecurity Australia was entitled to refuse to conduct a further review if complete information on New Zealand's production and processing methods were not provided to it.

The provision of the New Zealand manual to Biosecurity Australia could not have been on the basis that Biosecurity Australia would keep it confidential. Once again the standards that apply to an IRA apply:

[9] IRA Handbook annex 7 page 39.

> *"If a submission is used in Biosecurity Australia's decision making process, Biosecurity Australia cannot guarantee its confidentiality."*[10]

Biosecurity Australia purports to put the New Zealand manual at the centre of its decision making processes. That being the case, Biosecurity Australia cannot, and has not, provided any guarantee as to its confidentiality.

The document has been provided to Biosecurity Australia by one or more New Zealand parties in the face of the express statement that *Biosecurity Australia cannot guarantee its confidentiality*. It can, and should, have been published by Biosecurity Australia for assessment by the Australian industry.

Had Biosecurity Australia informed stakeholders in December 2010 that there would be no public file, Apple and Pear Australia Ltd would have requested access to the New Zealand manual, at that time, under both Australian and New Zealand Freedom of Information laws? There would thereby have been the prospect of the document being available to Australian industry before we were called on to respond to the Draft Report. It was Biosecurity Australia's misleading statement that it would conduct the 2011 Review to the standards of an IRA, when it did not propose to maintain a public file that has disadvantaged the Australian industry.

8. TIMEFRAME FOR DIRECTOR MAKING HIS/HER FINAL DECISION

Apple and Pear Australia Limited is very concerned with the time frame for the Director of Quarantine's decision on revised measures taken.

Apple and Pear Australia Limited have been informed that the timetable for the Director making his decision is August 17th 2011. Biosecurity Australia cannot commence any analysis until the majority of submissions are received.

Therefore from the 5th of July the following process has to be completed.

- Biosecurity Australia to review submissions.
- Then Biosecurity Australia needs to identify relevant issues raised by stake holders and assess if they should be taken into account in the analysis.
- Biosecurity Australia to revise or otherwise its analysis and complete a final risk analysis.
- Biosecurity Australia to present the risk analysis to the Director of Quarantine.

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[10] IRA Handbook annex 9 page 42.

- Director to consider relevance of issues that stake holders have identified as shortcomings in Biosecurity Australia's analysis.
- Director to make his final decision

The time given to undertake this complex process is 41 days or 29 days if the people involved do not work weekends. This assumes that there are no other distractions for the people involved.

By any reasonable standard, to make the decision that the process will be completed in the timeframe decided does not give stake holders any confidence that their views will be adequately considered, or they were considered at the outset to be irrelevant.

EXECUTIVE SUMMARY.

Because of the inoculum potential and the ability of new inoculum to be repeatedly dispersed throughout an orchard by wind, splashing rain, and insects, it has been said that ***There is no such thing as a "little bit" of fire blight*** when dealing with this disease.

FIRE BLIGHT – Erwinia amylovora

Overview:

The change in the 2011 Review's assessed unrestricted risk of fire blight from low to very low arises solely from the assessed change in the likelihood of entry, establishment and spread of that pest. The assessment that the likelihood of entry, establishment or spread will change is not based on any scientific information cited in the 2011 Review and there is no reasoning set out in the 2011 Review which supports that change. Rather that changed assessment of the likelihood of importation, establishment and spread arises from the abandonment of the semi-quantitative method of risk analysis used in the 2006 IRA and its replacement by the qualitative method with the decision rules set out at page 9 of the 2011 Review.

Thus in 2006 the IRA assessed that 3.9% of all apples imported from New Zealand would be infested with the fire blight bacteria. There is no scientific information and no reasoning in the 2011 Review which questions that conclusion. Rather the 2011 Review concludes:

> *"In summary, considering a significant volume of trade, the evidence shows that E. amylovora has the potential to be associated with fruit from major export areas in New Zealand, but that the proportion of infested fruit will be small and the bacterial populations in low numbers per fruit."*

That reasoning can only rationally support the conclusion that "the event [that is the importation of the pest] would be very likely to occur". An accurate application of the decision rules set out on pages 8 and 9 of the 2011 Review would result in the allocation of a qualitative likelihood of "high" to the importation of fire blight. The statement in the 2011 Review that "the evidence supports a rating of "moderate" for the importation of *E. amylovora* is irrational and unreasonable.

The primary driver of the change in the assessed risk of fire blight is the use of the qualitative assessment that the likelihood of distribution of the pest in Australia is extremely low in 2011.

The analysis, purportedly reviewed in 2011, which was undertaken in 2006 proceeded on the basis that distribution within Australia would vary widely between orchard wholesalers, urban wholesalers, retailers, food services and consumers; and that the assessment of the likelihood of distribution required consideration of the proximity of each of those distribution modalities to commercial fruit crops, nursery plants, household and garden plants and wild and amenity plants.[11] The allocation of the simple qualitative descriptor of "extremely low" to the likelihood of distribution in the 2011 Review simply ignores those various distribution modalities and their proximity to possible points of infection. The 2011 Review contains no scientific information and no reasoning which could support putting aside the analysis based on those different modalities and proximity points.

However it is the arbitrary allocation of the qualitative descriptor "extremely low" to that stage of the analysis which completely determines that the 2011 Review would conclude that the probability of entry, establishment and spread of fire blight was extremely low. That conclusion does not flow from any scientific information or reasoning. Rather it flows from the "matrix of rules for combining qualitative likelihoods" set out at table 2.2 on page 9 of the 2011 Review.

It is the change in the method of risk assessment between 2006 and 2011 as it concerns the distribution of fire blight which drives the change in the assessed level of unrestricted risk of fire blight. That change is not based on any scientific information or reasoning. The making of that change is irrational and unreasonable.

Conclusion

In considering the above information the following conclusions can be made:

a) 'DIRECT IMPACT' ratings have not changed from 2006 to 2011, and
b) One 'INDIRECT IMPACT' ratings have been lowered from 2006 to 2011, and
c) the rating for 'CONSEQUENCE' has not changed been from 2006 to 2011, and
d) the Overall probability of entry, establishment and spread has moved from VERY LOW (2006) to EXTREMELY LOW (2011).

It is worthy of considering the following scenario

[11] See the analysis in the 2006 IRA at pages 80FF.

- The World Trade Organisation Appellate Body ruled in favour of Australia in that the alternative measures proposed by New Zealand had not been proven to meet Australia's Appropriate Level of Protection.

(a) Measures 1-8, as proposed by Biosecurity Australia in 2006, and addressed in the subsequent five bullet points of New Zealand's panel request, relates to "*Fire Blight*" and were considered as 'measures' by both the World Trade Organisation Panel and Appellate Panel:

> "The requirement that apples be sourced from areas free from fire blight disease symptoms."
>
> "The requirement that orchards/blocks be inspected for fire blight disease symptoms, including that they be inspected at an inspection intensity that would, at a 95% confidence level, detect visual symptoms if shown by 1% of the trees, and that such inspections take place between 4 to 7 weeks after flowering."
>
> "The requirement that an orchard/block inspection methodology be developed and approved that addresses issues such as visibility of symptoms in the tops of trees, the inspection time needed and the number of trees to be inspected to meet the efficacy level, and training and certification of inspectors."
>
> "The requirement that an orchard/block be suspended for the season on the basis that any evidence of pruning or other activities carried out before the inspection could constitute an attempt to remove or hide symptoms of fire blight."
>
> "The requirement that an orchard/block be suspended for the season on the basis of detection of any visual symptoms of fire blight
>
> "The requirement that apples be subject to disinfection treatment in the packing house."
>
> "The requirement that all grading and packing equipment that comes in direct contact with apples be cleaned and disinfected (using an approved disinfectant) immediately before each Australian packing run."
>
> "The requirement that packing houses registered for export of apples process only fruit sourced from registered orchards."

- The new science incorporated into the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" offers nothing that should result in the **overall probability of entry, establishment and spread has moved from VERY LOW (2006) to EXTREMELY LOW (2011).**

- If anything the new science would support the maintenance of the 2006 measures or in fact adding additional measures.

- The standard orchard practices are not new information as it was in existence back in 1998 and was certainly considered by both industry and Biosecurity Australia in the 2006 Import Risk Analysis.

- The Integrated Fruit Production Manual again is nothing new and certainly the information available to the Australian Apple industry offers nothing that would indicate the fire blight has been eradicated from New Zealand apple growing regions.

- At the very least, pest free places of production should be a mandatory requirement. This could only be achieved with orchard inspections.

- Under Biosecurity Australia's present proposal, Australia faces the potential of receiving infected/infested fruit from orchards that have active fire blight.
Science supports the fact that fruit can appear symptomless at harvest. The risk of Australia receiving infected fruit that would spread the disease is very real.

- The documentation obtained from the visit by Biosecurity Australia representatives to New Zealand in March 2011 offers nothing new in relation to new science or standard orchard practices that would support the reduction of the unrestricted risk from **LOW** to **VERY LOW**

In conclusion Apple and Pear Australia Limited find that there is absolutely no new information that justifies the decision by Biosecurity Australia to reduce the unrestricted risk from LOW to VERY LOW and as a result no reason to allow apples from New Zealand in without any true measures.

MINIMUM MEASURES:

As a minimum Apple and Pear Australia Limited believe the following measures should be implemented for managing FIRE BLIGHT:-

- **Pre harvest orchard inspection to be undertaken by AQIS with the elimination of a block / orchard for the season with an outbreak of Fire Blight, and**
- **Disease latency infection test on each lot before export to prove freedom from Fire Blight, and**
- **Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent, and**
- **Inspection of 600 randomly selected cartons per lot for trash**

EUROPEAN CANKER

Overview:
The 2011 conclusions with respect to the importation and distribution of European canker are that each of those events has a qualitative likelihood of very low. The application of the decision matrix at table 2.2 results in the inevitable conclusion that the overall probability of entry, establishment and spread will be described qualitatively as extremely low.

There is nothing in the scientific information or reasoning contained in the 2011 Review which in any way departs from the conclusions on the likelihood of importation and distribution of the 2006 IRA. Once again it is the change to a qualitative methodology from the semi-quantitative methodology used in 2006 which results in the change in the level of unrestricted risk. That change is unsupported by any scientific evidence or reasoning. It is irrational and unreasonable.

In addition the 2011 Review involves a change in the assessed consequences for European canker. In 2006 the IRA had concluded that the direct consequences on plant life of the pest were expected to be minor at the national level and significant at the regional level.

In 2011 the review concludes that the impact would be minor at the regional level and significant at the district level.

That change is based solely upon the work of Beresford and Kim 2011. While that work assessed Tasmania as marginal for European canker it did not cover other areas of Australia. The reduced assessment of the consequences of European canker relies solely upon the earlier work of Beresford and Kim 2008 which came to no firm conclusion on other apple growing regions of Australia. The reliance on Beresford and Kim 2008 is misplaced.

Conclusion

In considering the above information the following conclusions can be made:

e) 'DIRECT IMPACT' ratings have been lowered from 2006 to 2011, and
f) Two 'INDIRECT IMPACT' ratings have been lowered from 2006 to 2011, and
g) the rating for 'CONSEQUENCE' has been lowered from MODERATE (2006) to LOW (2011, and
h) the Overall probability of entry, establishment and spread has moved from LOW (2006) to EXTREMELY LOW (2011).

Apple and Pear Australia limited argues that with the carton being the most logical mode of transport for trash Biosecurity Australia MUST include 600 randomly selected cartons per lot to ensure that trash is not present and exported to Australia.

On the finding of any trash within retail-ready packs the full lot needs to be returned to New Zealand, treated or destroyed.

It is worthy of considering the following scenario

- The World Trade Organisation Appellate Body ruled in favour of Australia in that the alternative measures proposed by New Zealand had not been proven to meet Australia's Appropriate Level of Protection.

- Measures 9 to 13 as proposed by Biosecurity Australia in 2006, and addressed in the subsequent five bullet points of New Zealand's panel request, relates to "*European canker*" and were considered as 'measures' by both the World Trade Organisation Panel and Appellate Panel:

  > "The requirement that apples be sourced from export orchards/blocks free of European canker (pest free places of production)."
  >
  > "The requirement that all trees in export orchards/blocks be inspected for symptoms of European canker, including that orchards/blocks in areas less conducive for disease are inspected for symptoms by walking down every row and visually examining all trees on both sides of each row, and that areas more conducive to the disease are inspected using the same procedure combined with inspection of the upper limbs of each tree using ladders (if needed), and that such inspections take place after leaf fall and before winter pruning."
  >
  > "The requirement that all new planting stock be intensively examined and treated for European canker."
  >
  > "The requirement that an orchard/block be suspended for the season on the basis that any evidence of pruning or other activities carried out before the inspection could constitute an attempt to remove or hide symptoms of European canker."
  >
  > "The requirement that exports from an orchard/block be suspended for the coming season on the basis of detection of European canker and that reinstatement would require eradication of the disease, confirmed by inspection."

- The new science incorporated into the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" offers nothing that should result in the **overall probability of entry, establishment and spread has moved from LOW (2006) to EXTREMELY LOW (2011).**

- If anything the new science would support the maintenance of the 2006 measures or in fact adding additional measures.

- The standard orchard practices are not new information as it was in existence back in 1998 and was certainly considered by both industry and Biosecurity Australia in the 2006 Import Risk Analysis.

- The Integrated Fruit Production Manual again is nothing new and certainly the information available to the Australian Apple industry offers nothing that would indicate the European canker has been eradicated from New Zealand apple growing regions.

- When assessing the risks from European Canker, Biosecurity Australia has treated New Zealand as being a low risk region. The facts are that at least one area in New Zealand is a high risk area (Auckland, Otago). These areas have a known presence of canker and have ideal climatic conditions for this disease. Biosecurity Australia has concluded that only 5% of New Zealand apples are grown in these areas and as such this fruit does not pose a risk. There is a total lack of recognition that the fruit from these areas will arrive in Australia in undiluted consignments.

- At the very least, pest free places of production should be a mandatory requirement. This could only be achieved with orchard inspections.

- Under Biosecurity Australia's present proposal, Australia faces the potential of receiving infected fruit from orchards that have active European Canker.
  Science supports the fact that fruit can appear symptomless at harvest but develops rots later. The risk of Australia receiving infected fruit that would spread the disease is very real.

- The documentation obtained from the visit by Biosecurity Australia representatives to New Zealand in March 2011 offers nothing new in relation to new science or standard orchard practices that would support the reduction of the unrestricted risk from **LOW** to **NEGLIGIBLE**.

In conclusion Apple and Pear Australia Limited find that there is absolutely no new information that justifies the decision by Biosecurity Australia to reduce the unrestricted risk from LOW to NEGLIGIBLE and as a result no reason to allow apples from New Zealand in without any true measures.

MINIMUM MEASURES:

As a minimum Apple and Pear Australia Limited believe the following measures should be implemented for managing European canker:-

- **Banning of apples from the high risk areas for European canker (eg., Auckland), and**
- **Orchard inspection with the elimination of a block / orchard for the season with an outbreak of European canker, and**
- **Disease latency infection test on each lot before export, and**
- **Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent**
- **Inspection of 600 randomly selected cartons per lot,, *and***
- **A maximum pest limit of zero.**

APPLE LEAF CURLING MIDGE:

Overview:

In the case of Apple Leaf Curling Midge the 2006 Import Risk Analysis concluded that 4.1% of all apples imported to Australia would be infested with the pest.

There is nothing in the scientific information or reasoning in the 2011 Review which provides any basis for departing from that assessment.

To the contrary the 2011 Review concludes that:

> *"The information presented indicates that there is potential for some consignments of apples from New Zealand to contain apple leaf curling midge pupae that are viable and remain undetected during the minimal on arrival quarantine processes at the Australian border. Recognising that there is potential for this event to occur, though not with certainty in all consignments or in all years, …"*

Just like for Fire Blight, that analysis supports the conclusion that "the event [that is the importation of the pest] would be very likely to occur". The reasoning supports a rating of "high". The allocation of "moderate" meaning "the event would occur with an even probability" is inconsistent with the scientific evidence and the reasoning. It is irrational and unreasonable.

As with Fire Blight, so with Apple Leaf Curling Midge the change in the assessed level of unrestricted risk in the 2011 Review is driven solely by the change in the method for assessing the likelihood of distribution.

In the case of Apple Leaf Curling Midge the assessment of the likelihood of distribution depends centrally on the assessment of a mating pair of the pest being within sufficient proximity to each other and to a suitable host to result in transfer.

The 2006 Import Risk Analysis assessed the likelihood of that scenario by taking into account the different distribution modalities and proximity points referred to above with respect to fire blight. It also specifically took into account the impact of clustering.[12]

By departing from the 2006 methodology, without citing any scientific information or reasoning to do so, the 2011 Review has allocated the qualitative likelihood of "very low" for the likelihood of entry of Apple Leaf Curling Midge.

Again it is the matrix of rules for combining qualitative likelihoods[13] which determines that the overall probability of entry, establishment and spread of Apple Leaf Curling Midge cannot be higher than very low. That in turn determined the outcome of the unrestricted risk assessment undertaken in 2011 would be that that risk was within Australia's Appropriate Level Of Protection.

That change is not supported by scientific evidence or by reasoning and is irrational and unreasonable.

Conclusion:

In considering the information on Apple Leaf Curling Midge the following conclusions can be made:

i) there is no difference in the ratings for 'DIRECT IMPACT from 2006 and 2001, and
j) there is no difference in the ratings for 'INDIRECT IMPACT' from 2006 and 2011, and
k) there is no difference in the rating for 'CONSEQUENCE' from 2006 and 2011, but
l) the Overall probability of entry, establishment and spread has moved from HIGH (2006) to VERY LOW (2011).

[12] So for example at page 333 the 2006 IRA recorded that "after extensive discussion with Biosecurity Australia entomologists and team members it was decided that it would allow clearer consideration of the risks from arthropods to calculate estimates of the number of infested apples in each exposure point per week".

[13] Table 2.2 on page 9

Apple and Pear Australia limited argues that with the carton being the most logical mode of transport for trash which can carry apple leaf curling midge, Biosecurity Australia MUST include 600 randomly selected cartons per lot to ensure that trash is not present and exported to Australia.

On the finding of any trash within retail-ready packs the full lot needs to be returned to New Zealand, treated or destroyed.

It is worthy of considering the following scenario

- The World Trade Organisation Appellate Body ruled in favour of Australia in that the alternative measures proposed by New Zealand had not been proved to meet Australia's Appropriate Level of Protection.

- Measure 14, proposed by Biosecurity Australia in 2006, and addressed in the subsequent bullet point of New Zealand's panel request, relates to "*apple leafcurling midge*" and was considered a 'measure' by both the World Trade Organisation Panel and Appellate Panel:

  "The requirements of inspection and treatment for apple leafcurling midge, including:

  > the option of inspection of each lot on the basis of a 3000 unit sample selected at random across the whole lot for apple leafcurling midge, symptoms of quarantineable diseases, quarantineable pests, arthropods, trash and weed seeds, with detection of any live quarantineable arthropod resulting in appropriate treatment or rejection for export;
  >
  > the option of inspection of each lot on the basis of a 600 unit sample selected at random across the whole lot for symptoms of quarantineable diseases, trash and weed seeds, plus mandatory appropriate treatment of all lots."

- The new science incorporated into the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" offers nothing that should result in the **overall probability of entry, establishment and spread has moved from HIGH (2006) to VERY LOW (2011).**

- If anything the new science would support the maintenance of the 2006 measures or in fact adding additional measures.

- The standard orchard practices are no new information as it was in existence back in 1998 and was certainly considered by both industry and Biosecurity Australia in the 2006 Import Risk Analysis.

- The Integrated Fruit Production Manual again is nothing new and certainly the information available to the Australian Apple industry offers nothing that would indicate the Apple Leaf Curling Midge has been eradicated from New Zealand apple growing regions.

- The documentation obtained from the visit by Biosecurity Australia representatives to New Zealand in March 2011 offers nothing new in relation to new science or standard orchard practices that would support the reduction of the unrestricted risk from LOW to NEGLIGIBLE.

In conclusion Apple and Pear Australia Limited find that there is absolutely no new information that justifies the decision by Biosecurity Australia to reduce the unrestricted risk from LOW to NEGLIGIBLE and as a result no reason to allow apples from New Zealand in without any true measures.

MINIMUM MEASURES:

As a minimum Apple and Pear Australia Limited believe the following measures should be implemented for managing Apple Leaf Curling Midge:-

- **Implementation of 'pest free place of production' (an accepted SPS process),** ***or***
- **Fumigation of apples before export,** ***and***
- **Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent**
- **Insepction of 600 randomly selected cartons per lot,** ***and***
- **A maximum pest limit of zero.**

ADDITONAL TECHNICAL ISSUES:

<u>Antibiotics</u>

Given that there is serious concern about the use of antibiotics within food production and given the likelihood that antibiotic use on fruit and vegetables islikely to be banned in the coming years Apple and Pear Australia Limited argues that Biosecurity Australia should

a) Eliminate any orchards for the season that utilises an antibiotic spray within that year, or

b) Ensure that ALL fruit that is exported from a block/orchard to which the trees/fruit have been sprayed with an antiobiotic MUST be individually labelled that they have been treated in this manner.

Viable But Not Culturable (VBNC)

Apple and Pear Australia Limited contends that there is an ever increasing body of evidence that confirms that Erwinia amylovora

a) can exists in a Viable But Non-Culturable state.

b) can exist in a Viable But Non-Culturable state in the calyx of mature apples, and

c) can be transferred in mature apples,

d) in a Viable But Non-Culturable state can be returned to a culturable state, and

e) in a returned culturable state be transferred to living tissue.

Apple and Pear Australia Limited argues that Biosecurity Australia must give due recognition to the existence if Viable But Non-Culturable Erwinia amylovora. As a result Bisecurity Australia must develop appropriate measures for apple exports from New Zealand including:-

a) Pre harvest orchard inspection with the elimination of an orchards for the season with an outbreak of Fire Blight, and

b) Disease latency infection test on each lot before export to prove freedom from fire blight.

Insects

Apple and Pear Australia Limited argue that Mediterranean Fruit Fly must be treated as a real vector for fire blight and that this should alter the potential indirect impact.

Sanitation

Biosecurity Australia has reported that in fact 99% of the export fruit is treated using sanitation (meeting with Apple and Pear Australia Limited, 8th April 2011) which is in variance with the information supplied above by an unidentified officer of the New Zealand Ministry of Agriculture and Forestry.

The unidentified officer also indicates that sanitation is not required by some 65 markets to which New Zealand export so is there circumstances when sanitation is not used for those markets and then utilised only for those markets requiring such treatments?

The unidentified officer also indicates that sanitation is not required *"under the industry best practice guidelines or MAF Food Safety requirements".*

The unidentified officer also indicates that *"there is no absolute data available but the 80% of packing houses mentioned will process approximately 90% by volume of the exported fruit processed".*

Given these discrepancies in information Apple and Pear Australia Limited believes that there is uncertainty that all export fruit to would be sanitised. Biosecurity Australia must

a) **Revisit the aspect of sanitation to obtain a clear understanding of what is implement by ALL New Zealand packing facilities, and**

b) **implement a measure which at minimum ensures all fruit destined for Australia is sanitised and that the sanitation process is recorded and signed off by Australia AQIS auditors.**

Apple and Pear Australia Limited seeks clarification from Biosecurity Australia as to whether they have investigated the "*unidentified mycelia sterilia*" referred to by the scientists undertaking this work.

Apple and Pear Australia Limited also seeks clarification from Biosecurity Australia as to

a) how they will ensure that ALL wash water ALL of the time will be free of fungal pathogens, and

b) what tests will be undertaken on wash water, and

c) how regularly will they be taken, and

d) how the results will be recorded, and

e) who will audit those results, and

f) how will non conformance be dealt with?

If punctured fruit is found on inspection what action will be taken by AQIS and Biosecurity Australia?

Pollination

Can Biosecurity Australia confirm that "each continuous planting of a single variety of apple" is the case within each orchard block or variety block?

Can Biosecurity Australia confirm if within "each continuous planting of a single variety of apple" there are pollinators? If so are those pollinator's different varieties of apples? Is it possible these pollinators could be more susceptible to diseases like Fire Blight and that they could harbour these diseases?

Western Australia Codling Moth / Mealybug / Leafrollers

Apple and Pear Australia Limited agrees that the measures are acceptable for Mealybug and Leafrollers and for Codling moth (WA Only).

BUT Apple and Pear Australia Limited finds it totally unacceptable that the same or similar measures proposed for Coddling Moth into WA are not used for more destructive pests like Fire Blight, European Canker and Apple Leaf Curling Midge.

Economic Impact At National, Regional And Local

Apple and Pear Australia Limited argues that the economic impact at National, Regional and Local levels need to be adjusted to a high classification based on the known costs of eradication of the alleged Fire Blight outbreak (1997), Citrus Canker and Myrtle Rust.

Equivalence

Apple and Pear Australia Limited has detailed a number of examples of protocols/measures that have been implemented by New Zealand and/or Australia which represent appropriate 'equivalence' measures.

Apple and Pear Australia Limited contends that Biosecurity Australia has failed in its 'duty of care' in not considering and/or utilising some of the appropriate 'equivalent' measures.

PROCEDURAL FAIRNESS

In a recent response from Senator Ludwig, Minister for Agriculture, Fisheries and Forestry it has been reported that

> "*A full copy of the integrated fruit manual has not been provided to Biosecurity Australia by the New Zealand authorities. The relevant extracts of the Integrated Fruit Production manual as cited in the 'Draft report for the non-regulated analysis of existing policy for apples from New Zealand' (draft report) of 4 May 2011are enclosed."*

As Apple and Pear Australia Limited has no reason to doubt the accuracy of this statement it concludes that Biosecurity Australia has not in fact been supplied and/or cited a FULL copy of the New Zealand Pipfruit Integrated Fruit Production Manual and has only been given access to three pest/disease fact sheets.

If this in fact the case Biosecurity Australia has

a) given misleading information to stakeholders, and

b) failed in their 'duty of care' in preparing the Draft Report.

SCIENTIFIC PAPERS NOT CONSIDERED BY BIOSECURITY AUSTRALIA

Apple and Pear Australia Limited contends that there is a body of evidence in both a general sense and also related to Viable But Non-Culturable that Biosecurity Australia has failed to consider (as detailed within the releveant parts of this submission).

Biosecurity Australia has justified the decisions of the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" on the citing of 'new science' but it is obvious that not all new and available science has been considered.

Apple and Pear Australia Limited assumes that this material has been not cited because Biosecurity Australia has not been aware of the scientific papers and not because Biosecurity Australia has pre-determined the result.

SECTION A: WTO REQUIREMENTS

The World Trade Organisation (WTO) did not find that Australia's quarantine measures for apples for New Zealand were not scientifically justified.

It found that the 2006 Import Risk Analysis conducted by Biosecurity Australia did not provide sufficient scientific justification for Australia's quarantine measures because:

(a) some measures were supported by neither scientific evidence nor transparent reasoning expressed in the 2006 risk analysis; and

(b) there was a lack of transparency in the 2006 risk analysis in the way some events which were assessed as unlikely ever to occur were allocated a quantitative likelihood range of a uniform distribution of 0 – 10^{-6}.

The only adverse findings from the World Trade Organisation were that Australia's measures were maintained inconsistently with articles 5.1 and 5.2 of the SPS Agreement. These 2 articles are concerned with the standards for the conduct of risk analysis and not with the substance of the measures identified as required through conduct of such an analysis.

It is accepted that NZ will not question the way in which this outcome is reached or the lack of compliance with the SPS Agreement or the World Trade Organisation ruling.

This does not absolve Biosecurity Australia from its obligations and responsibilities in undertaking risk analysis to appropriate standards, including in accordance with our World Trade Organisation obligations. Apple and Pear Australia Limited's review concludes that the 2011 Review falls short of those standards – it is not supported by science or reasoning, is less transparent than the 2006 Analysis which it purportedly reviews and has consequently produced an arbitrary, irrational and unreasonable set of conclusions.

INTRODUCTION

Dr Colin Grant, Chief Executive of Biosecurity Australia indicated in their 'Advice 2010/38' that they were undertaking the commencement of a non-regulated analysis of existing policy for the importation of apples from New Zealand.

"This Biosecurity Australia Advice is to inform stakeholders of the commencement of a non-regulated analysis of existing policy (a review) for New Zealand apples to Australia. This review has been initiated in response to the final ruling by the World Trade Organization (WTO) regarding the validity of existing measures required for the import of New Zealand apples. Biosecurity Australia will prepare a draft report that will be circulated to stakeholders for comment.

The Biosecurity Australia Policy Memorandum 2007/07, of 27 March 2007, advised stakeholders (that) the Director of Animal and Plant Quarantine had determined a policy for the importation of apples from New Zealand subject to a range of phytosanitary measures to manage the risk of identified quarantine pests and diseases.

New Zealand considered the measures required for fire blight, European canker and apple leaf curling midge are inconsistent with Australia's international obligations under the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement). New Zealand referred the matter to the Dispute Settlement Body of the WTO on 6 December 2007 to seek a resolution of the dispute. A Panel was formed and, on 9 August 2010, ruled that Australia's phytosanitary measures for New Zealand apples were not justified.

Australia notified its intention to appeal the Panel's decision and the Appellate Body reported on 29 November 2010, reaffirming the Panel's rulings that Australia's phytosanitary measures for New Zealand apples are not justified. There are no further avenues for appeal. As a member of the WTO, Australia is obliged to implement the independent reports of the Panel and Appellate Body.

Biosecurity Australia will conduct a review of existing policy for New Zealand apples for the three pests at dispute to meet our international obligations and the requirements of the Australian Quarantine Act 1908 and relevant sub-ordinate legislation. The review will be conducted to the standard of an import risk analysis, will take into account the WTO decision, and will be issued as a draft report for stakeholder comment.

Following the completion of the comment period, Biosecurity Australia will consider all comments and publish a final report.

On the 4th May 2011 the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" was released for public comment.

Apple and Pear Australia Limited contend that:

- the decision to use a non-regulated analysis is inappropriate and against the requirements established by the WTO; and,
- the analysis does not meet Australia's Appropriate Level of Protection

Each of these is presented below.

IRA versus Non-regulated analysis.

Apple and Pear Australia Limited do not accept the decision of Biosecurity Australia to utilise a non-regulated analysis at this time in the process. We not that all past applications by New Zealand have been undertaken utilising an Import Risk Analysis (IRA) process and that Biosecurity Australia has provided no justification for moving from the IRA process to a non-regulated analysis.

In fact the action of Biosecurity Australia to undertake a non-regulated approach is in direct contradiction of the decision by the Australian Government and the ruling of the World Trade Organisation. This is because

> *"the Government announced that a science-based review of the import risk analysis for New Zealand apples would be conducted".*

The World Trade Organisation Panel in their report titled *"Australia – Measures affecting the importation of Apples from New Zealand: Report of the Panel"* (9^{th} August 2010) made the following conclusions and recommendations.

1. *For the reasons indicated in this report, the Panel has found that:*

   a) *There is no evidence that the process of selection and consultation of experts was conducted improperly, that due process in the expert consultation phase of these proceedings was compromised, nor that Australia's procedural rights were in any manner negatively affected in this regard;*

   b) *The 16 measures at issue in the current dispute, both as a whole and individually, constitute SPS measures within the meaning of Annex A(1) and are covered by the SPS Agreement;*

   c) *Australia's measures at issue regarding fire blight, European canker and ALCM, as well as the requirements identified by New Zealand as "general" measures that are linked to all three pests at issue in the present dispute, are inconsistent with Articles 5.1 and 5.2 of the SPS Agreement and, by implication, these requirements are also inconsistent with Article 2.2 of the SPS Agreement;*

   d) *New Zealand has failed to demonstrate that the measures at issue in the current dispute are inconsistent with Article 5.5 of the SPS Agreement and, consequentially, has also failed to demonstrate that these measures are inconsistent with Article 2.3 of the SPS Agreement;*

   e) *Australia's measures at issue regarding fire blight, European canker and ALCM, are inconsistent with Article 5.6 of the SPS Agreement; New Zealand has failed to demonstrate, however, that the requirements* *identified by New Zealand as "general" measures that are linked to all three pests at issue in the present dispute, are inconsistent with Article 5.6 of the SPS Agreement; and,*

f) New Zealand's claim under Annex C (1) (a) claim and its consequential claim under Article 8 of the SPS Agreement are outside of the Panel's terms of reference in this dispute.

2. Under Article 3.8 of the DSU, in cases where there is an infringement of the obligations assumed under a covered agreement, the action is considered prima facie to constitute a case of nullification or impairment. The Panel concludes that, to the extent that Australia's measures at issue regarding fire blight, European canker and ALCM, as well as the requirements identified by New Zealand as "general" measures that are linked to all three pests at issue in the present dispute, are inconsistent with the SPS Agreement, they have nullified or impaired benefits accruing to New Zealand under the WTO Agreements.

3. The Panel recommends that the Dispute Settlement Body request Australia to bring the inconsistent measures as listed above into conformity with its obligations under the SPS Agreement.

Apple and Pear Australia Limited contends that to this point the Australian Government and Government Agencies have failed to bring the *"* *inconsistent measures listed above into conformity with its obligations under the SPS Agreement* ***".***

Instead it appears that Biosecurity Australia has 'walked away' from this decision of the WTO panel and has turned to a more simplistic approach of using a 'non-regulated analysis' rather than repairing the IRA process, bring it into line with the SPS Agreement and then use the 'new IRA' to complete the process.

Apple and Pear Australia Limited believes that Australia has failed to act on the direction of the WTO Panel and in doing so has failed the Australian Apple and Pear Industry in its obligations to protect the industry from quarantineable pests and diseases.

The Appellate Body in their report titled "Australia – measures affecting the importation of apples from New Zealand: Report of the Appellate Body" (dated 29th November 2011) made the following findings and conclusions:-

1. For the reasons set out in this Report, the Appellate Body:

a) <u>upholds</u> the Panel's finding, in paragraphs 7.172 and 8.1(b) of the Panel Report, that the 16 measures at issue, both as a whole and individually, *constitute SPS measures within the meaning of Annex A(1) to the SPS Agreement;*

b) *upholds the Panel's finding, in paragraphs 7.906 and 8.1(c) of the Panel Report, that Australia's measures regarding fire blight and ALCM, as well as the general measures relating to these pests, are inconsistent with Articles 5.1 and 5.2 of the SPS Agreement, and that, by implication, these measures are also inconsistent with Article 2.2 of the SPS Agreement;*

c) *finds that Australia has not established that the Panel acted inconsistently with its duty to conduct an objective assessment of the matter before it, within the meaning of Article 11 of the DSU;*

d) *reverses the Panel's finding, in paragraphs 7.1403 and 8.1(e) of the Panel Report, that Australia's measures at issue regarding fire blight and ALCM are inconsistent with Article 5.6 of the SPS Agreement; but is unable to complete the legal analysis of New Zealand's claim under that provision; and*

e) *reverses the Panel's finding, in paragraphs 7.1477 and 8.1(f) of the Panel Report, that New Zealand's claim under Annex C (1) (a) and its consequential claim under Article 8 of the SPS Agreement fall outside the Panel's terms of reference; but finds that New Zealand has not established that the 16 measures at issue are inconsistent with Annex C (1) (a) and Article 8 of the SPS Agreement.*

2. *The Appellate Body recommends that the DSB request Australia to bring its measures, found in this Report and in the Panel Report as modified by this Report, to be inconsistent with the SPS Agreement, into conformity with its obligations under that Agreement.*

Apple and Pear Australia Limited again believes that Australia has failed to act on the direction of the World Trade Organisation Appellate Panel and in doing so has failed the Australian Apple and Pear Industry in its obligations to protect the industry from quarantineable pests and diseases.

The most damming responses by the World Trade Organisation Panel and the Appellate Panel were:-

> *"…..the IRA's evaluation of the potential consequences associated with the entry, establishment or spread of fire blight into Australia did not rely on adequate scientific evidence and, accordingly, was not coherent and objective. (page 74)*

And

“Because the Panel found that some of the individual likelihoods were flawed, it determined that the IRA's estimation of the overall probability of importation was not supported by adequate scientific evidence and, accordingly, was not coherent and objective.” (Page 73)

and

“In the light of the above, the Panel found that, with respect to its analysis of the fire blight risk, the "IRA is not a proper risk assessment within the meaning of Article 5.1 and paragraph 4 of Annex A to the SPS Agreement" (Page 74)

And

“In the light of the above, the Panel found that, with respect to its analysis of the ALCM risk, the IRA is not a proper risk assessment within the meaning of Article 5.1 and Annex A (4) to the SPS Agreement , and found, accordingly, that Australia's inspection and treatment requirements regarding ALCM on New Zealand apples are inconsistent with Articles 5.1, 5.2, and 2.2 of the SPS Agreement.”

and

“With respect to the general measures, the Panel also found that the IRA is not a proper risk assessment, "[c]onsidering the link in the IRA between the 'general' measures ... and the specific requirements regarding fire blight ... and ALCM, as well as the lack of any separate justification for these 'general' measures in the IRA ..."

Apple and Pear Australia Limited argues that this simple statement – “the IRA is not a proper risk assessment” which is utilised throughout the Panel and Appellate Reports is fundamental to rejecting past IRA’s undertaken by Biosecurity Australia.

Apple and Pear Australia Limited have consistently argued that past IRA processes and documents have not been *‘objective and coherent’* and would argue that the draft non-regulated document also fails to be ‘*objective and coherent’.*

Apple and Pear Australia Limited also argues that given that both the Panel and the Appellate Panels have assessed that “the IRA is not a proper risk assessment within the meaning of Article 5.1 and paragraph 4 of Annex A to the SPS Agreement” that the Australian Government and the Agencies MUST review and adjust the IRA process.

Given that Apple and Pear Australia Limited believes that the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" released in May 2011 again fails the tests applied by the WTO assessment and rulings in that it is not 'objective and coherent'.

APPROPRIATE LEVEL OF PROTECTION.

The Minister for Agriculture, Fisheries and Forestry in a media release dated the 24th June is reported to say that ***"Australia's biosecurity system is in place to protect Australian primary producers, and the environment, from pests and diseases".***

Apple and Pear Australia Limited believe that the Australian Government will fail to satisfy this requirement if they accept any biosecurity proposals based on the "Draft report for non-regulated analysis policy for apples from New Zealand.

Apple and Pear Australia Limited strongly believe that Australia's Appropriate Level of Protection has been severely compromised by the proposals within the "Draft report for non-regulated analysis policy for apples from New Zealand.

Biosecurity Australia has an obligation to uphold Australia's Appropriate Level Of Protection and to take a conservative position when faced with uncertainty or developing science.
The "Draft report for non-regulated analysis policy for apples from New Zealand" fails to do this as a whole and in particular in areas such as:-

- Viable But Not Culturable: Should be assumed to be a risk.
- Bio films: Should be assumed to be a risk.
- System Failure: It should be assumed that systems will fail.
- 'Clustering': It should be assumed that "clustering" will occur.

In considering Australia's Appropriate Level Of Protection it is important to review the decisions handed down by the World Trade Organisation Appellate Panel in relation to Section 5.6 of the SPS Agreement. The Appellate Panel stated that:-

> *"Under Article 5.6, in order to assess whether a significantly less trade-restrictive alternative measure that would meet the appropriate level of protection is available, we consider that a panel must identify both the level of protection that the importing Member has set as its appropriate level, and the level of protection that would be achieved by the alternative measure put forth by the complainant. Thereupon the panel will be able to make the requisite comparison between the level of protection that would be achieved by the alternative measure and the importing Member's appropriate level of protection."*

The Appellate Panel ruled in favour of Australia in relation to the alternative measures proposed by New Zealand:-

> "*For all these reasons, we consider that the Panel's approach to its analysis of New Zealand's Article 5.6 claim was in error. Because the Panel unduly relied on findings that it had made in reviewing the IRA under Article 5.1 and failed to find affirmatively that New Zealand's alternative measures would meet Australia's appropriate level of protection, the Panel's Article 5.6 finding lacks a proper legal basis. We therefore find that the Panel erred in concluding that New Zealand had raised a presumption that restricting imports of New Zealand apples to mature, symptomless apples was an alternative measure with respect to fire blight that would meet Australia's appropriate level of protection and erred in concluding that New Zealand had made a prima facie case that the inspection of a 600-fruit sample of each import lot would be an alternative measure with respect to ALCM that would meet Australia's appropriate level of protection."*

The expert members who gave evidence to the panel made the following assessments:-

Dr Deckers reported to the World Trade Organisation Panel that

> *"The limitation of apple exports to mature symptomless apples is not enough to achieve Australia's ALOP. Traceability of the fruits to the level of orchard where the apples have been produced is necessary for the risk evaluation in Australia. Fruits from heavy infected orchards or from orchards with hail damage can harbour the bacteria in the calyx end of the fruits".*

Dr Paulin reported to the World Trade Organisation Panel that:

> *"The restriction of export to mature symptomless apples would make even safer the different measures taken by Australia (disinfection, storage...), but could not replace any of them".*

Given these statements and the ruling of the World Trade Organisation Appellate Panel, Apple and Pear Australia limited finds no evidence and therefore no reason why Biosecurity Australia can establish a position contrary to the above rulings.

Protocols to ensure Australia's Appropriate Level Of Protection is achieved.

Biosecurity Australia has failed to recognise or identify all of the risks in relation to New Zealand apples. As such, the limited protocols that they have recommended are inadequate to ensure that Australia's Appropriate Level Of Protection is met.
As well as excluding identifiable risks in their risk assessment, Biosecurity Australia has also failed to take into account the practical shortcomings of systems to prevent incursions of pests and diseases.

These shortcomings MUST be addressed with the inclusion of the following protocols.

a. Third party audits to ensure that growers adhere to New Zealand's Integrated Fruit Production System.
b. Removal of orchards from export where the system has not prevented outbreaks of the identified pests and disease prior to harvest.
c. Implement a statistically acceptable inspection system to ensure that trash is excluded from cartons.
d. Ensure that the risks of VBNC are addressed by including the condition that fruit cannot be shipped until 6 weeks after harvest.

More detailed arguments in relation to rulings on Alternative Measures and their linkage to the Appropriate Level Of Protection are cover within Section C of this submission.

SECTION B: THE 2010 REVIEW METHOD

Biosecurity Australia has published a draft of its review of Australia's quarantine measures. The scope of that review is a reconsideration of the 2006 risk analysis. The Draft Report describes itself as:

> *"A science based review of the import risk analysis for New Zealand apples."*[14]

Through that review of the 2006 Analysis, the Draft Report proposes to change the assessments of unrestricted risk for the three pests in issue as follows:

Likelihood of entry, establishment and spread	**2006**	**2011**
- Fire Blight	Very low	Extremely low
- European canker	Low	Extremely low
- ALCM	High	Very low
Consequences – European canker	Moderate	Low
Unrestricted risk – whole of Australia		
- Fire Blight	Low	Very low
- European canker	Low	Negligible
- ALCM	Low	Negligible

As this submission demonstrates, there is no scientific evidence cited which could support any of those changes; and there is no reasoning contained in the Draft Report capable of supporting any of them.

Rather, the singular driver of the changed assessments of unrestricted risk of each of the pests is the change to a purely qualitative risk assessment method which uses a single wrapped up assessment of the likelihood of importation and of distribution of each pest in issue. In each case change to the assessed level of unrestricted risk derives solely from the method used to assess the likelihood of importation and distribution of the pest in Australia; and not from any change to the substantive assessments of those likelihoods.

The Draft Report, and Biosecurity Australia, are completely silent on any reason for that change in risk assessment method.

In the 2006 Analysis distribution had been addressed on the basis that distribution within Australia would vary widely between orchard wholesalers,

[14] Draft report paragraph 1.2.1.

urban wholesalers, retailers, food services and consumers; and that the assessment of the likelihood of distribution required consideration of the proximity of each of those distribution modalities to commercial fruit crops, nursery plants, household and garden plants and wild and amenity plants.[15]

The 2011 Review on the other hand allocates a simple, singular, qualitative descriptor to the likelihood of distribution of each pest. In doing so, the 2011 Review simply excludes from further consideration the differences in likelihood of distribution that flow from those various distribution modalities and their proximity to possible points of infection or infestation. The 2011 Review contains no scientific information and no reasoning which could support putting aside an analysis based on those different modalities and proximity points.

Further, the 2006 Analysis expressly addressed the increased likelihoods of distribution and establishment that flow from clustering. The 2011 Review ignores the issue.

The WTO's findings on the Uniform Distribution of $0 – 10^{-6}$ obviously required adjustments to the 2006 model – but provided no reason for its wholesale abandonment in favour of a significantly more opaque and arbitrary method of analysis.

Having adopted that approach to the assessments of likelihoods, Biosecurity Australia has adopted a set of decision rules[16], apparently without authority.[17]

In each case the changed assessments in the Draft Report of the probability of entry, establishment and spread of the pests in issue flows directly from one of those decision rules, the "*Matrix of rules for combining qualitative likelihoods*"[18] set out at table 2.2 on page 9 of the 2011 Review.

That change of method, combined with the complete absence of any discussion in the Draft Report or elsewhere of reasons for it, invites the inference that the method was chosen because it would produce the outcome. Consequently, without a cogent explanation for the change of method, any decision based on that changed method risks fundamentally undermining Australia's claim to have a science based system of risk analysis.

[15] See the analysis in the 2006 IRA at pages 80ff.

[16] See pages 8 and 9

[17] If a document containing such authority exists it is "operational information" within the meaning of s.8A of the *Freedom of Information Act 1982*. No such document has been published as required by that Act. Further, on 15 June 2011 Minter Ellison advised Hall & Wilcox that *"all relevant information is referenced within the draft report which is publicly available"*. No such document is referenced in the draft report.

[18] Table 2.2 on page 9.

Model Comparisons of values for entry, establishment and spread.

a. Use of Negligible.

Apple and Pear Australia Limited would argue that the criticism by the WTO of the semi quantitative model required Biosecurity Australia to review that analysis and make it more transparent. Instead the 'Draft report for the non-regulated analysis of existing policy for apples from New Zealand" has adopted a more opaque method of assessment which continues to conflate the assessment of events with negligible likelihoods with those that almost certainly would not occur.

The Appellate Panel report says (Page 108 – 109):-

> "…….*the Panel was correct in finding that the interval and distribution used in the IRA for "negligible" events were not appropriate for modelling events that almost certainly would not occur and that the methodological flaws were serious enough to constitute an independent basis for the IRA's invalidity"*
>
> *And*
>
> *"The Panel found that because of methodological flaws that magnify the risk assessed, the IRA is not a proper risk assessment within the meaning of Article 5.1 of the SPS Agreement. One of the two methodological flaws the Panel found concerns the IRA's choice of probability interval for events with a "negligible" likelihood of occurring. The Panel found that the choice of a probability interval of 0 to 10^{-6} for events with a "negligible" likelihood of occurring was not properly justified in the IRA and led to an overestimation of the probability of entry, establishment and spread of the pests at issue.*"
>
> *And*
>
> *"This, in our view, also demonstrates that, insofar as the methodological flaws in the IRA, and notably the choice of the probability interval of 0 to 10^{-6} for events with a negligible likelihood of occurring, magnify the risk assessed, the Panel correctly found that they constituted an independent basis for the inconsistency of Australia's SPS measures with Articles 5.1, 5.2, and 2.2 of the SPS Agreement."*

Apple and Pear Australia Limited would argue that the Risk Estimate Matrix used by Biosecurity Australia is flawed through the utilisation of a 'negligible' likelihood and consequence.

b. <u>Comparison of assessments from 2006 to 2011.</u>

In reviewing both documents the relevant tables relating to the summary of the unrestricted risks have been extracted and reviewed as shown below:-

Summary of the assessment of unrestricted risk of quarantine pests - 2006

Common name of pest	Annual probability of Entry, establishment and spread (PEES)	Consequences	Unrestricted annual risk	Assessment for Management Measures: YES/NO
Pests of concern to the whole of Australia				
Fire blight	Very low	High	Low	Yes
European Canker	Low	Moderate	Low	Yes
Apple Leaf Curling midge	High	Low	Low	Yes
Garden Featherfoot	Very low	Low	Negligible**	No
Grey-brown Cutworm	Low	Low	Very low**	No
Leafrollers	Low	Moderate	Low	Yes
Pests of concern to Western Australia*				
Apple scab	High	Moderate	Moderate	Yes
Codling moth	Low	Moderate	Low	Yes
Mealybugs	Moderate	Low	Low	Yes
Oriental fruit Moth	Very low	Moderate	Very low**	No
Oystershell Scale	Very low	Low Negligible**		No

*Western Australia has a pest and disease status that, in some respects, is different from other areas of Australia. This regional freedom from pests or diseases that might already be present in other locations in Australia is recognised in the risk assessment.
**at or below Australia's ALOP.

Summary of the assessment of unrestricted risk for quarantine pests - 2011

Pest	**Unrestricted risk**	**Additional Measures Required** `
2011 Non-regulated analysis		
Fire blight (*Erwinia amylovora*)	Very Low	N

European canker (*Neonectria ditissima*)	Negligible	N
Apple leaf curling midge (*Dasineura mali*)	Negligible	N
2006 Final IRA report		
Garden featherfoot (*Stathmopoda horticola*)	Negligible	N
Grey-brown cutworm (*Graphania mutans*)	Very low	N
Leafrollers:	Low	Y
Brownheaded leafroller (*Ctenopseustis herana*)		
Brownheaded leafroller (*Ctenopseustis obliquana*)		
Greenheaded leafroller (*Planotortrix excessana*)		
Greenheaded leafroller (*Planotortrix octo*)		
Native leafroller (*Pyrogotis plagiatana*)		
Apple scab (*Venturia inaequalis*) (WA only)	Moderate	N*
Codling moth (*Cydia pomonella*) (WA only)	Low	Y
Mealybugs:	Low	Y
Citrophilus mealybug (*Pseudococcus calceolariae*) (WA only)		
Mealybug (*Planococcus mali*) (WA only)		
Oriental fruit moth (*Grapholita molesta*)	Very low	N
(WA only)		
Oystershell scale (*Diaspidiotus ostreaformis*)	Negligible	N
(WA only)		

*Subsequent to the release of the release of the *Final Import Risk Analysis Report for Apples from New Zealand* in November 2006, *Venturia inaequalis* has been detected in Western Australia and is no longer considered a regional quarantine pest. Quarantine measures are therefore not required.

In summary

- Fire Blight has moved from LOW to VERY LOW
- European Canker from LOW to NEGLIGIBLE
- Apple Leaf Curling Midge from LOW to NEGLIGIBLE

An assessment of the areas in which those risk assessments have changed between the 2006 and 2011 Reviews is presented below:

Fire Blight

Table 4.2 Probability of entry, establishment, and spread for *Erwinia amylovora* *(Table 4.2, 2011)*

Importation	Distribution	Entry	Establishment	Spread	PEES*
Moderate	Extremely Low	Extremely Low	High	High	Extremely low

*Probability of entry, establishment and spread.

Impact scores for *E. amylovora*

Direct impact	**Impact scores** **2011**	 **2006**
Plant life or health	F	F
Human life or health	-	A
Any other aspects of the environment	A	A
Indirect impact		
Control or eradication	E	E
Domestic trade or industry	E	E
International trade	A	D
Environment	A	A
Communities	-	D

Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix shown in Table 2.5 on page 12.

Unrestricted risk estimate for *Erwinia amylovora*	***2011***	***2006***
Overall probability of entry, establishment and spread:	Extremely low	Very Low
Consequences:	High	High
Unrestricted risk:	Very Low	Low

Biosecurity Australia has indicated, the unrestricted risk for *Erwinia amylovora* has now been assessed as "very low", which achieves Australia's ALOP. Therefore, additional risk management measures are not recommended by Biosecurity Australia for this pest.

<u>Apple Leaf Curling Midge.</u>

Probability of entry, establishment, and spread for *Dasineura mali (Table 4.3, 2011)*

Importation	**Distribution**	**Entry**	**Establishment**	**Spread**	**PEES***
Moderate	Very Low	Very Low	Moderate	Moderate	Very Low

*Probability of entry, establishment and spread.

Impact scores for *Dasineura mali*

Direct impact	**Impact scores**	
	2011	**2006**
Plant life or health	D	D
Human life or health	-	A
Any other aspects of the environment	A	A
Indirect impact		
Control or eradication	D	D
Domestic trade or industry	D	D
International trade	D	D
Environment	B	B
Communities	-	B

Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix.

Unrestricted risk estimate for *Dasineura mali*	***2011***	***2006***
Overall probability of entry, establishment and spread:	Very low	High
Consequences:	Low	Low
Unrestricted risk:	Negligible	Low

Biosecurity Australia has indicated, the unrestricted risk for *Dasineura mali* has now been assessed as "negligible", which achieves Australia's ALOP. Therefore, additional risk management measures are not recommended by Biosecurity Australia for this pest.

European Canker

Probability of entry, establishment, and spread for *Neonectria ditissima (Table 4.4, 2011)*

Importation	**Distribution**	**Entry**	**Establishment**	**Spread**	**PEES***
Very Low	Very Low	Extremely Low	Moderate	Moderate	Extremely Low

*Probability of entry, establishment and spread.

Impact scores for *Neonectria ditissima*

Direct impact	**Impact Scores**	
	2011	**2006**
Plant life or health	D	E
Human life or health	-	A
Any other aspects of the environment	C	D
Indirect impact		
Control or eradication	D	D
Domestic trade or industry	D	D
International trade	A	B
Environment	B	C
Communities	-	C

Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix.

Unrestricted risk estimate for *Neonectria ditissima*	***2011***	***2006***
Overall probability of entry, establishment and spread:	Extremely Low	Low
Consequences:	Low	Moderate
Unrestricted risk:	Negligible	Low

As indicated, the unrestricted risk estimate for *N. ditissima* has been assessed by Biosecurity Australia as “negligible”, which now achieves Australia’s ALOP. Therefore, additional risk management measures are not recommended by Biosecurity Australia for this pest.

SECTION C: SCIENCE

Apple and Pear Australia Limited have undertaken an analysis of the additional science referenced in the 2011 analysis compared to the previous Import Risk Analysis. As it is obvious that the conclusions and protocols in the 2011 report vary significantly from the 2006 report, the reasons should be identifiable. As risk analysis have to be science based under the World Trade Organisation agreements, the new science supporting any changes should be identifiable.

Apple and Pear Australia Limited's analysis of the additional science referenced in the 2011 report clearly shows that while the science indicates that the bacterial disease, Fire Blight, can be more unpredictable or take on new forms, there is no new science to indicate that it is less dangerous than previously concluded or more manageable than previously concluded. This is similarly the case with European canker and Apple Leaf Curling Midge.

Rather, as set out above the changes in 2011 flow not from new science or new analysis but rather from an unexplained and unjustified change to risk analysis methodology.

NEW REFERENCES WITHIN THE DRAFT REPORT: DATED 2007 THROUGH TO 2011

Given that Department of Agriculture, Fisheries and Forestry handed down their final report in 2006 it was felt that any reference within the current draft document date 2007 to 2011 would be considered as new information. Apple and Pear Australia Limited have sourced all the references within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" during that period have now collated all of those as new references.

All those references are listed within Appendix A of this submission.

Apple and Pear Australia have categorised each of them in the following way:-

- ***General information with no new science.***

- ***New scientific reference for review.***

- ***Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science.***

- ***Expert comment in the proceedings of the Panel's meeting with the experts: Australia – measures affecting the importation of apples from New Zealand. World Trade Organization WT/DS367/12 but no new science.***

Those classified as 'new scientific reference for review' have been extracted and place in Appendix B and the appropriate scientific papers reviewed and the comments are detailed within the body of this submission.

This material could be considered as 'NEW SCIENCE" in relation to the Import Risk Analysis being undertaken by Biosecurity Australia.

Apple and Pear Australia Limited has not specifically commented on each and every one of the new reference in the document but has reviewed each of the scientific papers and drawn the appropriate and relevant conclusions from these papers.

In considering the science Apple and Pear Australia Limited has considered a number of specific aspects including:-

- Maturity
- Symptomless
- Severity
- Extreme events
- Pathogenicity/Strains

In addition Apple and Pear Australia Limited have considered the individual pests/disease in some detail:-

- Fire Blight
- European Canker
- Apple Leaf Curling Midge.

Maturity

One of the measures proposed by New Zealand and supposedly accepted by Biosecurity Australia is "*that mature, symptomless apples do not provide a pathway for transmitting fire blight, and that, therefore, the risk that mature, symptomless apples would transmit fire blight is negligible".*
One of the important aspects of this is defining what constitutes 'mature' apples.

In 1996 it was recorded that

"Commercial maturity indicates the quality of fruit for eating whereas physiological maturity may not. For fruit to be physiologically mature they must be able to continue ontogeny even if detached from the plant:

And

*Physiological maturity becomes important if fruit are to be stored as picking prior to the climacteric is desirable". (*Mills, T, 1996)

This was also dealt with as part of the WTO panel investigations through the following question

"Is there a commonly accepted definition or criterion (biological, physiological, commercial, etc.) for determining if an apple fruit is mature? Is there a distinction between physiological and commercial maturity?"

Dr Deckers responded by saying the following:-

*"Yes, the final picking date is determined by the evolution of different fruit maturity factors like starch degradation in the fruits, fruit firmness, fruit colour (red colour formation or the green background colour development) and the soluble solids (Brix). These different parameters are related to each other and should reach at the beginning of harvest specific and variety dependent values. These values can be put into a formula in order to calculate the so called maturity index or Streif index where the formula is F/(R*S). For each variety there is a maturity index on which the harvest would start and a maturity index at which the harvest would end. Fruits are harvested in the preclimacteric phase and in fact fruits are mostly harvested as immature fruits that still have a good storage capacity. The fruits should be ripe at the time of the final consumption with a full development of the flavour at fruit maturity."*

Dr Latorre responded by saying the following:-

"Physiologically, apple fruits are mature (physiological maturity) at the stage of development when fruits will continue ontogeny even if detached. Commercial maturity indicates the stage when fruits have developed all their qualities (attributes) and are ready to eat. Therefore physiological and commercial maturity are not synonyms.

Yes, there is an accepted criterion to determine apple maturity, which can be determined on the basis of starch content, firmness, juice sugar and acid content, seed color, flesh color, background color, and internal ethylene concentration. For the best storage results, apples must be harvested at their physiological maturity, just before the onset of the climacteric rise (commercial maturity). Although the best way to determine the optimal harvest period is by monitoring the respiration rate, in practice, this is estimated by the starch content (iodine index), background color, solid solubles, and/or firmness. These maturity indices have been adjusted to reflect the particularities of the main apple cultivars. In addition, days after full bloom can be used as a general guide to estimate fruit maturity."

Dr Paulin responded by saying the following:-

> *"There are* *several* *accepted definitions and criteria for determining if an apple is mature. Several simple tests exist (such as starch hydrolysis, as detected on halves of fruit by the iodine reaction, which allows the determination of a maturity stage). Maturity itself can be defined in relation with cropping-time (to determine when a fruit is best picked up), or with trade (when the fruit can be best shipped and sold), organoleptic (when the fruits are at their optimal eating quality). All these correspond to different stages of physiological maturity. Usually, for apple, the commercial maturity occurs before the optimal physiological maturity (stage where the fruit is at its best flavour and taste quality, before decaying)".*

Dr Schrader responded by saying the following:

> *"A commonly accepted definition or criterion for determining if an apple fruit is mature is the Streifindex. According to this method developed by Dr Streif, the degradation of starch (determined with Lugol's solution), the firmness of fruit flesh and the content of sugar is combined ([firmness/ (percentage soluble solids concentration x starch index)]. The practical utility of the Streifindex method lies in the ease with which apple fruit maturity at harvest can be evaluated for its suitability for long-term storage (e.g. Delong, J. M., Prange, R. K., Harrison, P. A., Schofield, R. A., Deell, J. R, 1999, "Using the Streif Index as a final harvest window for controlled-atmosphere storage of apples", Hort Science 34 (7), pp. 1171-1191 (26 ref.), pp. 1251-1255)".*

Dr Swinburne responded by saying the following:

> *"The term "mature fruit" used in the context of both FWS appears to refer to the stage at which fruit is ready to be picked, not to any subsequent ripening process".*
>
> And
>
> *"The physiological processes involved in the ripening of fruit such as apple are well understood and consist of a number of stages, beginning with the appropriate time to harvest. The optimum time of picking is generally judged to be when the fruit have achieved maximum colour and can be readily detached (abscission layer formation), perhaps augmented by using an iodine test to ascertain when starch has largely disappeared (converted to sugar). Fruit at this stage can be referred to as "mature", however with many cultivars this would not be commensurate with optimum eating quality as the ripening process would still be incomplete. Moreover, fruit of many cultivars at this stage retain a measure of resistance to fungi responsible for rotting.*
>
> And
>
> *"Apples, along with other fruit such as banana, undergo major changes post-harvest, characterised by the onset of an increase in respiration (the climacteric), triggered by the production of the hormone ethylene in the form of a diffusible gas. At this time cell walls start to become softened, the levels*

of soluble sugars increases whilst those of acids decrease. Volatile compounds associated with flavour are at their highest levels following the climacteric. This is the optimum stage for eating (ripe), both for flavour and texture, but perhaps rarely achieved in commerce. The onset of the climacteric can also herald an increase in susceptibility to rotting by a number of fungal pathogens, including N. Galligena."

And

"In the following stage respiration rates steadily diminish and wall softening continues leading to loss of texture. Acids and volatiles also decline, adversely affecting flavour and the fruits lapse into senescence (over-ripe) and become unmarketable. Fruit frequently reaches this later stage in the domestic environment (i.e. after retail sale").

And

"Post harvest technologies are designed to extend the marketing period of fruit. Of these the most obvious is cold storage, which reduces respiration rates at all stages. More sophisticated methods have in addition the aim of reducing the availability of oxygen within the store, either by simply sealing the chamber to exhaust supply, or by flushing with nitrogen. These affect both pre- and post climacteric changes. Scrubbing the atmosphere of ethylene delays the onset of the climacteric. The degree of sophistication applied to store conditions is usually in accordance with plans for marketing, the most complex being reserved for the longest held".

And

"*In commerce fruit is usually sent to market in a continuous stream following harvest, subject to quality controls imposed by either the buyer (e.g. supermarket chains), and/or the producer. This will involve storage periods of varying length. Thus it is to be expected that fruit shipped from New Zealand to Australia would span the physiological stages outlined above from harvestable maturity up to the point where the eating quality drops below the demands of the consumer".*

In reviewing the information supplied by the WTO Panel experts there are some areas of agreement but also there are some areas of divergence. These are detailed as follows:-

- *Fruits are harvested in the preclimacteric phase and in fact fruits are mostly harvested as immature fruits that still have a good storage capacity. The fruits should be ripe at the time of the final consumption with a full development of the flavour at fruit maturity.*

- *"Physiologically, apple fruits are mature (physiological maturity) at the stage of development when fruits will continue ontogeny even if detached.*

- *Commercial maturity indicates the stage when fruits have developed all their qualities (attributes) and are ready to eat.*

- *Therefore physiological and commercial maturity are not synonyms.*

- *For the best storage results, apples must be harvested at their physiological maturity, just before the onset of the climacteric rise (commercial maturity).*

- *Maturity itself can be defined in relation with cropping-time (to determine when a fruit is best picked up), or with trade (when the fruit can be best shipped and sold), organoleptic (when the fruits are at their optimal eating quality). All these correspond to different stages of physiological maturity.*

- *Usually, for apple, the commercial maturity occurs before the optimal physiological maturity (stage where the fruit is at its best flavour and taste quality, before decaying).*

- *The practical utility of the Streifindex method lies in the ease with which apple fruit maturity at harvest can be evaluated for its suitability for long-term storage.*

- *The optimum time of picking is generally judged to be when the fruit have achieved maximum colour and can be readily detached (abscission layer formation), perhaps augmented by using an iodine test to ascertain when starch has largely disappeared (converted to sugar). Fruit at this stage can be referred to as "mature", however with many cultivars this would not be commensurate with optimum eating quality as the ripening process would still be incomplete.*

- *"Apples, along with other fruit such as banana, undergo major changes post-harvest, characterised by the onset of an increase in respiration (the climacteric), triggered by the production of the hormone ethylene in the form of a diffusible gas.*

- *"Post harvest technologies are designed to extend the marketing period of fruit. ……….. These affect both pre- and post climacteric changes".*

- *In commerce fruit is usually sent to market in a continuous stream following harvest, subject to quality controls imposed by either the buyer (e.g. supermarket chains), and/or the producer. This will involve storage periods of varying length.*

- *"Thus it is to be expected that fruit shipped from New Zealand to Australia would span the physiological stages outlined above from harvestable maturity up to the point where the eating quality drops below the demands of the consumer".*

Dr Deckers was recorded as saying that

> *"Bacterial ooze formulation does not occur on mature apple fruits because the amylum which is present in the immature fruit allows a rapid multiplication of*

the EA bacteria. The mature fruits don't contain amylum because the amylum is transferred into sugars during the maturation process".

Apple and Pear Australia Limited believes that what this process means is that the amylum – starch – which is carbohydrate is an important part of the food source for the rapid multiplication of the Erwinia amylovora bacteria. When an apple is fully mature – that is all the amylum has transferred fully to sugars - there is no food source for the bacteria.

The aspects of this science which has not been questioned are

a) **At what stage does the fruit become fully mature – no starch but all sugar?**
b) **While there is amylum in the apple is there the opportunity for the bacteria to multiply?**
c) **Is the minimum level of amylum at which the bacteria will not replicate? If so what is that level.**

Apple maturity is undertaken using a Starch – Iodine test and low numbers indicate lots of starch. In many countries apples for long term storage are harvested when the starch removal score is 3 to 4. Ripe fruit ready to eat, too ripe for long term storage will score between 5 and 7.

For fruit that is harvested for long term storage the apples having a starch index of 3 to 4 are in fact not truly mature in the sense of starch to sugar measure. While they might be 'mature' for the purposes of export and sale they are still 'immature' in relation to the potential of disease infection and bacterial multiplication.

Apple and Pear Australia Limited believe Biosecurity Australia has not considered the relationship between varying levels of maturity and disease formation and multiplication. The science has not been tested and should be tested before any export of fruit from New Zealand is commenced.

To ensure that New Zealand fruit is truly mature, only fruit with nil starch index should be exported to Australia.

The assumption that 'mature' fruit is free of bacteria is not proven by the science.

What is obvious is that

a) There are different forms of maturity – '*physiological and commercial'*
b) There is a difference of opinion as to which comes first.
c) There are different stages of physiological Maturity
    - *cropping-time (to determine when a fruit is best picked up),*
    - *trade (when the fruit can be best shipped and sold),*
    - *organoleptic (when the fruits are at their optimal eating quality).*

d) At different maturity levels there are different susceptibility to pests and diseases

Apple and Pear Australia Limited would argue that Biosecurity Australia

a) Has not defined what Maturity means;

b) Has not defined what maturity is being used by New Zealand in the context of their proposed measure;

c) How the agreed 'maturity' will be measured;

d) Has not considered and investigated the different maturity ratings, particularly in relation to amlyum, against the susceptibility to infection and multiplication of diseases like Fire Blight;

e) Detailed the different maturity definitions for each variety to be exported by New Zealand;

f) Determined and detail how the variance in maturity across a season will be dealt with;

g) What science is being used to support the New Zealand measure?

As a result Apple and Pear Australia Limited requires Biosecurity Australia to detail aspects related to all of these issues above and that information must be forwarded to the stakeholders for further consideration.

<u>Symptomless</u>

One of the measures proposed by New Zealand and supposedly accepted by Biosecurity Australia is "*that mature, symptomless apples do not provide a pathway for transmitting fire blight, and that, therefore, the risk that mature, symptomless apples would transmit fire blight is negligible".*

One of the important aspects of this is defining what constitutes 'symptomless' apples and how this aspect of the measure is scientifically supported and meets Australia's Appropriate Level of Protection.

Dr Deckers reported:

> "*Class 1 export quality apples are mature apple fruit free of trash and the notion mature symptomless apples corresponds in fact to the same".*

Dr Latorre reported:

"Class 1 export-quality apples = Mature apple fruits, harvested at physiological maturity, that comply with the specification established for Class 1, e.g., as indicated in Exhibit NZ-93.

And

"Mature symptomless apples = apples that are visually (externally) healthy (asymptomatic) and have been harvested at physiological maturity, estimated by the use of one or more maturity indices".

Dr Paulin reported:

"*The category "class 1 export quality apple", as defined in the NZ 93 includes in its definition "mature apple fruits free of trash". …….. Again, "mature symptomless apples", are included in the category "class 1 export quality apples" which describes safely apples for export to Australia: it excludes fruits with symptoms (whatever they are), immature fruits, and trashes. These last items are not supposed to be exported under this category.*

Given the input from the experts Apple and Pear Australia Limited would believe that Biosecurity Australia has adopted the following definition

"***Mature symptomless apples = apples that are visually (externally) healthy (asymptomatic) and have been harvested at physiological maturity, estimated by the use of one or more maturity indices".***

Dr Paulin in addressing the issue of "Mature symptomless apples" made the *following comments:-*

*"Mature: Indicates that fruits have completed their development on trees, and therefore that they were not infected at an early stage (otherwise they would not achieve this development up to the mature stage). Mature fruits are recognized as resistant to infection: they do not develop symptoms if inoculated**,** because they do not allow the multiplication of bacteria.*

Symptomless means that they show no fire blight (or other disease) symptoms: this eliminates infected fruits issued from early infections.

Both these measures are actually necessary to eliminate the more evident risks of transfer of the bacteria with fruit. It decreases the risk drastically in eliminating the opportunities of carrying high population of E. amylovora which are associated with tissues harbouring progressive infection, for example in immature fruits. Nevertheless it cannot be considered as eliminating absolutely the risk of introduction of low (external) bacterial populations associated with fruits. It can then be considered to decrease the likelihood for entry of the bacteria with fruits from very low to extremely low, in the ALOP.

> *The restriction of export to mature symptomless apples would make even safer the different measures taken by Australia (disinfection, storage...), but could not replace any of them".*

Dr Deckers reported that

> *"Mature symptomless apple fruits coming from heavily infected orchards can harbour an epiphytic population of EA bacteria in their calyx end or as bacterial ooze sticked on the fruit skin and dried out".*

From the information it is obvious that the only test for 'symptomless' is an external visual inspection by any party throughout the process. There is no

a) Internal inspection
b) Plating for diseases either using internal tissue and/or the calyx.

As a result there are no scientific assessment(s) and/or test(s) undertaken to show that 'symptomless' fruit inspected internally are truly 'symptomless'

If as detailed above in the section on maturity that there are unanswered questions relating to the relationship between maturity indices and disease infection and multiplication then the whole process of mature fruit being symptomless is also bought into question. Particularly given the fact that "*both these measures are actually necessary to <u>eliminate the more evident</u> risks of transfer of the bacteria with fruit".*

Further the scientific experts indicate that mature symptomless are measures that "*cannot be considered as eliminating absolutely the risk of introduction of low (external) bacterial populations associated with fruits".*

Apple and Pear Australia Limited would argue that additional measures need to be implemented over and above the external visual inspection and that they include:-

a) Internal inspection

b) Plating for diseases either using internal tissue and/or the calyx.

<u>Severity</u>
In the "draft report for the non-regulated analysis of existing policy for apples from New Zealand" Biosecurity Australia indicates that

> "*There has been no reported severe outbreak of fire blight since 1998 even though computer models predict infective events each year in New Zealand as evidenced by the continued use of sprays to manage fire blight. It is most likely the level of E. amylovora infection in commercial orchards, as reported from the 1990‟s, is lower as a result of the full adoption of the IFP program and in particular the targeted management of fire blight and improved prediction methods".*

There are a number of points of clarity that are required including what is defined as ‘severity’.

Biosecurity Australia report that from their verification visit in March 2011 the following assessment:-

> *“In considering those orchards where either a low incidence of fire blight symptoms were observed or which had a history of some fire blight infection, orchard managers described a “severe” incidence as an average of around one strike per tree. During the verification visit some trees were observed as having multiple strikes, though the adjacent trees were seen to have either one strike or no strikes”.*

It is worth noting that the Biosecurity Australia visit was in March 2011 being in the middle of harvest and they were still able to observe trees with one or more Fire Blight strikes. If the ‘standard orchard practices’ were being implemented then one would have assumed there would be not Fire Blight strikes at this time of the production cycle.

Within Annex 1: “Japan – measures affecting the importation of apples (WT/DS245) recourse to article of the DSU by the United Sates” (WT/DS245/RW) there is consideration by the Panel of Experts as to what ‘severe’ might mean.

Dr Chris Hale (from New Zealand) (Page 140) made the following statement:-

> “*Just to say a word about severely blighted orchards. By whatever definition, I think a severely blighted orchard would need very little inspection, unless a severely blighted orchard was defines as one which had any infection at all”.*

Under questioning, Dr Geider (Expert from Germany) (Page 157) made the following response:-

> *“there should be no severely blighted commercial orchards. In that case the orchard is not suited for fruit production and the trees have to be removed. An orchard with one fire blight strike – is a blighted orchard and should be handled with care for fruit trade to fire blight free countries”.*

Dr Smith was then reported to say that:-

> *“There is no firm scientific basis for deciding where to set the limit between severe and light infection”.*

Dr Hayward (an expert from Australia) (Page 158) said that

> *“I think my answer to (b) would be similar to Dr Smith’s in that I am not very happy about sourcing fruit from a severely blighted orchard…..”*

Dr Hale then reported that

> *"the only extra information I can add is that in work that I did with Professor Sherman Thomson in 1987, shows that we did harvest some fruit from an orchard which was severely infected. The only bacteria that we found associated with that fruit was in the calyx end of the fruit….."*

Dr Hayward (Page 166) made the following comment/question:-

> *"It's a matter of definition how to define a severely blighted orchard. Does this mean every tree with 75 strikes per tree or does it mean an orchard in which there are some trees which have 75 strikes per tree?'*

Dr Hale responded by saying:

> *"Can I give a quick answer to that as I am probably the culprit at suggesting that a severely blighted orchard had 75 plus strikes on average, 75 plus strikes per tree. I would blame my colleague, Professor Sherman Thomson actually for coming up with that, but because I was the senior author on the paper it's been put down to me. It was a definition that we came up with for the purposes of our work just to show a relative sort of figure. It isn't really a definition at all, so we don't want to get hung up on that situation".*

What this highlights is that the experts on Fire Blight cannot reach consensus as to what the definition of severe' is and there is "*no firm scientific basis for deciding where to set the limit between severe and light infection".*

In conclusion Apple and Pear Australia Limited would argue that Biosecurity Australia should adopt the definition of *a "severe" incidence as an average of around one strike per tree".*

<u>Extreme events.</u>
The aspect of extreme weather events and also the changing climatic conditions as a result of climate change have not been given due consideration by Biosecurity Australia in this process.

Dr Deckers reported that

> *"There are circumstances that can increase the epiphytical presence of the EA bacteria on the apple fruits. This will happen when there is an important hail damage on the immature fruits in an orchard which can result in an important increase of the bacterial inoculums in the orchard with ooze formation on the immature fruits on the hail wounds, and the build up of an important epiphytical population of Erwinia bacteria on healthy looking mature fruits at the end of the season".*

Without looking at the national weather details there are enough examples of extreme conditions within New Zealand and in particular around Hawkes Bay and Nelson. From media reports alone there have been some major extreme weather conditions in both regions over the past decade.

The following are a list of Hail events have been recorded within the New Zealand media in the major apple growing regions of New Zealand over the past decade:

Hawkes Bay:	April 2004 October 2004 November 2009 September 2010 October 2010
Nelson:	September 2003 January 2005 January 2009 May 2009 December 2009 March 2011

Assessment of the New Zealand weather data will give detail of hail that may have fallen but not resulted in major damage/loss and therefore not recorded in the media.

What the above information does highlight is that over the past nine years there have been major hail events in one or both of the regions in three or 4 of those years.
In addition the hail has come at varying times throughout the production – growing and harvesting – periods.

There has been no assessment by MAF New Zealand or the industry to record the affect that these and other events have on the impact of Fire Blight infection/infestation within relevant orchards and/or regions.

Moreover, the severity and frequency of hail and extreme weather events are likely to be strengthened over time with climate change. Biosecurity Australia has failed to incorporate any assessment of the impact of climate change on the incidence and impact of Fire Blight. An analysis of this type is warranted and should precede the importation of apples from New Zealand into Australia.

<u>Pathogenecity/Strains</u>

One aspect that has not been detailed by Biosecurity Australia throughout the whole process is what specific stain or strains of Erwinia amylovora are in existence in New Zealand and those most likely to be transmitted to Australia. More specifically what specific major classification are the strain(s).

Pathogenicity in *E. amylovora* has been studied and several key factors have been identified. One critical factor essential for pathogenesis is the production of extracellular polysaccharides. For example, amylovoran is a major component of ooze produced by *E. amylovora* and contributes to bacterial movement in planta (Lee *et al*, 2010).
Studies have resulted in the development of three major classifications of *E. amylovora* strains: *Maloideae*, *Rubus* and *'Hokkaido'*. In addition, variations in aggressiveness among strains of *E. amylovora* have been observed (Lee et al, 2010).

Recently a new strain *E. amylovora* strain HKN06P1was isolated during the course of routine diagnostic processing of samples submitted to The Pennsylvania State Fruit Research and Extension Center in Biglerville, PA, USA. HKN06P1 caused significantly greater disease severity than the benchmark *E. amylovora* isolate Ea581a at both 7 and 15 dpi on 3-years-old, orchard-grown trees.
In experiments HKN06P1 produced the most biofilm. Amylovoran and levan are two major polysaccharides produced by *E. amylovora*, and they contribute to E. amylovora pathogenicity and a major component of biofilm aggregates. *E. amylovora* strain HKN06P1 produced significantly more amylovoran than other strains.

Growth in immature fruit was the single most important virulence characteristic accounting for disease severity in apple trees. This means that growth in immature apple fruit is a robust indicator of E. amylovora virulence in apple trees (Lee *et al*, 2010).

The research concluded that "***E. amylovora*** *strain HKN06P1 produced the greatest disease severity in every virulence assay used in this study. In fact, in the present study, HKN06P1 was more virulent even than E2002a and E4001a, two exceptionally virulent* ***E. amylovora*** *strains described in the literature. HKN06P1 also produced the most rapid disease incidence in immature apple fruit (Fig. 3B). As an example of an exceptionally virulent strain, HKN06P1 could serve as a useful tool for the understanding of the control of* ***E. amylovora*** *virulence. It would be interesting to determine whether the strong virulence of HKN06P1 incurs a fitness cost in the field, or whether strains like HKN06P1 would be expected to dominate the* ***E. amylovora*** *population over time".(Lee et al, 2010)*

This research highlights the important need to understand what strains exist within New Zealand. Biosecurity Australia must provide documentation as to whether the New Zealand strains are highly virulent or not and provide evidence to that effect.

This research also highlights the varying virulent aspects within immature fruit and therefore the establishment of where fruit stops being immature and becomes mature is integral to the process given that Biosecurity Australia has accepted that mature apples do not transmit *E. amylovora.*

New Science in relation to specific pests and diseases

This section addresses the new science in relation to:

Fire Blight
European Canker
Apple Leaf Curling Midge

FIRE BLIGHT – Erwinia amylovora

The change in the 2011 Review's assessed unrestricted risk of fire blight from low to very low arises solely from the assessed change in the likelihood of entry, establishment and spread of that pest. The assessment that the likelihood of entry, establishment or spread will change is not based on any scientific information cited in the 2011 Review and there is no reasoning set out in the 2011 Review which supports that change. Rather that changed assessment of the likelihood of importation, establishment and spread arises from the abandonment of the semi-quantitative method of risk analysis used in the 2006 IRA and its replacement by the qualitative method with the decision rules set out at page 9 of the 2011 Review.

Thus in 2006 the IRA assessed that 3.9% of all apples imported from New Zealand would be infested with the fire blight bacteria. There is no scientific information and no reasoning in the 2011 Review which questions that conclusion. Rather the 2011 Review concludes:

> *"In summary, considering a significant volume of trade, the evidence shows that E. amylovora has the potential to be associated with fruit from major export areas in New Zealand, but that the proportion of infested fruit will be small and the bacterial populations in low numbers per fruit."*

That reasoning can only rationally support the conclusion that "the event [that is the importation of the pest] would be very likely to occur". An accurate application of the decision rules set out on pages 8 and 9 of the 2011 Review would result in the allocation of a qualitative likelihood of "high" to the importation of fire blight. The statement in the 2011 Review that "the evidence supports a rating of "moderate" for the importation of *E. amylovora* is irrational and unreasonable.

The primary driver of the change in the assessed risk of fire blight is the use of the qualitative assessment that the likelihood of distribution of the pest in Australia is extremely low in 2011.

The analysis, purportedly reviewed in 2011, which was undertaken in 2006 proceeded on the basis that distribution within Australia would vary widely between orchard wholesalers, urban wholesalers, retailers, food services and consumers; and that the assessment of the likelihood of distribution required consideration of the proximity of each of those distribution modalities to commercial fruit crops, nursery plants, household and garden plants and wild and amenity plants.[19] The allocation of the simple qualitative descriptor of "extremely low" to the likelihood of distribution in the 2011 Review simply ignores those various distribution modalities and their proximity to possible points of infection. The 2011 Review contains no scientific information and no reasoning

[19] See the analysis in the 2006 IRA at pages 80FF.

which could support putting aside the analysis based on those different modalities and proximity points.

However it is the arbitrary allocation of the qualitative descriptor “extremely low” to that stage of the analysis which completely determines that the 2011 Review would conclude that the probability of entry, establishment and spread of fire blight was extremely low. That conclusion does not flow from any scientific information or reasoning. Rather it flows from the “matrix of rules for combining qualitative likelihoods” set out at table 2.2 on page 9 of the 2011 Review.

It was the conclusion that the probability of entry establishment and spread of Fire Blight would now be qualitatively described as “extremely low” that determined the result that the unrestricted risk was “very low”.
It is the change in the method of risk assessment between 2006 and 2011 as it concerns the distribution of fire blight which drives the change in the assessed level of unrestricted risk of fire blight. That change is not based on any scientific information or reasoning. The making of that change is irrational and unreasonable.

Before considering some of the science in relation to Fire Blight it is worthy of reflecting on the facts about Fire Blight.
Dr Sharon Douglas from the Department of Plant Pathology and Ecology from the Connecticut Agricultural Experiment Station, NEW HAVEN, CONNECTICUT, USA in a report on Fire Blight makes the following conclusions:-

“*The severity of Connecticut outbreaks in 2001 could be partly attributed to the unusual weather conditions in spring, which included a heat wave during bloom followed immediately by frost*

Although fire blight is erratic in occurrence, there is a trend for more frequent and more devastating outbreaks that can be attributed to several factors associated with current orchard management practices and market demand. Four key changes over the last decade have increased our vulnerability to fire blight. These are briefly summarized as follows:

*a. **Orchard density**: instead of planting 100-200 apple trees/acre, we now plant up to 10 times that density with 250-1,500 trees/acre.*

*b. **Tree size**: in order to accomplish high tree densities, it is necessary to use size-controlling rootstocks; M.9 and M.26 are two of the most commonly used rootstocks; they are also highly susceptible to fire blight.*

*c. **Varieties:** many of the new varieties that meet the demands of the fresh fruit market (e.g., Gala, Fuji, Ginger gold, Jon gold, Brae burn) are also highly susceptible to fire blight; the combination of susceptible varieties on susceptible rootstocks further complicates the susceptibility problem.*

*d. **Training systems**: new training systems used to make high density plantings more productive push trees immediately into strong vegetative growth and force early production.*

Fire blight is caused by the bacterium Edwina amylovora. This organism is readily spread by wind, splashing rain, insects, and human activities. Although this bacterium is considered a plant pathogen, it is also a competent epiphyte that can grow and multiply on plant surfaces, regardless of whether the plant is resistant or susceptible to fire blight. At moderately warm temperatures (65-75°F), it has been estimated that the bacterium can double every 20-30 minutes.

There are five different types or phases of infections that can occur during a fire blight outbreak. However, not all infection types occur during every outbreak of the disease. The infection types are canker, blossom, shoot, trauma, and rootstock blight. These types differ in the sources of inoculum, types of tissues that are infected, and the weather conditions that influence the infection process. The symptoms associated with each infection type can be quite distinct, but once an epidemic is underway, they become increasingly difficult to differentiate. Since the same control strategies do not work for all infection types, it is important to be able to recognize the infection type in order to select the appropriate control measure.

Canker Blight

It has been estimated that one active, overwintering canker can produce enough bacteria to severely contaminate flower blossoms on trees in an area consisting of ¼-½ acre.

This phase of disease is always present if fire blight was a problem the previous season.

Blossom Blight

Symptoms of this phase of fire blight usually appear within one to two weeks after bloom, although they can develop as late as one month after infection if temperatures are cool.

- *Infected blossoms often adhere to the cluster base.*
- *Infection of a single flower in a cluster of five usually kills the entire spur.*
- *Bacterial ooze can develop under wet conditions and the bacteria are readily spread by pollinating insects.*
- *Symptoms can develop on infected fruit and can differ in appearance, depending on when the fruit were infected.*
- *Bacterial ooze can develop on fruit surfaces during wet weather.*
- *Flowers must be open (full bloom) and colonized by the bacteria.*
- *They are subject to infection within minutes after any wetting event (e.g., heavy dew, rain) when the average daily temperatures are equal to or greater than 60°F.*
- *Wetting events also include high volume sprays or overhead irrigation applied during bloom.*

This phase of disease is critical for the development of fire blight epidemics. Once the bacteria have successfully infected the blossoms, they are readily *spread throughout the orchard by pollinating insects.*

Shoot Blight
Shoot blight symptoms are also called "blight strikes" and develop on actively growing vegetative shoots.

- *They can be associated with, but not limited to, insect feeding or damage.*
- *Disease occurrence has also been associated with modest wind damage to tender young shoots.*
- *On highly susceptible varieties, infections move rapidly and can invade large supporting limbs.*
- *Depending on the cultivar and stage of development, a single shoot infection can result in the death of an entire limb, or if the central leader of a main trunk is involved, a tree can be lost in a single season.*

Trauma Blight
Symptoms are similar to shoot blight but are usually more random and widespread throughout the orchard.

- *This phase of fire blight is associated with a traumatic event such as hail, frost, or severe wind.*
- *Although mature shoots and limbs are generally resistant to infection, these traumatic events cause wounds that allow the bacteria to directly penetrate the tissues and bypass normal defenses.*
- *Since the bacteria are usually already present on the tissues as epiphytes, all they need are wounds and moisture in order to infect. Infection is not limited to susceptible varieties since the physical damage of the trauma destroys natural defense mechanisms in the tree.*

The amount of trauma blight is usually associated with the amount of epiphytic colonization in the orchard since this phase of disease requires bacteria to already be present in the orchard.

Rootstock Blight
The primary way rootstocks are infected is now known to be through internal means, often through apparently healthy limbs and trunks of trees that had only a few blossom infections or shoot strikes.
Rootstock blight is common on highly susceptible M.9 and M.26 rootstocks.

STRATEGIES FOR MANAGEMENT
*Because of the inoculum potential and the ability of new inoculum to be repeatedly dispersed throughout an orchard by wind, splashing rain, and insects, it has been said that **There is no such thing as a "little bit" of fire blight** when dealing with this disease.*

Removing Primary Sources of Inoculum
***Dormant pruning:** since the bacteria overwinter in living tissues at the margins of cankers, pruning during the dormant season will remove a significant amount of primary inoculum. A thorough pruning is necessary in order to remove as many of the infections as possible.*

Early-season inspection and pruning: *it is helpful to inspect the orchard for any overwintering cankers that may have been overlooked during dormant pruning.*
Many of the small cankers that went unnoticed during previous pruning efforts become more visible once they start to ooze bacteria.
These inspections usually begin around green tip.

Bactericide Control
Copper sprays: *copper sprays* ***do not*** *kill bacteria within overwintering cankers but are used to reduce the ability of the fire blight bacteria to colonize bark and bud surfaces during the early prebloom period.*
Streptomycin sprays*: prevention of blossom infections is a critical aspect of a disease management program. Streptomycin is bactericidal so it kills the bacteria. At bloom, antibiotic sprays are highly effective against the blossom blight phase of disease.*
Streptomycin sprays have been found to be ineffective for prevention and control of shoot blight infections.
They can be helpful to control trauma blight associated with wind damage and hailstorms if applied immediately (within 12-18 hours) after the weather event.
Biochemical sprays: *Messenger®, a biochemical pesticide containing the harpin protein, has been found to help in control of the blossom blight phase of fire blight, especially when used in combination with streptomycin sprays.*
Biological sprays: *limited and inconsistent information is available on the efficacy of compounds such as BlightBan®.*

Removing Secondary Sources of Inoculum
Cutting of blight strikes: *this is critical for control of secondary spread of fire blight. Over the years the philosophy regarding removal of this shoot blight phase has undergone significant changes—to prune or not to prune. It is now clear that new infections should be cut as soon as they appear and before significant necrosis is evident.*
However, in blocks with tight spacing, special care must be taken to avoid spreading the bacteria during the process of removal. (Douglas, 2006)"

New Zealand is extremely vulnerable to outbreaks to Fire Blight given that the production systems described by Dr Taylor are exactly how production is undertaken. As has been indicated and accepted Fire Blight is endemic to all regions of New Zealand and no matter what controls New Zealand might have used in the past or currently the disease has not been eradicated.
While there are management practices in place the reality is Fire Blight is always within the apple orchards of New Zealand.

In relation to Fire Blight in particular, the assumption that it can be controlled to a level not yet achieved anywhere else in the world by the use of standard orchard practices and other proposed measures, appears to be at best ill-informed and at worst irresponsible.
This assumption is contrary to present scientific knowledge and experience in the 49 countries where it has established. In fact there is still a continuing spread of Fire Blight around the world.

Most recent outbreaks of Fire Blight have occurred in

a) Syria.
The disease was found to occur in isolated foci within Syria especially in regions with warm and humid conditions (eg., Al-Zabadani area) which is also very close to the Lebanese border. (Ammouneh *et al*, 2008)

b) Morocco
Found in the Meknes Region, 140 km east of Rabat.
In an effort to eradicate the disease, 42 ha of pears were dug up and burned in October 2006. In the spring of 2007, fire blight reappeared in the same orchard and was encountered in five other orchards with disease incidences from 1 to 60%.
The occurrence of fire blight in Morocco creates a serious threat to the pome fruit industry. (Fatmi *et al*, 2008)

NEW SCIENCE

FIRE BLIGHT – Erwinia amylovora

Probability of entry

Probability of importation.

Japan has a significant pome fruit industry **(Apple University 2010)** and as a result of negotiations since the Japan-USA apple dispute at the WTO, New Zealand now has access to the Japan market without specific risk management measures for fire blight **(Japan Apple Regulations 2007).**

Apple and Pear Australia Limited seeks clarification from Biosecurity Australia as to how the Japanese within their protocol confirm that New Zealand fresh fruit is not infested with Fire Blight.

Apple and Pear Australia Limited seeks clarification from Biosecurity Australia that the Japan Apple Regulation 2007 is in fact the same document as supplied from the public file that is 'MAFF Ministerial Notification No 353 of 10th March 2997.

The incidence of fire blight from year to year mainly depends on spring seasonal conditions **(APPS 2009).**

Apple and Pear Australia Limited argues that this is not new science.

Association of the pest with the commodity pathway-calyx infestation

Erwinia amylovora predominantly colonise flowers (Thomson, 1986; Thomson, 2000) and only relatively low bacterial numbers have been recorded on dried remnant flower parts subsumed into the calyx sinus of mature fruit (Hale *et al.* 1987; Sholberg *et al.* 1988; **Temple *et al.* 2007**).

New scientific reference reviewed

Biosecurity Australia has not indicated what the 'relatively low bacterial numbers' are in numerical terms.

Apple and Pear Australia Limited would contend that the research emphatically highlights that Erwina amylovora will colonise the '*dried remnant flower parts subsumed into the calyx sinus of mature fruit'* which must lead to the potential for calyx infection.

A later publication revised this estimate down based on new evidence and clarification or correction of previously misinterpreted data present in the literature **(Roberts and Sawyer 2008).**

New scientific reference reviewed

While the research gives an estimation down Apple and Pear Australia Limited would highlight the following issues from within the scientific paper:-

"By using the corrected and newly published data and by making assumptions based upon documented pathogen biology, the model gives more robust statistical support to the opinion that the risk of importing Ea on commercial apple fruit and the concomitant risk of establishing new outbreaks of fire blight is so small as to be insignificant."

And

"In all scenarios, the risk was found to be so small as to be ''insignificant''.

And

"Thus, Roberts et al. (1998) used non-zero estimates for nodes, even those for which there was no evidence a step in the hypothetical pathway could be completed. Even using these inflated hypothetical values the theoretical probabilities were extraordinarily low."

And

"Thus, the values for number of fruit assayed changed from 80 to 20 because none of the Rome apple fruit were mature at the times of assay, and only the last harvest of Red Delicious may have been mature (S. Thomson, personal communication)."

And

"To date no information or data are available that would establish the existence of this state for Ea in nature; only laboratory induction of the VBNC state has been reported. Given that there are no data on the incidence of VBNC cells of Ea on mature apple fruit (or anywhere else in nature) or any evidence that such a state is epidemiologically significant with regards to natural populations of Ea or the initiation of fire blight disease, there is no path to inclusion of VBNC cells of Ea in the PRA other than speculation, which would be inappropriate and contrary to the stated goal of providing a quantitative assessment of risk."

And

"From nine trials marked S3 but not S2 or S1, 3144 mature fruit were tested and 63 were found to be externally contaminated with Ea,….."

And

"Live Ea cells were detected on 2 of 570 contaminated fruit assayed after cool storage for 25 d plus 14 d at room temperature, again from fruit with the highest initial infestation levels.

And

"The mean infestation rate from Table 1 is therefore a biased estimate for the production areas of concern in this trade issue."

And

"Yamamura et al. (2001) additionally stated, 'our results are not conclusive …..'. Results based on sampling, statistics and modelling are never certain and, in this sense, are never 'conclusive.' However, at any given level of knowledge, conclusions can be drawn."

Apple and Pear Australia Limited would make the following assessments of this work:-

a) The research is still based on 'making assumptions'.
b) The research admits to a 'biased estimate'.
c) The research highlights that in as number of the research projects considered that there was mature 'contaminated fruit' with 'live Ea'.
d) This research lacks validity given that it was undertaken in 2007 and there has been substantial new research on VBNC and Biofilms in relation to Erwinia amylovora.

Apple and Pear Australia Limited would contend that the results of this research are not 'conclusive'.

Apple and Pear Australia Limited was also contend that the model has still failed to consider
a) Clustering, and
b) Severe outbreaks of Fire Blight in an orchard, and
c) Severe climatic events like hail and wind storms.

This later work now reports no *E. amylovora* were detected in apple fruit from orchards without fire blight symptoms and 1.3% of apple fruit are infested from orchards with fire blight symptoms. Many apple fruit samples from orchards with symptoms detected no *E. amylovora* **(Roberts and Sawyer 2008).**

New scientific reference reviewed

Apple and Pear Australia Limited highlights the statement from Roberts and Sawyer in that "1*.3% of apple fruit are infested from orchards with fire blight symptoms".* This confirms that apple fruit can be 'infested with Fire Blight.

More recently, **Ordax *et al.* (2010b)** reported no *E. amylovora* could be detected from 100 apples immediately after harvest from a severely infected fire blight orchard. Sensitive detection methods were employed that could detect < 1 cfu/ml of calyx extract and would have detected live or dead bacteria including those in a viable but non-culturable (VBNC) state.

Apple and Pear Australia Limited argues that this extraction from the scientific reference has been taken out of context of the total research undertaken.
The research was in relation to *"looking for Erwinia amylovora in asymptomatic fruits from trees naturally infected by fire blight"* and the following are additional extracts from the paper:-

> ***"In this report it has been shown that more than 400 calyces from asymptomatic mature apples harvested from trees naturally infected by E. amylovora gave negative results for the presence of the pathogen. Our high detection limit (<1cfu/ml), and the use of big Petri dishes incubated up to one week, suggest that probably there were not culturable E. amylovora cells in the calyx of these apples."***
>
> ***And***
>
> ***"As in that year there were no fireblight outbreaks in Spanish apple orchards, other symptomless fruits from other naturally infected trees were harvested, over 250 azarole fruits. Interestingly, the analysis of these fruits evidenced that 12% of the collected azaroles were latently infected, remaining E. amylovora cells alive inside the fruits, and going unnoticed due to the absence of symptoms."***

And

"Besides, we have developed an appropriate methodology for the detection of E. amylovora in asymptomatic fruits in spite of the low pathogen doses usually present in them, which could be very useful in surveys of plants from naturally infected orchards."

In the USA, numbers of bacteria on blossoms of apple and pear inoculated with *E. amylovora* bacteria decline to very low levels in the calyx of the subsequent mature fruit. In apples, no fire blight could be detected at harvest **(Temple *et al.* 2007).**

New scientific reference for reviewed

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'. As a result the statement above must be considered in the context of the report and not just a single statement drawn from a complex scientific experiment.

In a sample of commercial pear orchards, where disease incidence is typically higher than on apples (Agrios 1997; Paulin 2010a), of the orchards sampled, 27% had fire blight symptoms and only 1 fruit of 5600 sampled at harvest had *E. amylovora* with 32 cfu detected **(Temple *et al.* 2007).**

New scientific reference reviewed

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.
The above reference relates to pears and Apple and Pear Australia Limited argues that the statement has no relevance to the export of apples.
Notwithstanding this reference does highlight that mature pears can be infected/infested with *Erwinia amylovora*.

Association of the pest with the commodity pathway – infection

A recent review of the evidence supports the view that *E. amylovora* can occur in xylem vessels **(Billing 2011).** It is further stated that *E. amylovora* can multiply in the xylem and may survive latently for many years, expressing symptoms once the xylem vessel is damaged and bacteria are released into the parenchyma **(Billing 2011).**

New scientific reference reviewed

Apple and Pear Australia Limited would agree that the assessment made Billing (2011) gives an accurate position of the past science in relation to movement through the xylem.

The following are extracts from the paper which give further insight into the science relating to Fire Blight:-

> ***"No one since 1981 has retested the xylem-vessel hypothesis, but evidence presented in this review shows that there is no doubt that E. amylovora can and does enter xylem vessels and multiply there, and may remain viable in mature vessels for long periods, possibly several growing seasons. Storm damage or pruning tools may allow escape of the pathogen to external surfaces, but other means of escape from mature xylem vessels into bark tissue, where typical symptoms are expressed in the growing tree, have so far eluded discovery."***
>
> ***And***
>
> ***"Studies on mature trees are rarely feasible, so young plants need to be used."***
>
> ***And***
>
> ***"Evidence presented in this report strongly suggests (but does not prove) that the main route for systemic migration of E. amylovora is in the intercellular spaces of the parenchymal bark tissue. The pathogen can also invade and multiply in mature xylem vessels for long distances down the tree. How far suction pressure is involved in that movement is not known. If this is to be an important migration route, the bacteria need a ready means of escape from the vessels into the bark tissue. How this might be achieved also remains unknown."***

Ability of the pest to survive adverse conditions – viable but non-culturable state

A recent study has confirmed that *E. amylovora* can enter a VBNC state in the calyx of apple fruit in response to copper and then infect receptive host tissue after periods of 7–28 days post calyx inoculation under favourable laboratory conditions **(Ordax *et al.* 2009).** The level of infection recorded in this experiment was low and the culturing of *E. amylovora* from infected tissue was several orders of magnitude lower than bacteria that had not entered the VBNC state.

New scientific reference reviewed

Apple and Pear Australia Limited argues that this is important new science that Biosecurity Australia has failed to give adequate consideration.
This research would highlight the ability of Fire Blight to survive in a Viable But Non-Culturable form as well as a Biofilm.

The addition scientific work done and reported on during the period since 2009 give further understanding of the ability of Fire Blight to enter a Viable But Non-Culturable state.

For VBNC to be a risk pathway, bacteria would need to enter the VBNC state in the orchard and would need to resuscitate before, or during, an infection event in Australia for infection to occur. Copper is known to induce the VBNC state in the laboratory, but it is not generally applied at flowering because of plant phytotoxicity **(APPS 2009)** and there is still no evidence to confirm resuscitation can occur under natural conditions **(Paulin 2010a).**

Paulin (2010a) is a reference from the Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Ability of the pest to survive adverse conditions–Exopolysaccharides and biofilms

Under laboratory conditions, the EPS of *E. amylovora* (amylovoran and levan) can be used as carbon sources by the bacteria during periods of starvation **(Ordax *et al.* 2010a).** The utilisation of EPS may assist in the survival of *E. amylovora* during periods of starvation and this factor would be taken into account during the many studies of *E. amylovora* survival in the calyx.

New scientific reference reviewed

Apple and Pear Australia Limited argues that this is important new science that Biosecurity Australia has failed to give adequate consideration.
This research would highlight the ability of Fire Blight to survive in a Viable But Non-Culturable form as well as a Biofilm.

More recently it has been shown that EPS contributes to the formation of biofilms and plays an important role in the pathogenesis and disease development of *E. amylovora* in plants (Koczan *et al.* 2009; **Lee *et al.* 2010**).

New scientific reference reviewed

Apple and Pear Australia Limited strongly believes that Biosecurity Australia has not given sufficient credence to the aspect of biofilms when considering the export of apples from New Zealand.

Apple and Pear Australia Limited would direct Biosecurity Australia to the sections on Pathogenecity/Strains and Viable But Non-Culturable within this submission

Ability of the pest to survive epiphytically

Later, the work by Temple and colleagues were published as a full text article that comprehensively described the experimental methods. Under field conditions, immature pear or apple fruit on the tree were artificially covered by an inoculum suspension with 10^7 cfu per ml, or calyces infested with inoculum from ooze (10^8–10^9 cfu) **(Temple *et al.* 2007).** Populations of *E. amylovora* declined by an order of magnitude every three to four days in the first two weeks after inoculation. From a starting population of 1.6 x 10^7 cfu, by day 56, only one pear fruit of 450 tested positive and had only four cfu **(Temple *et al.* 2007).** This study confirmed the poor survival and rapid decline of *E. amylovora* bacteria, even from very high levels, on the surface of fruit.

New scientific reference reviewed

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.
The research utilised a process of 'artificially' covering the trees and fruit with inoculum suspension.
Would this same situation happen in normal natural conditions particularly as Erwinia amylovora does infect/infest immature apples and pears? (As consistently reported in many scientific papers.)

Ability of the pest to survive packing, transport and storage conditions.

Although, wash water for organic fruit does not contain a sanitiser, exopolysaccharides (EPS) of *E. amylovora* are water soluble (Maas Geesteranus and de vries 1984; **Ordax *etal.* 2010a).**

Can Biosecurity Australia confirm that because the EPS is water soluble this it has any effect on Viable But NonCoulturable bacteria and/or Biofilms?

The main EPS of *E. amylovora* (amylovoran) is an acidic polysaccharide with strong water-binding activity with strong water-binding activity, i.e., it is a typical hydrophilic EPS of the kind found among many Gram-negative bacteria; EPS with these properties form loose slime layers which readily disperse in water (Ayres *et al.* 1979; Politis and Goodman 1980; Belleman *et al*. 1994; Nimtz *et al*. 1996; **Pers comm.; Dr Chris Hayward April 2011).**

This reference is a 'personal communication'.

Mature fruit inoculated with a suspension of 10^7 cfu, less than 10^0 cfu per fruit could be detected after 4 weeks, and no bacteria could be detected after eight weeks in cold storage using a sensitive detection method that could detect as little as 2 cfu **(Temple *et al.* 2007).**

New scientific reference reviewed

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.
The research utilised a process of 'artificially' covering the fruit with inoculum suspension as referenced by the following extract:-

> ***"Survival of E. amylovora on stored fruit.***
> ***A suspension of fresh Ea153N cells scraped from agar cultures was prepared at 5 × 10^7 CFU/ml and sprayed with a hand pump sprayer to runoff onto 240 fruit."***

Would this same situation happen in normal natural conditions?

Recent work in Spain has shown that no *E. amylovora* could be detected from 300 mature apples after 10 months in cold store. Sensitive detection methods were employed that could detect < 1 cfu/ml of calyx extract and would have detected live or dead bacteria including those in a viable but non-culturable (VBNC) state **(Ordax *et al.* 2010b).**

New scientific reference for review

Apple and Pear Australia Limited argues that this extraction from the scientific reference has been taken out of context of the total research undertaken.
The research was in relation to *"looking for Erwinia amylovora in asymptomatic fruits from trees naturally infected by fire blight"* and the following are additional extracts from the paper:-

> ***"In this report it has been shown that more than 400 calyces from asymptomatic mature apples harvested from trees naturally infected by E. amylovora gave negative results for the presence of the pathogen. Our high detection limit (<1cfu/ml), and the use of big Petri dishes incubated up to one week, suggest that probably there were not culturable E. amylovora cells in the calyx of these apples."***
>
> ***And***
>
> ***"As in that year there were no fireblight outbreaks in Spanish apple orchards, other symptomless fruits from other naturally infected trees were harvested, over 250 azarole fruits. Interestingly, the analysis of these fruits evidenced that 12% of the collected azaroles were latently infected, remaining E. amylovora cells alive***

inside the fruits, and going unnoticed due to the absence of symptoms."

And

"Besides, we have developed an appropriate methodology for the detection of E. amylovora in asymptomatic fruits in spite of the low pathogen doses usually present in them, which could be very useful in surveys of plants from naturally infected orchards."

Probability of distribution

Risks from by-products and waste

Erwinia amylovora is not considered a good competitor against other epiphytic bacteria that are naturally found on surface of apple or pear fruit (Roberts *et al.* 1989; **Temple *et al.* 2007; Paulin 2010a).**

New scientific reference reviewed

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.
This statement appears to be based on the fact that *"1 of 5,600 pear fruits sampled from commercial orchards yielded 32 CFU of E. amylovora".*
The majority of the bacteria that were recovered from the 'surveys for E. amylovora on fruit from commercial orchards' were not Erwinia amylovora but other orchard bacteria.

The following are extracts from the scientific paper that are worthy of highlighting:-

"Subsamples of fruit tissues revealed that surviving cells were associated with the calyx".

And

"The calyx survival studies provided evidence that floral populations of E. amylovora can persist on pear and apple fruit for a period of time after bloom".

And

"one fruit was found to harbor a small epiphytic population of the pathogen".

And

"fire blight lesions on the external surface of nearly mature fruit of summer pear cv. Bartlett, however, has been reported from Washington State".

And

"For both pear and apple, the data also showed small but consistent increases in pathogen population size over the first 7 to 14 days of cold storage".

All of these extracts highlight was is possible and likely within the natural environment.

Paulin (2010b) is a reference from the Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

The epiphytic bacterium *Pantoea agglomerans* has been shown to survive at significantly higher numbers than *E. amylovora* during fruit maturation to harvest **(Temple *et al.* 2007).**

New scientific reference reviewed

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.

The following is an extract from the scientific paper:-

"*Surveys for E. amylovora on fruit from commercial orchards.*

Of the 56 surveyed orchards, at the time of harvest, 15 (27%) had fire blight symptoms present in the orchard or in an adjacent block of a different cultivar; whereas the remaining 41 orchards (73%) were apparently disease free as determined by visual inspection. At least some bacteria were recovered on filter membranes of nearly all fruit washings, many of which were green-colored on MS medium and fluoresced when transferred to PAF medium, indicative of Pseudomonas spp. Orange to red colonies with resemblance to E. amylovora on MS medium were recovered from 15% of washed fruit; a subset of 179 orange/red colonies were selected and tested for identification (Table 2).
Partial identification of the orange/red-colored isolates by fatty acid analysis (GC-FAME) most frequently yielded Enterobacter (8%), Pantoea (12%), and Pseudomonas spp. (8%), and a few nonpathogenic Erwinia spp. (2%) (E. rhapontici and E. persicina). A total of 3 of 179 orange/red isolates produced a hypersensitive reaction (HR) in tobacco leaves, indicative of a type III secretion

system. Partial sequences of the 16S rDNA of these isolates yielded (with >99% similarity in GenBank) E. amylovora, E. persicina, and Citrobacter freundii. The one isolate identified as E. amylovora by its 16S rDNA sequence also was positive for production of ooze on immature pear and for presence of pEA29; all other isolates were negative for these tests (Table 2). Consequently, 1 (0.02%) of 5,600 pear fruits sampled from commercial orchards yielded 32 CFU of E. amylovora (Table 3).”

What this would highlight is that there is a wide variety of bacteria at the time of this experiment on the surface of fruit.

What is not clear from the research is whether the apple fruit were tested in this part of the experiment or whether the above results are only related to pears.
Biosecurity Australia needs to clarify this point.

Pantoea agglomerans is also known to reduce the pH of its environment **(Pusey *et al.* 2008)** to levels that are known to reduce, or even stop, *E. amylovora* growth (Shreatha *et al.* 2005).

New scientific reference reviewed

While there may be some substance to this assessment of the science it is worth considering the following extract and the final conclusion to this particular scientific paper:-

“Under ideal laboratory conditions for bacterial colonization of flowers, we found that P. agglomerans strain E325 exhibited a capacity to reduce the pH on stigmas to levels that could reduce growth of E. amylovora. Conversely, an increase in pH was observed on flowers inoculated with E. amylovora alone and was comparable to previous results with pear fruit tissue inoculated with the pathogen (51).”

And

“Two separate data sets, one dealing with pH on the stigma and the other with antibiotic production in a partial stigma-based medium, were not shown to be directly related, but both have possible implications in biological control of fire blight with P. agglomerans strain E325. Analysis of exudates from inoculated stigmas indicated that strain E325 may lower the pH on stigmas, which to some degree, may reduce growth of E. amylovora. Secondly, assuming pH values are close to those actually occurring on flower stigmas, results indicate a pH range on the stigma favorable for antibiotic activity, which was found in vitro to be pH sensitive. Work is in progress to further investigate acidification and antibiosis and their possible roles and

interrelationship in the suppression of E. amylovora by P. agglomerans E325 on stigmatic surfaces of apple and pear."

Erwinia amylovora is known to be nutritionally fastidious (Schroth *et al.* 1974), uses a much smaller range of carbon sources than saprophytes **(Cabrefiga *et al.* 2007),** and therefore specific nutrients or carbon sources may not be available for growth to occur in waste material.

New scientific reference reviewed

The scientific paper titled 'Mechanisms of antagonism of *Pseudomonas fluorescens* EPS62e against *Erwinia amylovora*, the casual agent of fire blight" was a report on the work undertaken on pears.
Apple and Pear Australia Limited seeks confirmation from Biosecurity Australia that the information in this scientific paper can be extrapolated to apples.

The following is extract from the scientific paper:-

"Table 3 shows the carbon sources that have been reported as more abundant in pear and pome fruits [12,14,45] in relation to the ability of EPS62e and E. amylovora to utilize them. Nine of these carbon sources were tested in this study, and eight of these sources were used by EPS62e whereas only five were used by E. amylovora. Globally, the most abundant carbon sources in nectar and pear tissues, such as glucose and fructose, were used by both the antagonist and the pathogen. Sucrose, which is found in all organs, was only used by E. amylovora. Therefore, in terms of the effects of nutrient use and availability on plant host tissues, EPS62e has the potential to outcompete E. amylovora."

Is the formulation known as Serenade available and registered for use in New Zealand?

Is the formulation known as Serenade available and registered for use in Australia?

Apple and Pear Australia Limited fails to see how this scientific paper can lead to the statement that '*specific nutrients or carbon sources may not be available for growth to occur in waste material'*.

Ability of the pest to move from the pathway to a suitable host

A recent laboratory experiment has shown that Mediterranean fruit fly can act as a vector of *E. amylovora* from infested apple fruit **(Ordax *et al.* 2010b).**

New scientific reference reviewed

This new science adds a new vector to the list and given that Mediterranean Fruit Fly is an established pest with Western Australia makes the spread of the disease within that state more likely.

This study showed transmission could occur under favourable artificial conditions, which do not replicate conditions that would occur with imported apple fruit. In the pathway considered in this review of policy, bacteria are within the adverse environment of the calyx, in low numbers and in an attenuated state. The experiment of **Ordax *et al.* (2010b)** is more closely aligned to the vector transfer of *E. amylovora* from oozing cankers on plant material, a method of dispersal that is already well known in the epidemiology of the fire blight (van der Zwet and Keil 1979).

New scientific reference for review

Apple and Pear Australia Limited rejects the assessment of Biosecurity Australia that the information shown through this study

a) 'do not replicate conditions that would occur with imported apple fruit', or the

b) 'bacteria are within the adverse environment of the calyx, in low numbers and in an attenuated state'.

Apple and Pear Australia Limited would accept that "*the experiment of Ordax et al. (2010b) is more closely aligned to the vector transfer of E. amylovora from oozing cankers on plant material, a method of dispersal that is already well known in the epidemiology of the fire blight (van der Zwet and Keil 1979)'* is a reasonable assessment from the scientific paper.

A recent study has reaffirmed that the flesh of fresh apple fruit does not lead to the multiplication of *E. amylovora* to produce symptoms or bacterial ooze **(Ordax *et al.* 2010b).**

New scientific reference for review

Apple and Pear Australia Limited finds this assessment as confusing given that the following extracts from the scientific research paper (part A) :-

> ***"In conclusion, it has been shown that asymptomatic fruits can be naturally contaminated after a fire blight episode, at least in a certain percentage. In fact, our results of the analysis of symptomless azaroles show that latent infections in fruits can occur, as reported in other host fruits for E. amylovora [Schroth et al., 1974; van der Zwet et al., 1990]."***

Apple and Pear Australia Limited finds this assessment as confusing given that the following extracts from the scientific research paper (part B) :-

> ***"The bacterium was able to retain their culturability in cuts and small peeled areas on disinfected mature apples at similar***

inoculums levels during the first 5 days (around 10^7 cfu/ml) regardless the area of the fruit in where the cuts or the peelings were performed."

And

"Moreover, epiphytic and endophytic E. amylovora populations were recovered in similar levels in transmitted fruits with cut damages or small peeled areas, so both kinds of lesions were shown as susceptible to be contaminated by this insect."

Apple and Pear Australia Limited has considered this paper in more detail in another section of this submission.

Ability of the pest to initiate infection of a suitable host.

There is no accepted threshold number of bacteria required to initiate an infection, and this may vary with environmental and host factors. One cell of *E. amylovora* can potentially infect pomaceous flowers through the hypanthium. However, the minimum infective dose generally depends on environmental conditions, pathogen aggressiveness, and host susceptibility. The likelihood of infection increases with inoculum load and high levels of fresh inoculum (>10^4 cfu) are required for high rates of infection (Cabrefiga and Montesinos 2005; **Pusey and Smith 2008**).

New scientific reference reviewed

The scientific paper did indicate that *'in our field experiment the inoculums level of 102 CFU per flower hypanthium'* can cause a disease incidence.

In contrast, stigmas of crab-apple trees supported bacterial growth in 4- to 10-day-old flowers, depending on temperature and pollination. However, disease incidence was relatively high only when hypanthia were inoculated at ages between 0 to 4 days (Pusey 2004). Later it was shown infection rates steadily decreased over a 10 day period from flower opening **(Pusey and Smith 2008).**

New scientific reference reviewed

In reviewing this scientific paper it is worth understanding the nature of the research application used in relation to the crab-apple trees:-

"Controlled-environment experiments with detached flowers have enhanced our understanding of variables affecting bacteria colonization on the stigma (12,20,21) and bacterial infection through the hypanthium (3,20). This approach may have less value for investigating disease in relation to flower age, since over time

the physiology of detached flowers is expected to increasingly diverge from that of blossoms in the field. Nevertheless, detached flowers appear to go through the same late development and senescence stages as those observed in the field (21; P. L. Pusey, unpublished).”

Probability of establishment

Availability of suitable hosts, alternative hosts in the PRA area.

Detailed information on exact flowering times for pome fruit production areas is not available. Flowering patterns vary with latitude and altitude. However, it has been shown for the Goulburn Valley that the flowering period for apple and pear coincides with suitable infection periods for *E. amylovora* **(Gouk 2008).**

New scientific reference reviewed

Details on exact flowering times of pome fruit production areas is available and Apple and Pear Australia Limited would be willing to make them available.

The work by S C Gouk highlights the vulnerability of one of the major apple and pear growing regions within Australia to Fire Blight.

Suitability of the environment

Erwinia amylovora is native to North America and was initially recorded from England in 1958 (van der Zwet and Kiel 1979). Since then is has established across continental Europe and to Mediterranean countries in Europe, Middle East and North Africa (CABI 2002; Bonn and van der Zwet 2000). Many of these countries, particularly the Mediterranean countries, have climates broadly similar to temperate regions of Australia **(Peel *et al.* 2007).**

New scientific reference reviewed

This scientific reference further highlights the position consistently taken by Apple and Pear Australia Limited that Australia has the appropriate climatic conditions for Fire Blight to establish and spread.

A recent study has confirmed that the Goulburn Valley in Victoria, the main pome fruit region of Australia, has suitable climatic conditions for inoculum production and infection in spring that coincide with the main blossom period and results in many potential high risk infection events **(Gouk 2008).** This study used the two most important predictive models for blossom infection that have been used effectively in North America and New Zealand to predict infective events and manage blossom infection (Steiner 1990; van der Zwet *et al.* 1994; Biggs *et al.* 2008; Manktelov and Tate 2001).

New scientific reference reviewed

The work by S C Gouk highlights the vulnerability of one of the major apple and pear growing regions within Australia to Fire Blight.

Reproductive strategy and the potential for adaption

The stigmas of blossoms are the most receptive sites for initiation of new infections, where bacteria can multiply rapidly. Bacterial populations often reach 10^6 to 10^7 cfu per healthy flower (Thomson 1986; **Johnson *et al.* 2009**).

New scientific reference reviewed

Apple and Pear Australia Limited would accept this as a reasonable assessment from the scientific paper.

Cultural practices and control measures

Naturally occurring bacterial antagonists (for example, *Pantoea agglomerans* [synonym: *Erwinia herbicola*] and *Pseudomonas fluorescens*) have proven to be effective against blossom infection (Johnson and Stockwell 2000; **Cabrefiga *et al*. 2007)** although results can be variable in some locations **(Sundan *et al.* 2009)**.

New scientific reference reviewed

The scientific paper titled 'Mechanisms of antagonism of *Pseudomonas fluorescens* EPS62e against *Erwinia amylovora*, the casual agent of fire blight" (Cabrefiga et al. 2007) was a report on the work undertaken on pears.
Apple and Pear Australia Limited seeks confirmation from Biosecurity Australia that the information in this scientific paper can be extrapolated to apples.

Sundan et al (2009) indicates the following:-

> ***"When examined individually, the biological control materials were not consistently effective in reducing blossom infection."***
>
> ***And***
>
> ***"The antibiotic streptomycin is currently the most effective compound available to growers for limiting populations of the fire blight bacterium on flowers."***
>
> ***And***
>
> ***"The success of bacterial biological control agents in the western United States has been erratic."***
>
> ***And***

“Our results indicate that biological control efforts with bacterial antagonists were largely ineffective in reducing the incidence of blossom blight in field trials with inoculated trees in Michigan, New York, and Virginia. The requirements for bacterial antagonists to be successful in biological control of blossom blight include the colonization of a large proportion of flower stigmata with growth to a large population size.”

And

“Of the three bacterial antagonists examined in this study, Pseudomonas fluorescens A506 exhibited the least potential biological control activity and colonized the lowest percentage of flowers (mean colonization of 61% in 13 experiments, Table 6).”

And

“These new observations indicate that there is still much to learn concerning the biology and ecology of Pseudomonas fluorescens A506 and Pantoea agglomerans C9-1. Likewise, it is also critical that a knowledge base is gained of E. amylovora virulence factors that enhance colonization of stigmata (19,37), as well as the physical partitioning of the pathogen in this habitat.”

And

Our results indicate that the biological control Serenade (active ingredient: lipopeptides produced by B. subtilis QST713) was slightly more efficacious in blossom blight control than the bacterial antagonists and more consistent from year to year and between locations.”

And

“In summary, the bacterial antagonists Pseudomonas fluorescens A506 and Pantoea agglomerans C9-1 and E325, and the biological control agent Serenade were insufficiently effective in controlling blossom blight when applied as the sole control agent in trials conducted in Michigan, New York, and Virginia.”

And

“However, materials with high variability in control performance are not good options for growers.”

Probability of spread

Suitability of the natural/or managed environment.

Many of these countries, particularly the Mediterranean countries, have climates broadly similar to temperate regions of Australia **(Peel *et al.* 2007).**

New scientific reference reviewed

This scientific reference further highlights the position consistently taken by Apple and Pear Australia Limited that Australia has the appropriate climatic conditions for Fire Blight to establish and spread.

More recently, fire blight has continued to spread in the Mediterranean region and has now been recorded from Syria and Morocco **(Ammouneh *et al.* 2007**; **Fatmi and Bougsiba 2008**).

New scientific reference reviewed

Apple and Pear Australia Limited argues that these outbreaks show that the movement of Fire Blight around the world continues unabated at cannot be contained even with the large amount of past current and new science that has/is being undertaken.

Most years, environmental conditions in many Australian apple and pear growing areas (notably the Goulburn Valley) are favourable for infection and spread of *E. amylovora* (Penrose *et al.* 1988; Wimalajeewa and Atley 1990; Fahy *et al.* 1991; **Gouk 2008**).

New scientific reference reviewed

The work by S C Gouk highlights the vulnerability of one of the major apple and pear growing regions within Australia to Fire Blight.

Recent research has identified the effectiveness of kasugamycin as a product that controls blossom infestation and subsequent shoot infection in apple and pears **(McGhee and Sundin 2011: Adaskaveg *et al.* 2011).** However, this product is not currently a registered chemical in Australia.

New scientific reference reviewed

Apple and Pear Australia Limited would accept that this research is of interested but as indicated the product is not currently registered in Australia and therefore has currently no value even were there and outbreak of Fire Blight in Australia.

Biosecurity Australia does not indicate whether this chemical is registered for use in New Zealand and/or whether it is being used in New Zealand.

The researchers highlight that

"Taken together, all of these results indicate that Kasumin represents a viable alternative antibiotic, in particular for use for fire blight management in orchards harboring SmR strains of E. amylovora."

Apple and Pear Australia Limited seeks clarification from Biosecurity Australia as to whether the New Zealand strains of Erwinia amylovora are SmR strains.

Potential for movement with commodities, conveyances or vectors

A recent review has stated *E. amylovora* can survive for many years in the xylem tissue and symptoms do not express until the xylem is damaged and the bacteria invade the parenchyma tissue **(Billing 2011).** These are factors that could assist in the spread of *E. amylovora* in planting material.

New scientific reference reviewed

Apple and Pear Australia Limited would accept this as a reasonable assessment from the paper prepared by Billing (2011).

Potential natural enemies

It has been reported that one reason why Australian orchards have remained free of fire blight is in part due to natural antagonists **(Sosnowski *et al.* 2009).**

New scientific reference reviewed

The following extract from the technical paper may assist in understanding the context of the above statement:-

"Biological control has been commonly employed to control endemic plant pathogens, but due to its variable nature has not been considered for eradication of exotic pathogens. However, there may be potential for its use as part of an integrated approach, especially for containing an outbreak. Bacteriophage may provide a promising strategy in the control of fire blight. Bacteriophages isolated from E. amylovora have shown a high degree of lytic activity against E. amylovora in the laboratory, but there have been no studies to determine the effectiveness of the phage as a control agent in the orchard environment. To date, E. amylovora lytic phage has been investigated only in areas where fire blight is endemic in the USA (Schnabel et al., 1999) and Canada (Svircev et al., 2002).
Australian orchards have remained free of fire blight and this may be due in part to the presence of some natural defence mechanisms in those orchards in the form of a natural antagonist of E. amylovora such as an aggressive bacteriophage."

Apple and Pear Australia Limited believes the later part of this extract is not supported by any scientific evidence and therefore has no relevance to the current Import Risk Analysis..

There is evidence for a unique microflora consisting of closely related saprophytic *Erwinia* species in Australian orchards, which requires further investigation **(Sosnowski *et al.* 2009)**

New scientific reference reviewed

As this statement is not supported by any scientific data Apple and Pear Australia Limited would seek clarification as to whether Biosecurity Australia has undertaken the investigation as considered important by the researcher?

Consequences

Significant at the national level

More recently a study has estimated the consequences of *E. amylovora* in Australia could in the range of $33 to $95 million per year depending on the model used to estimate consequences and confidence assigned to those estimates **(Cooke *et al.* 2009).**

New scientific reference reviewed

Apple and Pear Australia Limited questions where Biosecurity Australia has utilised this information in assessing the impact at the national, regional and local domestic situation.
This would seem to be a highly important figure in determining the consequence on the industry.

Further, the major pome fruit producing region in Australia is reported to have a very suitable climate based on fire blight predictive models **(Gouk 2008).**

New scientific reference reviewed

The work by S C Gouk highlights the vulnerability of one of the major apple and pear growing regions within Australia to Fire Blight.

Significant at the regional level

Eradication of *E. amylovora* has also been tried in other countries without success and highlight the difficulty and expense involved **(Sosnoski *et al.* 2009).** However, in Norway eradication events continue as the program has severely reduced the prevalence of the disease in combination with unfavourable seasonal conditions **(Sosnoski *et al.* 2009).**

New scientific reference reviewed

The following is an extract from the technical paper that puts this

statement in context:-

> ***"Fire blight was not detected in Norway between 1993 and 2000 (Sletten & Melboe, 2004). It is not clear if the recent detection of fire blight within the restriction zone in 2000 is due to the re-emergence of the original inoculum or a more recent introduction. Although no evidence was provided, it was believed that the limited spread from this incursion was due to the illegal movement of contaminated Cotoneaster plants and beehives between private gardens. The strict eradication campaign has now been re-established in Norway to prevent the spread of fire blight into the important fruit growing areas and nurseries (Sletten & Melboe, 2004)."***

OTHER ASPECTS OF THE SCIENTIFIC PAPERS.

"Transmission of Erwinia amylovora through the Mediterranean Fruit Fly Ceratitis capitata". (Ordax et al, 2009)

"*We have demonstrated that significant doses of active E. amylovora cells may be transmitted from contaminated to healthy apples by C. capitata (10^3-10^5 cfu/fruit) even with only 5 medflies and with no development of symptoms.*

Pollinating insects, like bees and wasps, are considered as the most important agents for the dissemination of E. amylovora [van der Zwet and Keil, 1979; Thomson, 2000]. However, although these insects can transmit up to 10^3 cfu/pear flower in only 48h, the pathogen could no persist more than this time period on their bodies [Alexandrova et al., 2002]. Interestingly, we have proved that E. amylovora is able to persist in C. capitata for at least 15 days, that is, more than half of the medfly life cycle, and in addition to that, in a range of around 10^4-10^6 cfu/medfly. These data point out the potential of C. capitata as an efficient vector for E. amylovora in comparison with other insects studied [Ark and Thomas, 1936; Bellemann et al., 1994, Hildebrand et al., 2000, Alexandrova et al., 2002]. However, some authors have considered that flies may not frequently transmit fire blight because they neither visit blossoms [Steward and Leonard, 1916; Thomson et al., 1975]. But in contrast, adult fruit flies feed predominantly on ripe and wounded fruits [Hendrichs and Hendrichs, 1990], and their high numbers has been related with the fire blight distribution in infected orchards [Hildebrand et al., 2000]. In the case of C. capitata, its common presence in fruit fields, and the relevant dose of E. amylovora cells that it may carry (at least when the inoculum level is high) could contribute to the pathogen dissemination in nature at short and middle distances. In fact, the potential capacity of C. capitata as a vector of plant and even human diseases has already been proved [Cayol et al., 1994; Sela et al., 2005]. Since in all cases the contaminated fruits were maintained as asymptomatic despite *containing a quite relevant concentration of transmitted E. amylovora cells, two potential carriers of fire blight arise from our results, medflies and the mature.*

The likelihood of mature apple fruit as a vehicle for dissemination of E. amylovora has been the subject of considerable research and risk assessment proceedings [summarized in Temple et al., 2007]. However, it was concluded that there is no evidence that asymptomatic apple fruit could be a carrier of E. amylovora [WTO, 2003; Temple et al. 2007; Roberts and Sawyer, 2008]. Nevertheless, the controversy on this topic continues in the scientific literature, and some recent studies have proved the possibility of mature apples as carriers of the pathogen under in vitro conditions [Kimura et al., 2005; Txukamoto et al., 2005a; 2005b; Ordax et al., 2009b]. Further, our new results support the idea of mature fruit as a plant material that could be playing some role in the epidemiology of fire blight. Thus, it seems that asymptomatic but contaminated mature fruit can act as an unnoticed dissemination vehicle, at least, in presence of insect vectors and under favourable conditions. This should be considered in future pest risk assessments.

Overall, our findings highlight the high potential of C. capitata to carry E. amylovora and to act as a vector of the fire blight disease, as well as the great survival ability of this plant pathogen to persist in an environment so much different to a plant as it is a fly. This could require the rigorous application of strict protection and sanitation measurements to reach and efficient control for both quarantine organisms, E. amylovora and C. capitata."

This paper is discussed later under the sub section on Insects.

"Root infection and colonization of pear plants inoculated with Erwinia amylovora by soil irrigation". (Santander et al, 200?)

"Recent studies have demonstrated that E. amylovora is able to survive and to maintain its pathogenic potential in natural water, raising new concerns on its possible dissemination by irrigation."

And

"Root infection of wounded and unwounded plants occurred after soil irrigation with E. amylovora, followed by migration and colinization of the aerial part of the plant."

And

"…E. amylovora is able to infect and colonise host plants through roots, suggesting that the transmission of this pathogen by irrigation water is possible."

__**Comparisons of Biosecurity Australia Assessment of FIRE BLIGHT**__

Apple and Pear Australia Limited has extracted the following information from the IRA's or 2006 and 2011. Unfortunately there are differences in how some of the information is structure so in some cases direct comparisons are difficult. Notwithstanding that there is enough information to make some conclusions.

Based on the information within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" Biosecurity Australia now indicates, the unrestricted risk for *Erwinia amylovora* has been assessed as "negligible" , which achieves Australia's Appropriate Level Of Protection. Therefore, additional risk management measures are not recommended for this pest.

<u>Fire Blight</u>

Table 4.2 Probability of entry, establishment, and spread for *Erwinia amylovora (Table 4.2, 2011)*

Importation	Distribution	Entry	Establishment	Spread	PEES*
Moderate	Extremely Low	Extremely Low	High	High	Extremely low

*Probability of entry, establishment and spread.

Impact scores for *E. amylovora*

Direct impact	Impact scores 2011	2006
Plant life or health	F	F
Human life or health	-	A
Any other aspects of the environment	A	A
Indirect impact		
Control or eradication	E	E
Domestic trade or industry	E	E
International trade	A	D
Environment	A	A
Communities	-	D

Unrestricted risk estimate

Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix.

Unrestricted risk estimate for *Erwinia amylovora*	***2011***	***2006***
Overall probability of entry, establishment and spread:	Extremely low	Very Low
Consequences:	High	High
Unrestricted risk:	Very Low	Low

Biosecurity Australia has indicated, the unrestricted risk for *Erwinia amylovora* has been assessed as "very low" , which achieves Australia's ALOP. Therefore, additional risk management measures are not recommended for this pest.

In considering the above information the following conclusions can be made:

m) 'DIRECT IMPACT' ratings have not changed from 2006 to 2011, and

n) One 'INDIRECT IMPACT' ratings have been lowered from 2006 to 2011, and

o) the rating for 'CONSEQUENCE' has not changed been from 2006 to 2011, and

p) the Overall probability of entry, establishment and spread has moved from VERY LOW (2006) to EXTREMELY LOW (2011).

It is worthy of considering the following scenario

- The World Trade Organisation Appellate Body ruled in favour of Australia in that the alternative measures proposed by New Zealand had not been proven to meet Australia's Appropriate Level of Protection.

(b) Measures 1-8, as proposed by Biosecurity Australia in 2006, and addressed in the subsequent five bullet points of New Zealand's panel request, relates to "*Fire Blight*" and were considered as 'measures' by both the World Trade Organisation Panel and Appellate Panel:

> "The requirement that apples be sourced from areas free from fire blight disease symptoms."
>
> "The requirement that orchards/blocks be inspected for fire blight disease symptoms, including that they be inspected at an inspection intensity that would, at a 95% confidence level, detect visual symptoms if shown by 1% of the trees, and that such inspections take place between 4 to 7 weeks after flowering."
>
> "The requirement that an orchard/block inspection methodology be developed and approved that addresses issues such as visibility of symptoms in the tops of trees, the inspection time needed and the number of trees to be inspected to meet the efficacy level, and training and certification of inspectors."

"The requirement that an orchard/block be suspended for the season on the basis that any evidence of pruning or other activities carried out before the inspection could constitute an attempt to remove or hide symptoms of fire blight."

"The requirement that an orchard/block be suspended for the season on the basis of detection of any visual symptoms of fire blight

"The requirement that apples be subject to disinfection treatment in the packing house."

"The requirement that all grading and packing equipment that comes in direct contact with apples be cleaned and disinfected (using an approved disinfectant) immediately before each Australian packing run."

"The requirement that packing houses registered for export of apples process only fruit sourced from registered orchards."

- The new science incorporated into the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand” offers nothing that should result in the **overall probability of entry, establishment and spread has moved from VERY LOW (2006) to EXTREMELY LOW (2011).**

- If anything the new science would support the maintenance of the 2006 measures or in fact adding additional measures.

- The standard orchard practices are not new information as it was in existence back in 1998 and was certainly considered by both industry and Biosecurity Australia in the 2006 Import Risk Analysis.

- The Integrated Fruit Production Manual again is nothing new and certainly the information available to the Australian Apple industry offers nothing that would indicate the Fire Blight has been eradicated from New Zealand apple growing regions.

- At the very least, pest free places of production should be a mandatory requirement. This could only be achieved with orchard inspections.

- Under Biosecurity Australia’s present proposal, Australia faces the potential of receiving infected fruit from orchards that have active Fire Blight.
  Science supports the fact that fruit can appear symptomless at harvest. The risk of Australia receiving infected fruit that would spread the disease is very real.

- The documentation obtained from the visit by Biosecurity Australia representatives to New Zealand in March 2011 offers nothing new in relation to new science or standard orchard practices that would support the reduction of the unrestricted risk from **LOW** to **VERY LOW**

CONCLUSIONS:

In conclusion Apple and Pear Australia Limited find that there is absolutely no new information that justifies the decision by Biosecurity Australia to reduce the unrestricted risk from LOW to VERY LOW and as a result no reason to allow apples from New Zealand in without any true measures.

MINIMUM MEASURES:

As a minimum Apple and Pear Australia Limited believe the following measures should be implemented for managing FIRE BLIGHT:-

- **Pre harvest orchard inspection to be undertaken by AQIS with the elimination of a block / orchard for the season with an outbreak of Fire Blight, and**
- **Disease latency infection test on each lot before export to prove freedom from Fire Blight, and**
- **Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent, and**
- **Inspection of 600 randomly selected cartons per lot for trash**

European Canker

OVERVIEW:

> The 2011 conclusions with respect to the importation and distribution of European canker are that each of those events has a qualitative likelihood of very low. The application of the decision matrix at table 2.2 results in the inevitable conclusion that the overall probability of entry, establishment and spread will be described qualitatively as extremely low.
>
> There is nothing in the scientific information or reasoning contained in the 2011 Review which in any way departs from the conclusions on the likelihood of importation and distribution of the 2006 IRA. Once again it is the change to a qualitative methodology from the semi-quantitative methodology used in 2006 which results in the change in the level of unrestricted risk. That change is unsupported by any scientific evidence or reasoning. It is irrational and unreasonable.

The conclusion that the probability of entry establishment and spread of European Canker would now be qualitatively described as “extremely low” was sufficient to determine that the unrestricted risk was within Australia’s ALOP. That conclusion was based on the change in risk assessment method and not on any scientific information or reasoning.

In addition the 2011 Review involves a change in the assessed consequences for European canker. In 2006 the IRA had concluded that the direct consequences on plant life of the pest were expected to be minor at the national level and significant at the regional level.

In 2011 the review concludes that the impact would be minor at the regional level and significant at the district level.

That change is based solely upon the work of Beresford and Kim 2011. While that work assessed Tasmania as marginal for European canker it did not cover other areas of Australia. The reduced assessment of the consequences of European canker relies solely upon the earlier work of Beresford and Kim 2008 which came to no firm conclusion on other apple growing regions of Australia. The reliance on Beresford and Kim 2008 is misplaced.

INFORMATION FROM WORLD TRADE ORGANISTION EXPERT PANEL ASSESSMENT:

Before assessing the new science presented by Biosecurity Australia within the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand” it is worth reviewing some of the evidence that was presented by the expert panel to the World Trade Organisation Panel.

Dr Deckers reported:

> *“It is possible that apple fruit is infected naturally endophytically with N. galligena and still develops to a normal looking fruit at the end of the season and that the N. galligena infection shows up only after a storage period of some months.”*

Dr Swinburne reported:

> *“There is no evidence that N. galligena can survive as an epiphyte per se. However, it is possible that the surface of an apple fruit could become contaminated by spores washed down from active canker lesions by rain. During the summer season these would be conidia.”*
>
> And

"Apple fruit of all cultivars (see Q55) can express resistance to rotting by N. galligena during their early developmental stages, up to and usually including harvestable maturity. Where wood canker lesions are prevalent, and the weather conditions are conducive to conidia production throughout fruit development, it is inevitable that infection (in the strict sense) of fruit can take place at any time. These infections will involve some colonisation of cells in lenticels, around growth cracks in the well at the stem end, or within the open area at the calyx."

And

. *"If the latter, then the term most applicable is that a quiescent infection has occurred. As apples ripen two major changes, reduction in the acidity and increase in soluble sugars, reduce the toxicity of benzoic acid, enabling the fungus to resume growth and progressively rot the fruit. For most cultivars in current commercial production this will occur after harvest. Consequently it is possible for infected fruit of all varieties to be harvested with no visible symptoms."*

Dr Deckers reported:

"Export quality apple fruit can carry the N. galligena fungal infection internally on susceptible apple varieties."

Dr Latorre reported:

"However, it is feasible that N. galligena can develop as a latent infection at harvest and hence, apparently healthy (asymptomatic) mature apples eventually could carry N. galligena internally. Infected but asymptomatic fruits would be impossible to differentiate from healthy fruits at harvest or during post-harvest processing."

A*nd*

"The timeframe for an infected mature apple fruit to develop visible symptoms varies from a few (6 to 7) days to several weeks or months (2 to 3 months), primarily depending on apple variety and on ambient temperatures."

Dr Swinburne reported:

"As outlined above (Q49) apples can have quiescent infections at harvest."

Dr Deckers reported:

"Depending on the different weather conditions , there will be different situations concerning the N. galligena presence and development in orchards. For N. galligena freedom of visible symptoms of N. galligena does not mean

that there cannot be a hidden presence of the disease with a delayed symptom expression e.g.on fruits with an internal infection of N. galligena."

Dr Swinburne reported:

"In contrast to the fire blight pathogen there are no tests for the presence of N. galligena in trees that would make it possible to assess an orchard for the presence of the fungus in the absence of visible symptoms."

Dr Deckers reported:

"The transmission of European canker can be made aswell by fruits latently infected as by fruits infested via the lenticels with spores of N. galligena. The rotten fruits can bring the N. galligena into an orchard and spread the disease. The experience of Braithwaite is considered to be relevant in this context."

Dr Latorre reported:

"As stated by Third Parties, three key factors are necessary for the infection of apple fruit with European canker: (i) conducive climatic conditions; (ii) the presence of a susceptible host; and (iii) sufficient inoculum concentration."

Dr Swinburne:

"Rainfall impacts at every stage of the infection cycle of N. galligena, beginning with the production of spores from existing lesions."

And

"For all these reasons mean annual rainfall/temperature data alone will be misleading in predicting the possibility that N. galligena could become established in any new region."

Dr Latorre reported:

"It should not be assumed that any area where the rainfalls are close to, or exceed 1000 mm annually, are necessarily prone to European canker development. Temperatures and rainfalls during the entrance periods (fruit-importing periods) should be provided, considering that they will affect the likelihood of establishment and spread of N. galligena after entrance."

Dr Deckers reported:

"*The impact of* N. galligena *on apple is thus more important than the impact of brown rot on pear."*

And

"A pest free place of production or an area of low pest prevalence will not be easy to guarantee because N. galligena is often spread by the importation of young apple trees where as well the apple variety as the rootstock can be infected by the N. galligena disease. Restricting the imports of apples to the pest free places or to the areas with low pest prevalence, together with the application of a fungicide schema during bloom will seriously reduce the risk of importation of internally infected fruits."

Dr Latorre reported:

"Both alternative measures, "pest-free places of production" and "low pest prevalence," can mitigate the risk of N. galligena entrance via asymptomatic fruits. These are acceptable methods which should be implemented according to FAO (ISPM 4, 10, 22)."

Dr Deckers reported:

"Mature symptomless apple fruits can be internally infected by NG and will not be able to fulfil Australia's ALOP."

Dr Latorre reported:

"Exporting only "mature asymptomatic apples" from New Zealand would disregard the fact that latent infection may occur on a mature apple fruit, the main issue of this dispute."

Dr Swinburne reported:

"Exclusion of exports from the remaining 5% of orchards would reduce the risk to insignificance."

And

"Australia's insistence on receiving only fruit from inspected orchards certified as free from canker would eliminate virtually all risk of fruit being infected."

Dr Latorre reported:

"In fact, there are several places in the world characterized by mean annual rainfall far below 1,000 mm where European canker occurs as a major disease."

And

"The Tasmanian outbreak demonstrates only that climate conditions are suitable for European canker there. The lack of considerable spread suggests that weather conditions are not favourable for European canker in Tasmania (Spreyton, Tasmania, AUS FWS Annex 2; Beresford and Kim, NZ Annex 3). These relatively unfavourable climatic conditions may imply that prevalence, incidence and severity of European canker remained low and that the disease never spread considerably outside Tasmania. However, these observations do not necessarily support the conclusion that the weather conditions are unsuitable for European canker in the rest of Australia….."

Dr Deckers reported:

"I am convinced that latent infections of N. galligena may occur in mature New Zealand apples and not become apparent until after storage. Probably there are significant differences between different apple varieties for these latent infections of N. galligena."

Dr Latorre reported:

"Although there is no relevant scientific evidence, it is acceptable to consider that no aspect of the process in the packing house reduces the number of latently infected fruits. Once the fungus has penetrated mature fruits, the normal post-harvest management including brushing, waxing, sorting and grading, cold storage and even fungicide treatments, will be unable to arrest the fungus inside the fruits."

And

"Latently infected fruits cannot be detected at the time of packing in New Zealand. However, symptoms may appear after several weeks of cold storage."

Dr Deckers reported:

"The final infection rate of the fruits will strongly depend on the presence of the N. galligena infections in the orchards in New Zealand. Maybe it should be good the take the differences in susceptibility of the different apple varieties for N. galligena into account when making the final estimation."

NEW SCIENCE:

Neonectria ditissima

Under field conditions, temperatures of 11–16°C with a measure of leaf wetness provide the best predictors of disease prevalence **(Beresford and Kim 2011).**

New scientific reference reviewed

While the research supports the temperature range of 11 – 16 ºC offer the best predictor of disease prevalence it is not definitive in saying that the disease will only occur in this temperature range. Conditions as temperatures either side of the range have not been tested.

Probability of entry
Association of the pest with the crop

However, annual rainfall alone is considered a poor predictor of disease prevalence **(Latorre 2010; Swinburne 2010a)** and duration of leaf wetness in combination with suitable temperature provide a more reliable predictor of European canker **(Swinburne 2010a).** Recent work predicts disease prevalence under field conditions is best predicted by temperatures of 11º C–16º C and a measure of leaf wetness (number of rainfall days per month) **(Beresford and Kim 2011).**

Lattore 2010 and Swinburne 2010 are Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

New scientific reference reviewed

While the research supports the temperature range of 11 – 16 ºC offer the best predictor of disease prevalence it is not definitive in saying that the disease will only occur in this temperature range. Conditions as temperatures either side of the range have not been tested.
Similarly, the leaf wetness days are only a guide and are not definitive in saying that the disease will only occur at 30% of days/month.

Later work predicts the current distribution of European canker in New Zealand based on temperature and leaf wetness **(Beresford and Kim 2011).**

New scientific reference reviewed

This work only predicts the distribution using averages and means of weather data. There is nothing within the model that deals with either variable climate (climate change) or extreme environmental events that might trigger an outbreak outside of the normal conditions.

Association of the pest with the commodity pathway

The typical rainfall and temperature patterns of major New Zealand apple export areas would suggest latent infection is very unlikely to occur as conditions during fruiting are not favourable for conidia production and subsequent fruit infection **(Beresford and Kim 2011).**

New scientific reference reviewed

In scientific and statistical terms what does 'very unlikely' mean? This term is not quantified within the documentation.

In the south east of England, under artificial conditions with high inoculum and humidity, fruit infection has been recorded to occur most readily up to four weeks after flowering and infection can continue to occur on fruit one week before harvest under suitable conditions **(Xu and Robinson 2010).**

New scientific reference reviewed

The research highlights that given the right level of inoculum and climatic conditions fruit infection can occur

a) up to four weeks after flowering, and

b) can continue to occur on fruit one week from harvest.

This would highlight the need for specific measures for orchards known to have an outbreak of European canker.

In addition, low temperatures that would justify frost management are not conducive to European canker **(Beresford and Kim 2011**) if *N. ditissima* was recorded from the region in the future.

New scientific reference reviewed

This is an assumption that endeavours to link low temperatures with frost management and infection without any sound scientific data.

Recent research has supported the suitability of the Auckland region for European canker disease based on a worldwide comparison of climate suitability **(Beresford and Kim 2011).**

New scientific reference reviewed

Given that this is the assessment of the scientists Biosecurity Australia must undertake specific measures for fruit that might be exported from this region

Ability of the pest to survive existing pest management

A recent study on fruit rots in New Zealand sampled over 12,000 apples from the Hawke's Bay area, that included treatments to promote rot development (wounding, cold storage), and found no European canker rots **(Scheper *et al.* 2007).**

New scientific reference reviewed

Apple and Pear Australia Limited find this a most confusing reference given that the work undertaken by Scheper et al was specific to storage rots after postharvest apple washing and gives no consideration and/or reference to European Canker. While 12,000 fruit might have been used they were used across various treatments including controls.
More importantly the researchers indicate that in undertaking the statistical analysis

> ***"there was no replication of main plots. Therefore it is not possible to test the main effect of the postharvest treatment"***

Ability of the pest to survive packing, transport and storage conditions

It is likely that latently infected fruits that can develop rots during this time **(Berrie *et al.* 2007)** will be removed during this inspection.

New scientific reference reviewed

Apple and pear Australia Limited would question the context of this particular reference particularly when the scientific paper says the following:-

> ***"However, as Bramley apples can be stored for almost twelve months losses due to nectria rot are potentially much higher, particularly in those stored in low level oxygen, high carbon dioxide regimes (3.5^{o} C, 1% oxygen, 5% carbon dioxide)(Prinja, 1989). N. galligena infects developing apples in the orchard between blossom and harvest. Some infections develop into eye rots in the orchard, but many remain latent and subsequently develop in cold store, usually after 3 months. Nectria rots in store occur as eye rots, stalk end rots or cheek rots. Those at the stalk end are often difficult to detect during grading, but develop into visible rots during marketing….."***

Apple and Pear Australia limited would contend that one possible scenario is that:-

a) there is infection in the orchard between blossom and harvest, and
b) the fruit comes straight from the orchard and is packed without cold storage, and
c) there is stalk end rots that are not picked up during grading, and
d) the fruit is immediately exported to Australia.

The end result is that the rot is detected during 'marketing' in Australia.

This seems a very logical and feasible pathway for *Nectria galligena*.

Probability of distribution

Ability of the pest to initiate infection of a suitable host

However, under field conditions, temperatures in the range of 11 ºC –16 ºC are a better predictor of disease prevalence **(Swinburne 2010a; Beresford and Kim 2011).**

Swinburne 2010a reference is Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

New scientific reference reviewed

While the research supports the temperature range of 11 – 16 ºC offer the best predictor of disease prevalence it is not definitive in saying that the disease will only occur in this temperature range. Conditions as temperatures either side of the range have not been tested.

In summer, low rainfall and high temperatures are unfavourable for disease development **(Beresford and Kim 2008; Beresford and Kim 2011).**

New scientific reference reviewed

While this statement may have some validity the researchers have not appeared to consider the climatic variability and extreme weather events that might present both rainfall and temperatures in summer that are favourable for disease development.

Probability of establishment

Suitability of the environment

Recent climate models have confirmed Tasmania as marginal for European canker **(Beresford and Kim 2011).** This work predicts with some accuracy the suitability of the climate for European canker around the world. Although this work does not cover other areas of Australia, an earlier version of this work presented information that predicts other apple growing regions of Australia would also be marginally suitable for European canker **(Beresford and Kim 2008).**

New scientific reference reviewed

The scientific work has only used a past example of the outbreak of European canker in Spreyton in Tasmania as a base from which the researchers have made this prediction. The use of other data from Tasmania the researchers have used Global Summary information from

Mt Wellington and the Grove research centre. Industry would question the relevance of that average/mean information from at least one of those weather stations.
Similarly they have used data from Australian weather sites that lack relevance to the actual growing areas within those regions.
For instance growers in Orange have highlighted in a recent Cherry Industry Climate Change project that the information from the Orange Airport weather station has no relevance to the specific growing regions that are many kilometres from the Orange Airport.
The researchers have not taken into account the specific aspects of regional variance in their modelling.

Another climate model predicted a greater range of locations that would be suitable for European canker in Australia **(Baker and Mewett 2009).** However, this study noted that conditions in Australia are typically less conducive (warmer and drier) than regions of the world where European canker is highly prevalent. The model also predicts regions of New Zealand are very suitable for European canker where the disease is rarely present or absent. This work may be considered a more conservative model in predicting European canker establishment.

New scientific reference reviewed

The report by Baker and Mewett indicates the following main findings of their work:-
:
"***Using the Beresford and Kim (2007) infection requirements and location-specific weather data, there are Australian commercial apple-growing regions and Australian port cities meeting the infection requirements for European canker."***

And

"Assuming that a combination of more than 6 hours rainfall and more than 8 hours of temperatures between 10–16^{o}C on the same day can cause European canker infection or spread (Grove 1990; Lolas and Latorre 1996; Latorre et al. 2002), it can be shown that New Zealand and Australian locations experience conditions in all seasons that meet these requirements."

And

"This report uses Lenswood (Adelaide Hills region) as representative of the cooler apple-growing regions of Australia. Based on the predictive model developed by Latorre et al. (2002), warnings of European canker infection could occur in the temperate commercial apple-growing regions of Lenswood during autumn."

The report concludes that:-

"A comparison of a limited number of Australian and New Zealand locations shows that climatic conditions in Australia can be very similar to those of regions already infected by European canker in New Zealand. It is therefore reasonable to assume that European canker could establish and spread to host plants in commercial apple-growing regions and metropolitan areas such as Sydney and Melbourne in Australia should European canker enter the country."

Reproductive strategy and the potential for adaption

Ascospores have only been recorded from the most suitable climatic regions in New Zealand (Brook and Bailey 1965**)** that are considered more suitable for European canker than regions in Australia **(Beresford and Kim 2011).**

New scientific reference reviewed

The research highlights that ascospores can exist within most suitable climatic regions within New Zealand. As a result the possibility of outbreak of the disease in New Zealand orchards in those most suitable climatic regions is real.

Probability of spread

Suitability of the natural/or managed environment

The lack of spread may have been because of the absence of airborne ascospores which are better suited to long-distance dispersal than conidia (Ransom 1997), combined with marginal climatic conditions **(Beresford and Kim 2011).** The use of chemicals to control apple scab may also have limited disease spread **(Latorre 2010; Swinburne 2010a).**

New scientific reference reviewed

This reference is an expert judgement that is not supported by any scientific data and while the response by both Latorre and Swinburne are expert judgements it does highlight that other aspects other than climatic conditions may have limited the disease spread in Tasmania.

The Latorre 2010; Swinburne 2010a *references are Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science*

Consequences

Plant life or health – Significant at the district level

In Australia, recent climate models have confirmed Tasmania as marginal for European canker **(Beresford and Kim 2011).** This work predicts with some accuracy the suitability of the climate for European canker around the world. Although this work does not cover other areas of Australia, an earlier version of this work presented information that predicts that most other apple growing regions of Australia would be marginally suitable for European canker **(Beresford and Kim 2008).** These apple growing areas include the major production area of the Goulburn Valley in Victoria. The marginal climatic suitability of Australia will limit any potential impact *N. ditissima* may have on host plants.

New scientific reference reviewed

The scientific work has only used a past example of the outbreak of European canker in Spreyton in Tasmania as a base from which the researchers have made this prediction. The use of other data from Tasmania the researchers have used Global Summary information from Mt Wellington and the Grove research centre. Industry would question the relevance of that average/mean information from at least one of those weather stations.

Similarly they have used data from Australian weather sites that lack relevance to the actual growing areas within those regions.

For instance growers in Orange have highlighted in a recent Cherry Industry Climate Change project that the information from the Orange Airport weather station has no relevance to the specific growing regions that are many kilometres from the Orange Airport.

The researchers have not taken into account the specific aspects of regional variance in their modelling.

OTHER ASPECTS OF THE SCIENTIFIC PAPERS.

"The effect of storage conditions on development of rots due to Nectria galligena in Cox and Gala apples first results". (Berrie et al. 2007)

"Apple canker caused by the fungus Nectria galligena is the most important fungal diseases in apple orchards in the UK. The fungus is equally important as a fruit rot and can result in significant losses in store."

"Identification of Regional Climatic Conditions Favorable for Development of European Canker of Apple." (Beresford and Kim, 2011).

"European canker caused by the fungus *Neonectria galligena (Bres.) Rossman & Samuels is an important disease of apple in some temperate regions (16), where it can result in death of buds, shoots, spurs, and branches (14). In extreme cases, whole trees may have to be removed where a canker has girdled the main trunk. It can also cause eye rot of fruit, which is a serious* *problem in Northern Ireland (8) and is periodically problematic in England (2) and northwestern Europe (32) (e.g., The Netherlands [3]).”*

And

“Dubin and English (13) suggested that mean annual rainfall above a threshold of 1,000 mm was associated with European canker development in California, although this threshold would appear not to apply in all regions (e.g., in Kent, England, where European canker is a serious problem but mean annual rainfall is only 600 to 700 mm) (27).”

And

“These validation areas included areas in New Zealand (1), Australia (34), the United States (49), Denmark (23, 33), and The Netherlands (20) (Fig. 1). For these areas, published information was less detailed than for the reference areas ……”

And

“Monthly climatic analysis suggested that, in Auckland, rainfall conditions would be highly conducive to European canker development, with the rainfall frequency threshold exceeded in every month (Fig. 7A). The temperature range threshold was also exceeded in most months but not from December to March (summer to early autumn).”

And

“In Nelson, the rainfall frequency and temperature thresholds were exceeded from April to May in autumn and from September to November in spring (Fig. 7B), supporting observations that conditions are less favorable for European canker in that area than in Auckland.”

And

“In Napier, rainfall frequency and temperature conditions were close to the thresholds from April to November (mid-autumn to late spring), although the thresholds were only ever exceeded by a small amount.”

And

“For the reference and validation areas combined, monthly rainfall frequency and temperature range variables showed patterns of variation within an average year that differed according to region”

And.

“In several other areas, where the disease sometimes occurs but is not a major problem (e.g., Sebastopol, Talca, and Napier), conditions are marginally

favorable, with the climatic thresholds exceeded by a small amount in only a few months of the year. For favourable and marginally favorable areas, the months or seasons in which the thresholds were exceeded varied considerably. This was associated with regional differences in the seasonal pattern of change in the temperature and the rainfall variables."

And

"The weather data used in this study may have had limitations because hourly temperatures had to be interpolated from daily data for most sites"

And

"This study was carried out with little quantitative disease data, although relatively good availability of climatic data. This is a common problem for geoclimatic analyses of disease risk, where information about disease in relation to climatic conditions may be as subjective as the descriptors "mild" and "wet" that have been used for European canker."

And

Also, in the absence of monthly disease data for the validation areas, the posterior probability that long-term temperature and rainfall variable thresholds were met was useful for relating sketchy published disease information to the climatic thresholds."

And
"New modelling approaches are required to make use of subjective information where quantitative disease data are lacking so that relationships between disease and the occurrence of two or more climatic variables simultaneously can be determined"

Given these points extracted from the scientific paper one could conclude that this scientific work has been undertaken with less than appropriate data and as result lacks some true scientific outcomes The terms like 'less favorable' and 'marginally favorable' are used but are not quantified or defined in any way.
In addition there are terms like 'only exceed by a small amount" which again were not quantified or qualified.

Apple and Pear Australia Limited would argue that the 2011 Review's analysis does not give an accurate and true picture of the spread of European canker in New Zealand or the likely spread within Australia of European canker.

ADDITIONAL INFORMATION:

The following is information supplied to Biosecurity Australia by the New Zealand Ministry of Agriculture and Forestry on the 8th April 2011.

Q. *It was indicated that overhead irrigation was not in widespread use in the pipfruit sector (outside of use as a frost management tool in some areas, specifically Central Otago). Is there evidence to support that statement?*

A. **No 'data' or publication is available to validate this claim it is just a reflection of regional convention.** The irrigation system used is a commercial decision of the grower; frost protection by overhead sprinklers in any region other than Central Otago will lead to potential Apple scab (*Venturia inaequalis*) disease problems very early in the season and is avoided for this reason. Some isolated orchards may use tree-targeted water during summer to minimise sunburn and heat stress in the fruit but this is usually managed on a varietal block basis mindful of disease pressures.

Q. *Have there been significant changes to the management strategy for European canker since the 1999-2005 surveys that last reported rots on fruit? Has the proportion of uptake of the IFP increased since that time?*

A. By 2000 IFP uptake was universal in the export industry. The only variation to that has been the growth of organic production (introduced as a variant of classical IFP in 1997) over the period indicated in the question.

Winter management strategies for European Canker are as outlined in the 2008 IFP Fact Sheet.

The conclusion that be made is that there has been no ***"significant change to the management strategy for European canker since the 1999 – 2005 surveys".***

In addition the response highlights that Integrated Fruit Production was implemented in 2000 and is therefore not a new process as promoted by Biosecurity Australia within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand".

<u>Comparisons of Biosecurity Australia Assessment of EUROPEAN CANKER</u>

Apple and Pear Australia Limited has extracted the following information from the IRA's or 2006 and 2011. Unfortunately there are differences in how some of the information is structure so in some cases direct comparisons are difficult. Notwithstanding that there is enough information to make some conclusions.

Probability of entry, establishment, and spread for *Neonectria ditissima (Table 4.4, 2011)*

Importation	**Distribution**	**Entry**	**Establishment**	**Spread**	**PEES***
Very Low	Very Low	Extremely Low	Moderate	Moderate	Extremely Low

*Probability of entry, establishment and spread.

Impact scores for *Neonectria ditissima*

Direct impact	**Impact Scores** **2011**	**2006**
Plant life or health	D	E
Human life or health	-	A
Any other aspects of the environment	C	D
Indirect impact		
Control or eradication	D	D
Domestic trade or industry	D	D
International trade	A	B
Environment	B	C
Communities	-	C

Unrestricted risk estimate
Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix.

Unrestricted risk estimate for *Neonectria ditissima*	***2011***	***2006***
Overall probability of entry, establishment and spread:	Extremely Low	Low
Consequences:	Low	Moderate
Unrestricted risk:	Negligible	Low

Based on the information within the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand” Biosecurity Australia now indicates, the unrestricted risk for *Neonectria ditissima (or Neonectria galligena)* has been assessed as “negligible‶ , which achieves Australia’s Appropriate Level Of Protection. Therefore, additional risk management measures are not recommended for this pest.

In considering the above information the following conclusions can be made:

q) **'DIRECT IMPACT' ratings have been lowered from 2006 to 2011, and**
r) **Two 'INDIRECT IMPACT' ratings have been lowered from 2006 to 2011, and**
s) **the rating for 'CONSEQUENCE' has been lowered from MODERATE (2006) to LOW (2011, and**
t) **the Overall probability of entry, establishment and spread has moved from LOW (2006) to EXTREMELY LOW (2011).**

It is worthy of considering the following scenario

- The World Trade Organisation Appellate Body ruled in favour of Australia in that the alternative measures proposed by New Zealand had not been proven to meet Australia's Appropriate Level of Protection.

- Measures 9 to 13 as proposed by Biosecurity Australia in 2006, and addressed in the subsequent five bullet points of New Zealand's panel request, relates to "*European canker*" and were considered as 'measures' by both the World Trade Organisation Panel and Appellate Panel:

    "The requirement that apples be sourced from export orchards/blocks free of European canker (pest free places of production)."

    "The requirement that all trees in export orchards/blocks be inspected for symptoms of European canker, including that orchards/blocks in areas less conducive for disease are inspected for symptoms by walking down every row and visually examining all trees on both sides of each row, and that areas more conducive to the disease are inspected using the same procedure combined with inspection of the upper limbs of each tree using ladders (if needed), and that such inspections take place after leaf fall and before winter pruning."

    "The requirement that all new planting stock be intensively examined and treated for European canker."

    "The requirement that an orchard/block be suspended for the season on the basis that any evidence of pruning or other activities carried out before the inspection could constitute an attempt to remove or hide symptoms of European canker."

    "The requirement that exports from an orchard/block be suspended for the coming season on the basis of detection of European canker and that reinstatement would require eradication of the disease, confirmed by inspection."

- The new science incorporated into the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" offers nothing that should result in the **overall probability of entry, establishment and spread has moved from LOW (2006) to EXTREMELY LOW (2011).**

- If anything the new science would support the maintenance of the 2006 measures or in fact adding additional measures.

- The standard orchard practices are not new information as it was in existence back in 1998 and was certainly considered by both industry and Biosecurity Australia in the 2006 Import Risk Analysis.

- The Integrated Fruit Production Manual again is nothing new and certainly the information available to the Australian Apple industry offers nothing that would indicate the European canker has been eradicated from New Zealand apple growing regions.

- When assessing the risks from European Canker, Biosecurity Australia has treated New Zealand as being a low risk region. The facts are that at least one area in New Zealand is a high risk area (Auckland, Otago). These areas have a known presence of canker and have ideal climatic conditions for this disease. Biosecurity Australia has concluded that only 5% of New Zealand apples are grown in these areas and as such this fruit does not pose a risk. There is a total lack of recognition that the fruit from these areas will arrive in Australia in undiluted consignments.

- At the very least, pest free places of production should be a mandatory requirement. This could only be achieved with orchard inspections.

- Under Biosecurity Australia's present proposal, Australia faces the potential of receiving infected fruit from orchards that have active European Canker. Science supports the fact that fruit can appear symptomless at harvest but develops rots later. The risk of Australia receiving infected fruit that would spread the disease is very real.

- The documentation obtained from the visit by Biosecurity Australia representatives to New Zealand in March 2011 offers nothing new in relation to new science or standard orchard practices that would support the reduction of the unrestricted risk from **LOW** to **NEGLIGIBLE**.

CONCLUSIONS:

In conclusion Apple and Pear Australia Limited find that there is absolutely no new information that justifies the decision by Biosecurity Australia to reduce the unrestricted risk from LOW to NEGLIGIBLE and as a result no reason to allow apples from New Zealand in without any true measures.

Apple and Pear Australia limited would argue that with the carton being the most logical mode of transport for trash Biosecurity Australia MUST include 600 randomly selected cartons per lot to ensure that trash is not present and exported to Australia.

On the finding of any trash within retail-ready packs the full lot needs to be returned to New Zealand, treated or destroyed.

MINIMUM MEASURES:

As a minimum Apple and Pear Australia Limited believe the following measures should be implemented for managing European canker:-

- **Banning of apples from the high risk areas for European canker (eg., Auckland), and**
- **Orchard inspection with the elimination of a block / orchard for the season with an outbreak of European canker, and**
- **Disease latency infection test on each lot before export, and**
- **Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent**
- **Inspection of 600 randomly selected cartons per lot,, *and***
- **A maximum pest limit of zero.**

Apple Leaf Curling Midge

OVERVIEW.

In the case of Apple Leaf Curling Midge the 2006 Import Risk Analysis concluded that 4.1% of all apples imported to Australia would be infested with the pest.

There is nothing in the scientific information or reasoning in the 2011 Review which provides any basis for departing from that assessment.

To the contrary the 2011 Review concludes that:

> *"The information presented indicates that there is potential for some consignments of apples from New Zealand to contain apple leaf curling midge pupae that are viable and remain undetected during the minimal on arrival quarantine processes at the Australian border. Recognising that there is potential for this event to occur, though not with certainty in all consignments or in all years, …"*

Just like for Fire Blight, that analysis supports the conclusion that "the event [that is the importation of the pest] would be very likely to occur". The reasoning supports a rating of "high". The allocation of "moderate" meaning "the event would occur with an even probability" is inconsistent with the scientific evidence and the reasoning. It is irrational and unreasonable.

As with Fire Blight, so with Apple Leaf Curling Midge the change in the assessed level of unrestricted risk in the 2011 Review is driven solely by the change in the method for assessing the likelihood of distribution.

In the case of Apple Leaf Curling Midge the assessment of the likelihood of distribution depends centrally on the assessment of a mating pair of the pest being within sufficient proximity to each other and to a suitable host to result in transfer.

The 2006 Import Risk Analysis assessed the likelihood of that scenario by taking into account the different distribution modalities and proximity points referred to above with respect to fire blight. It also specifically took into account the impact of clustering.[20]

By departing from the 2006 methodology, without citing any scientific information or reasoning to do so, the 2011 Review has allocated the qualitative likelihood of "very low" for the likelihood of entry of Apple Leaf Curling Midge.

Again it is the matrix of rules for combining qualitative likelihoods[21] which determines that the overall probability of entry, establishment and spread of Apple Leaf Curling Midge cannot be higher than very low. That in turn determined the outcome of the unrestricted risk assessment undertaken in 2011 would be that that risk was within Australia's Appropriate Level Of Protection.

That change is not supported by scientific evidence or by reasoning and is irrational and unreasonable.

Introduction.

The midge Dasineura mali (Kieffer) is a significant pest of apples in several countries, especially New Zealand (Suckling et al, 2007).

Apple leaf-curling midge (ACLM) is a pest in most apple growing regions of New Zealand and its high incidence of infestations in many commercial orchards has raised quarantine problems in the apple industry (He et al, 2008).

Within the 2001 version of the New Zealand Pipfruit Integrated Fruit Production Manual the following information is detailed:-

[20] So for example at page 333 the 2006 IRA recorded that "after extensive discussion with Biosecurity Australia entomologists and team members it was decided that it would allow clearer consideration of the risks from arthropods to calculate estimates of the number of infested apples in each exposure point per week".

[21] Table 2.2 on page 9

- Apple leafcurling midge (ALCM, *Dasineura mali*) larvae can damage the Leaves, flowers and fruitlets of apple trees. Control of ALCM may be required on young trees to stop tree development being retarded and on mature trees to prevent fruit contamination by pupal cocoons.

- ALCM has three generations per year in Nelson, Canterbury and Central Otago, five in Hawkes Bay and 6-7 in Waikato and Auckland.

- The number of generations per year, and consequently the seasonal abundance of ALCM may be greater when weather conditions are wetter than normal.

- Natural enemies do not provide sufficient control and spraying may be required depending on the level of egg infestation of actively growing shoots in an orchard.

INFORMATION FROM WORLD TRADE ORGANISTION EXPERT PANEL ASSESSMENT:

Before assessing the new science presented by Biosecurity Australia within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" it is worth reviewing some of the evidence that was presented by the expert panel to the World Trade Organisation Panel.

Dr Cross reported:

The conditions for adult emergence of ALCM

"Australia is probably correct to assert that (some) adults could emerge as soon as the appropriate triggers are encountered by the pupa. It is likely that individuals would emerge over quite an extended period ranging from <1 day to > 60 days and possibly to > 1 year depending on conditions."

and

"It is likely that ALCM in cocoons on apple fruits emerging from cold storage would be at a wide range of stages of development including:

1. *Third instar larvae that have just cocooned and need to complete diapause and post diapause development.*

2. *Mature third instar larvae that have just cocooned that do not require diapause but have to complete pupal development.*

3. *Pupae at various stages of development including some at late stages of development that were nearly ready to emerge as adults at the moment of putting into cold storage."*

And

"NZ assertions seem to be based on an assumption that cold storage of apples would either kill individuals that were pupating or perhaps force them into diapause, though no evidence to support this has been supplied. Indeed, if pupae were killed by exposure to cold, then ALCM's existence would be threatened by post diapause cold periods in spring. No evidence has been produced that AA or CA storage with very low oxygen conditions (< 1%) lead to rapid mortality of ALCM pre-pupae or pupae."

And

"What is lacking is good quality studies investigating 1) the effect of temperature on the rate of development (duration) of the different life stages of ALCM 2) requirements for diapause induction and breaking in ALCM 3) the effect of exposure to varying degrees of cold and CA storage on survival of the different ALCM life stages 4) The requirements for temperature, humidity and windspeed for emergence of adults after pupation. Until such studies are done this question cannot be resolved with certainty."

The flight range of ALCM

"There don't appear to have been any studies into the flight range of ALCM females where females are forced to find a host. The distance in Aus IRA of 200 m is perhaps plausible but not supported by evidence. The 30 m distance (over 3 generations) given in Suckling et al (2007) (NZ exhibit 15) is based on the decline in shoot infestation rates in new apple trees adjacent to an old established planting in a sex pheromone mating disruption trial, a situation which is not directly analogous to the situation required for the risk assessment of a mated female flying to a distant host."

The adult life span of ALCM

"The life span of females in the field will depend very much on microclimatic conditions at the time. The life span of 2-6 days appears to be based on cursory laboratory observations and not on a properly conducted study of the distributions of longevity of males and females and how they are affected by conditions. The meaning of the terminology "life span of 2-6 days" is vague."

The climatic factors in respect of ALCM spread

"ALCM can tolerate quite a wide range of climates and it is inevitable that conditions conducive to ALCM establishment and spread are present in several, perhaps many areas of Australia, especially in areas where the climate is favourable to apple growing."

The life stage in which ALCM could enter Australia on export apples imported from New Zealand

“The answer is essentially the same as given in (i) above. Unless New Zealand can provide evidence to the contrary, ALCM could enter Australia as mature 3rd instar larvae (in the full range of stages of diapause) or as pupae (in the full range of stages of post diapause pupal development) in cocoons round the stalk or eye of apple fruits or possibly attached to bulk bins used in the orchard for picking apple fruits.”

Dr Deckers reported:

“The adult emergence of ALCM will not be immediately after the cold storage; it will take some time depending on internal processes of development of the insect in the pupae that will depend on the environmental conditions.”

And

“The flight range in an orchard is normally limited, but introduction in a newly infected orchard indicate a general spread over the whole orchard in a very short time. This could indicate that wind distribution can play a role.”

And

“Why not decide on the need for a fumigation only when there is a problem with ALCM found on an apple in the orchard or during grading and packing; this would allow to reduce the risk of a potential introduction into Australia substantially.”

Dr Cross reported:

“Australia is also right to question the use of the prodding test to establish whether or not non-shrivelled individuals are alive or dead as this would not be a very accurate test. Some individuals that did not move in response to prodding could be viable. Rearing to adult is necessary for establishing mortality.”

And

“Given the crucial importance of viability in calculating risks and determining appropriate sample sizes it does seem important that a more rigorous study is conducted over several seasons. Australia's IRA does need to take viability into account. Until good data is produced, it would be entitled to conservative estimate of 50% viability (= 50% mortality) given the lack of data and likely variable nature of this parameter.”

And

“SPS measures would need to deal with the critical issue of disposal of waste fruit well away from apple trees. No detailed study has been presented by NZ to quantify these risks in similar pack houses in NZ.”

And

“In each generation a proportion of larvae may go into diapause and not emerge till the following year or the year after that. The proportion doing this varies considerably between generations and years.”

And

“As stated in the answers given to Question 97 above, the survey of Tomkins et al (1994) found 63% of cocoons were found to be empty and the second study of Rogers et al (2006) (Exhibit NZ 17) gives estimates of 36.6%-42.2 % empty cocoons. These are two snap shots of what is likely to be a very variable parameter, due to variations in the availability of shoot growth and temperature and rainfall patterns as well as geographical and topographical variations. Better data is required.”

And

“A conservative estimate might consider 30% of cocoons to be parasitised on average.”

Dr Deckers reported:

“The number of generations of ALCM can be different from one year to another and the population development will depend also on the presence of shoots in an active growing stage in the orchard.”

<u>Dr Cross reported</u>:

“At picking, depending on the firmness of attachment of the fruit, the way the fruit is picked and the degree of care taken to remove leaf material from picked fruits, a proportion of fruit will have mature leaves and leafy stipules attached.”

And

“However, there is a requirement for the apples to be free of trash.”

<u>Dr Sgrillo reported</u>:

“A rough evaluation can be done, considering that <u>theoretically</u> a couple of adults with the right age and conditions, in the right time and at the right place could initiate a population.”

And

"Also the data available is not fully reliable. Rogers et al. (2005) states: 'Naturally infested apples were selected from Nelson orchards with *<u>uncharacteristically high levels of ALCM</u>* *during 2005'. Therefore the data is not representative of the average New Zealand conditions."*

<u>Dr Cross reported:</u>

"The sampling is destructive (i.e. each apple sampled is not returned to the whole lot where it would be equally likely to be re-sampled), it is assumed that the midge cocoons are randomly distributed so the underlying distribution is the hypergeometric."

<u>Dr Deckers reported</u>:

"The necessity to treat all the lots when a fruit sample of only 600 apples is inspected is surprising: why not only treat the lots of apples when they come from an infected orchard or when some ALCM have been found."

And

"I don't understand why the fumigation treatment applied on the infected apple plots would not be able to reduce the ALCM populations sufficiently. Is there a clear scientific evidence for this view?"

<u>Dr Cross reported:</u>

"In some years in some orchards, there could well be flushes of new growth in the weeks running up to and including harvest."

And

"If there is a second mandatory independent border inspection of 600 fruits were done then this is essentially the same as a total inspection of 1200 apples."

And

"There appears to be a fundamental disagreement between the parties as to whether a second inspection would be carried out, Australia asserting that such an inspection would either not occur or would be ineffective. This needs to be resolved."

<u>Dr Cross reported</u>:

"Australia's IRA on this point seems objective and credible but, as stated in the answer to question 94, a weakness in the IRA was that Australia failed to quantify (or at least delimit) the geographic range and range of conditions which are necessary for ALCM establishment and spread, both in terms of

temperature and rainfall and their seasonal occurrence. The geographic and climatic limits were not established."

Dr Cross reported:

"Australia's IRA part B page 185 does not indicate that ALCM is only likely to be a significant pest problem in nurseries and young trees in orchards that are establishing and was deficient in this respect as pointed out by NZ in para 4.371 of its FWS. However, Australia is right to point out in paras 840 of their FWS that invasive species do not necessarily behave in the same way when they are introduced to different parts of the world. If ALCM were to establish in Australia without its parasitoid Platygaster demades, in regions with a suitable climate it could be more numerous and damaging than it currently is in similar regions in NZ"

And

"The establishment of ALCM in Australia could lead to increased use of insecticides if suitable insecticides were available in Australia ….."

Dr Deckers reported:

"The imposed measure for a chemical control of the problem of ALCM in the New Zealand orchard should concentrate on the last generations of the ALCM. Together with the proposed inspection of a 600 fruit sample after harvest, this could help to achieve Australia's ALOP for ALCM."

Review of New Science.

Apple and Pear Australia Limited have reviewed the new science as referenced within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand". Our analysis suggests that the new science does not support any change in the risk assessment of ALCM. APAL's analysis indicates that the 'new science' is actually very general in nature and has no bearing on any aspect relating to the export of apples from New Zealand. Apple and Pear Australia Limited provide specific comments on the new evidence presented within each of the scientific references:

Dasineura mali

This species is native to northern Europe, and has been introduced to both North America and New Zealand **(Gagné 2007).**

New scientific reference reviewed

This is general information on the pest but does not have any bearing on the aspects relating to the export of apples from New Zealand.

When fully grown, larvae are 1.5–2.5 mm long **(LaGasa 2007).**

New scientific reference reviewed

This is general information on the pest but does not have any bearing on the aspects relating to the export of apples from New Zealand.

Pupation takes place in a white silken cocoon 2–2.5 mm in length **(LaGasa 2007)**

New scientific reference reviewed

This is general information on the pest but does not have any bearing on the aspects relating to the export of apples from New Zealand.

The adult female deposits eggs in the leaf folds or along the margins of immature apple leaves **(LaGasa 2007).**

New scientific reference reviewed

This is general information on the pest but does not have any bearing on the aspects relating to the export of apples from New Zealand.

Probability of Entry
Ability of the pest to survive existing pest management

Control of *D. mali* in New Zealand involves a range of biological control agents such as the egg parasitoid *Platygaster demades* (Hymenoptera: Platygasteridae) and predatory mites such as *Anystis* spp. (Acarina: Anystidae) **(Shaw and Wallis 2008).**

New scientific reference reviewed

This research was undertaken in a block of apples at the HortResearch orchard in Nelson and not in a commercial orchard. In addition most of the trees had either five applications of IFP insecticides or eleven applications of carbaryl.
More importantly the researchers report that

> ***"The relatively small size of the trial plots, the mobility of some of the natural enemies monitored and the inability of carbaryl to exclude them totally from the treated plots makes interpretation of the results difficult".***

The mirid bug *Sejanus albisignata* (Hemiptera: Anthocoridae) is also noted as a predator of *D. mali* eggs **(Shaw and Wallis 2008).**

New scientific reference reviewed

The mirid bug *Sejanus albisignata is* known not to exist in Australia. The findings of this research raises the question of whether the predator mired bug could be transported to Australia with infested apples or trash.

Biosecurity Australia has failed to assess the implications and consequences of the mirid bug being transported to Australia by apples and then in itself becoming a ‘pest’ within the Australian environment and having its own dire consequences?

Similar parasitism results were found in the North Palmerston district, which is between Wellington and Hawke’s Bay. In that study, the parasitism rates were 55, 41, 68 and 73 per cent of the first, second, third and fourth (overwintering) generations respectively **(He and Wang 2007).**

New scientific reference reviewed

This research was done in an organic orchard at Massey University, Palmerston North in New Zealand and not on a commercial orchard. There is no understanding of the level of the Apple Leaf Curling Midge population and while the research highlights that parasitism does occur it is not a process that results in the elimination of the insect within the orchard.

The researchers also highlight that

> ***“information on the seasonal cycle of P. demades under natural conditions is still lacking, making it difficult to understand its population dynamics and the co-evolution of the host-parasitoid system”.***

And

> ***“Sandanayaka & Charles (2006b) suggest that ALCM may become a contaminant of export fruit if mature larvae fall into the calyx of the fruit and pupate there. All unparasitised ALCM in the first three generations emerged normally during the season.***
> ***Therefore, it is thought that the main cause of fruit contamination could be ALCM parasitised by aestivated P. demades and fourth generation ALCM (Fig. 1) attaching to the fruits.”***

Based on these statements the research

c) **lacks clarity on how the host-parasitoid system works in natural conditions, and**
d) **gives an indication that apple fruit will be contaminated, but**
e) **gives no confirmation as to what might be in contaminated fruit.**

The parasite *Platygaster demades* was introduced into New Zealand in 1925 to assist in the control of pear leaf-curling midge.

The findings of this research raise a number of questions: whether the parasite *Platygaster demades is* known to exist in Australia and whether the parasite could be transported to Australia with infested apples or trash.

Again, Biosecurity Australia has failed to assess the implications and consequences of the Platygaster demades parasite being transported to Australia by apples and then in itself becoming a pest within the Australian environment and having its own dire consequences?

Association of the pest with the commodity pathway

If a pupa did not move when prodded it was considered to be dead. Expressed as a proportion of occupied cocoons, 75 per cent contained dead pupae **(Rogers 2008)**

> ***New scientific reference reviewed***

The actual statement made by Dr David Rogers in his letter to Karen Sparrow, Manager Plant Imports, Biosecurity New Zealand dated 16th August 2008, was

> ***"In our study the figure of 60% of all cocoons, included both occupied and unoccupied cocoons. The context of the study was to determine actual quarantine risk, ie viable occupied cocoons. Therefore we expressed the number of dead ALCM as a proportion of all cocoons (both occupied and unoccupied) that could be found during inspection. If the number of dead ALCM was expressed as a percentage of occupied cocoons only, the mean mortality was 75%".***

Apple and Pear Australia Limited see no relevance to the statement that *"if a pupa did not move when prodded it was considered to be dead"* given that there is no reference to that statement in the correspondence from Dr Rogers.
If you consider the reverse to the statement the number of live ALCM as expressed as a percentage of occupied cocoons only the mean live ALCM is 25%. This would be considered a significantly high quantity of live cocoons.

The 2008 response by Dr Rogers was in relation to a question raised about the original paper titled "Apple leafcurling midge cocoons on apple: pupal occupancy and mortality". The interesting aspect is that Biosecurity Australia report in their bibliography to the "draft report for the non-regulated analysis of existing policy for apples from New Zealand" that the 2006 paper is an 'unpublished paper provided by Ministry of Agriculture and Forestry, New Zealand.

Apple and Pear Australia Limited would question how an unpublished paper has any relevance to the Import Risk Analysis process.

Probability of distribution
Completion of development

In that study, the parasitism rates were 55, 41, 68 and 73 per cent of the first, second, third and fourth (overwintering) generations respectively **(He and Wang 2007).**

New scientific reference reviewed

Refer to the information above in relation to a similar quote from He and Wang, 2007.

Ability of the pest to move from the pathway to a suitable host

Adult male *D. mali* have been recorded to fly distances of at least 50 metres **(Cross and Hall 2009)**, though longer distance flight may also be possible **(Cross 2010**). While specific studies on the flight potential of females have not been conducted, similar flight distances would be expected.

New scientific reference reviewed

This is general information on the movement of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.
All that one can take from this science is that 50 metres is at least the distance that an adult male can travel. It could be much further but it has not been researched.

Cross 2010 reference is an Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Suckling *et al.* (2007) further reported that the maximum colonisation distance for females was 30m.

New scientific reference reviewed

This is general information on the movement of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.
All that one can take from this science is that 30 metres is at least the distance that an adult male can travel. The researcher/s conclusion that 30 metres is a maximum distance for female movement is in conflict with the reference by Cross and Hall, 2009 and Cross, 2010.

It is worth noting that this distance is in relation to the research about colonisation of a block from the edge of a block and not necessarily about the distance travelled in flight. There may be other factors within the orchard that may affect/restrict the movement in a normal flight pattern.

Ability of the pest to initiate infestation of a suitable host

Adult female midges held at 4°C with moisture available survive 4–5 days, and rarely 6 days. Further, most male and female midges held at 18–20°C in a low airflow environment survived less than one day **(Cross 2010).** A shorter life span of 1–2 days has also been reported **(Suckling *et al.* 2007).**

> ***Cross 2010 reference is an Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science***
>
> ***New scientific reference reviewed***

In relation to the reference "a shorter life span of 1-2 days has been reported (Suckling et al, 2007) Apple and Pear Australia Limited believe that there is no relevance to this given that

a) the quote comes from the 'Materials and Methods' part of the document and not within the 'results', and

b) the information is referenced as W.R.M.S., unpublished data.

Probability of establishment
Suitability of the environment

It is possible that the relatively dry environmental conditions in many regions of Australia where apple and crab-apple trees are grown would be unsuitable for *D. mali* to survive long enough to establish a persistent population. This, along with potential absence of suitable conditions to enter or break diapauses, would appear to be the case in countries such as Greece, Turkey and Spain that produce apples, but have no records of *D. mali* (**CABI CPC 2008).**

This is general information on the environmental conditions under which the pest might/might not survive but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.
The comment above is based on supposition and not on any science.

APAL does not believe that the CABI Crop Protection Compendium 2008 document is in itself a true scientific paper. The original scientific source for the research reported within CABI and used by Biosecurity Australia needs to be referenced. If this is not possible the document has little relevance to this risk assessment process.

Reproduction strategy and the potential for adaptation

Females are reported to commence "calling" for mates two hours after emerging from pupation **(Suckling *et al.* 2007).**

> ***New scientific reference reviewed***

This reference actually gives strong support to the fact that live fertile females start mating and egg development in a very short period of time and if such insects were to arrive in Australia could result in very quick population development.

The pheromone has subsequently been utilised to develop a trap for male *D. mali* **(Cross and Hall 2009).**

New scientific reference reviewed

This is general information on the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand. While pheromones may be a way of managing the insect they do not eliminate the pest. In other examples of pheromone use Australian growers are aware that pheromones are far less effective when there are high populations of the insect. Chemicals are required to lower the pressure before obtaining effective management from the pheromones.

Cultural practices and control measures

Generalist predators such as *Anystis sp*. and *Sejanus albisignata* also provide some control of *D. mali* in New Zealand **(Shaw and Wallis 2008).** While *Sejanus* species are not recorded from Australia, there are two species of *Anystis* in Australia, *A. wallacei* and *A. baccarum* (AICN 2005). These species, or other generalist predators, may result in some mortality in any *D. mali* populations. However, it is not considered that they would prevent *D. mali* from establishing a founding population

New scientific reference reviewed

Biosecurity Australia has not advised stakeholders whether the two species *A. wallacei* and *A. baccarum* found in Australia are the same Anystis species as those found in New Zealand.
If there are different species of Anystis in New Zealand they should be identified. Moreover, Biosecurity Australia should conduct a risk assessment on those Anystis species to determine the level of risk that they are transported to Australia with apples and then in themselves become a 'pest'.

More importantly, however, Biosecurity Australia itself has highlighted that

> ***"These species, or other generalist predators, may result in some mortality in any D. mali populations. However, it is not considered that they would prevent D. mali from establishing a founding population".***

European earwig (*Forficula auricularia*) has also been established as a predator of *D. mali* larvae and will bite through leaves to access its prey (**He *et al.* 2008).**

New scientific reference reviewed

**This scientific work is a combination of laboratory and field work.
In previous work of He and Wang (2007) they report that there are four generations occurring in Palmerston North**

> ***"overwintered generation, late September–late October; first generation, late November–early January; second generation, mid January–early March; and third generation, early March–early April".***

**The research was again done in an organic orchard at Massey University. Given that insecticides are not used in the organic orchard it is highly likely that both the Apple Leaf Curling Midge and the European Earwig were in higher numbers.
Given that the orchard was an organic orchard the use of the insecticide carbaryl would not have been used. The work of Shaw and Wallis (2008) highlights that carbaryl is used in IFP orchards and that *"no earwigs were recorded in the carbaryl treatment".*
Australian apple growers are well aware of the biological control capacity of Earwigs but find that their numbers within orchards are never high enough. More importantly Earwigs are a pest in cherry orchards so growers producing both apples and cherries are in conflict over the value of the Earwig as a predator.**

What the research does not cover is how widely spread European Earwigs are within New Zealand orchards. Biosecurity Australia gives no indication of that within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand".

**The research being addressed by the above reference appears to have been undertaken in a short period in January 2008 as part of the second generation. There is no reference to whether this pattern is replicated in other parts of the year and in other generations.
More importantly the researchers highlighted that**

> **"*Further investigation into this potential biological control agent for ALCM is warranted. For example, programmes like laboratory mass-rearing and field augmentation, conservation and trapping can be developed to biologically control ALCM populations using European earwigs".***

Apple and Pear Australia limited would argue that while the science is of some interest it is not in practise within New Zealand and has no scientific evidence that it is successfully in reducing the populations of Apple Leaf Curing Midge.

Probability of spread

Suitability of the natural/or managed environment

From Europe, *D. mali* is reported as present in Finland, Norway and Sweden in the north and Bulgaria, Italy, and Macedonia in the South **(CABI CPC 2008).**

General information with no new science.

This is general information on the potential distribution of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.

APAL does not believe that the CABI Crop Protection Compendium 2008 document is in itself a true scientific paper. The original scientific source for the research reported within CABI and used by Biosecurity Australia needs to be referenced. If this is not possible the document has little relevance to this risk assessment process.

The distribution of *D. mali* appears to have reached an equilibrium with the pest spanning the northern latitudes from 38°N to 65°N **(CABI CPC 2008; Cross 2010)**

General information with no new science.

This is general information on the potential distribution of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.
Any extrapolation to possible Australian conditions will only be based on models which use broad parameters and fail to take into account specific environmental and topographical aspects of the unique growing regions of Australia.
It is well known that in an apple growing region the climatic and environmental conditions vary from one subregion to another subregion and this results in different maturity times and harvest times.
One model does not fit all circumstances unless you put in the very specific localised information.

Cross 2010 reference is an Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Presence of natural barriers

Adult *D. mali* is capable of independent flight. Adult males have been trapped with pheromone lures at distances up to 50m **(Cross and Hall 2009)** though longer distances were not tested.

New scientific reference reviewed

This is general information on the movement of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.
All that one can take from this science is that 50 metres is at least the distance that an adult male can travel. It could be much further but it has not been researched.

Other aspects of the scientific papers.

In reviewing the scientific papers referenced in the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand", Apple and Pear Australia Limited extracted additional information which is useful in assessing both the new science and the relevance of that or not in making changes to the measures proposed by Biosecurity Australia between 2006 and 2011. This includes:

"Trapping Dasinuera mali (Diptera: Cecidomyiidae) in Apples" (Suckling et al, 2007).

*"**The lack of shoot infestation by January, February, and March (late summer) was unexpected (Table 2) and could be attributed to the exceptionally dry season**. It was noteworthy that shoot infestation was at an extremely low level in the next larval generation (0 in 250 shoots in each block, in December) and unfortunately remained very low in January and April in both treatment and controls. The mean number of growing shoot tips per tree on 22 February 2006 was 9.08 _0.52), almost the same as the number of shoots per tree. This suggests that the lack of infestation was not due to a shortage of suitable host foliage at the right stage. **The lack of rainfall, required for pupation (Shaw et al. 2005), is a more likely explanation**."*

This highlights the importance of the climatic conditions to the outbreaks of ALCM.

*"Multiple mating up to five times was readily achieved by males that were presented with a surplus of virgin females in the laboratory. **Although it is not clear how often multiple mating occurs in the field**, this result indicates sufficient potential to represent a major challenge to mass trapping, because such a high level of male suppression is needed to suppress damage (El-Sayed et al. 2006)".*

While experiments in the laboratory give an answer there is no guarantee that the same results are reflected in the field.

"This finding supports the proposition that the large number of males caught were largely immigrants in each generation, and suggests that one ha plot sizes may be too small to fully evaluate population suppression using pheromone against this pest. Furthermore, the negligible rate of infestation in the control plots means that there is no evidence for impact on female mating or population suppression at this stage".

This research implies that apple specific blocks that are no more than one hectare in size may be too small to achieve population suppression using pheromones.
Apple and Pear Australia Limited seeks clarification as to whether Biosecurity Australia has considered this implication as part of the assessment of the risk of establishment of APLC while undertaking their assessment of the New Zealand application to export apples? If Biosecurity Australia has done so, the results and justifications for their analysis should be documented within the Report. If not Biosecurity Australia should now consider the consequences of this information.

"The results presented here have shown that it is at least possible to achieve levels of male suppression that approach the high levels theoretically needed for successful control by mass trapping of this species, but there are some important caveats over any extrapolation to the potential for economic control by using this approach."

Again this highlights the difficulty in extrapolating theoretical results into what happens within the 'natural environment' of the apple orchard.

"Semiochemicals in management of Apple Leaf Midge" (Natural Resource Institute, East Malling Research, UK. 2006).

"*There is currently no satisfactory method of controlling the pest. All apple varieties are susceptible and it is unlikely that resistant varieties can be developed".*

"Previous trials indicated that synthetic pyrethroids applied as foliar sprays were the only insecticides out of a wide range of materials tested with significant efficacy against the pest"

And

"treatment with six sprays at 3-4 day intervals was required to be highly effective."

This information gives strong credence to the fact that even with a heavy chemical use there is no satisfactory method of controlling Apple Leaf Curling Midge

"Exploitation of the sex pheromone of apple leaf midge Dasineura mali Kieffer (Diptera: Cecidomyiidae for pest monitoring: Part 1. Development of lure and trap." (Cross and Hall, 2009).

"Heavy infestations cause shortening of the extension growth and premature leaf fall. This is usually of little consequence in established

orchards, but very severe attacks can occur with in excess of 90% of leaves severely affected and each leaf with large numbers of larvae."

And

"Effects on fruit size and fruit bud formation have not been qualified on apple, although a study in Germany, a 10% increase in yield occurred when control of pear leaf midge, Dasineura pyri (Bouche) was achieved".

And

"Occasionally, cocoons lodge on the surface of fruits, their presence restricting market access of fruit for export to countries where apple leaf midge is not present (Tomkins et al., 2000)."

And

"D. mali was very effectively controlled by the systemic organophosphorus insecticide vamidothion, but this insecticide, which is highly toxic to humans, is no longer available in most countries and there is currently no satisfactory control for this pest. In New Zealand, there is some use of the organophosphorus insecticide diazinon (Burnip et al., 1998), but this insecticide is also only partially effective and not widely available elsewhere."

And

"Once inside their leaf galls, the larvae are protected from insecticide sprays"

And

"However, natural enemies are not adequate to prevent significant attacks."

Again this information highlights the fact that Apple Leaf Curling Midge will be a major pest for Australian apple production if allowed to enter Australia.

<u>Comparisons of Biosecurity Australia Assessment of Apple Leaf Curling Midge.</u>

Apple and Pear Australia Limited have extracted the following information from the IRA's or 2006 and 2011. Unfortunately there are differences in how some of the information is structure so in some cases direct comparisons are difficult. Notwithstanding that there is enough information to make some conclusions.

Probability of entry, establishment, and spread for *Dasineura mali (Table 4.3, 2011)*

Importation	**Distribution**	**Entry**	**Establishment**	**Spread**	**PEES***
Moderate	Very Low	Very Low	Moderate	Moderate	Very Low

*Probability of entry, establishment and spread.

Impact scores for *Dasineura mali*

Direct impact	**Impact scores**	
	2011	**2006**
Plant life or health	D	D
Human life or health	-	A
Any other aspects of the environment	A	A
Indirect impact		
Control or eradication	D	D
Domestic trade or industry	D	D
International trade	D	D
Environment	B	B
Communities	-	B

Unrestricted risk estimate
Unrestricted risk is the result of combining the probability of entry, establishment and spread with the estimate of consequences. Probabilities and consequences are combined using the risk estimation matrix.

Unrestricted risk estimate for *Dasineura mali*	***2011***	***2006***
Overall probability of entry, establishment and spread:	Very low	High
Consequences:	Low	Low
Unrestricted risk:	Negligible	Low

Based on the information within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" Biosecurity Australia now indicates, the unrestricted risk for *Dasineura mali* has been assessed as "negligible‟ , which achieves Australia's ALOP. Therefore, additional risk management measures are not recommended for this pest.

In considering the above information the following conclusions can be made:

- **u) there is no difference in the ratings for ‘DIRECT IMPACT’ from 2006 and 2011, and**
- **v) there is no difference in the ratings for ‘INDIRECT IMPACT’ from 2006 and 2011, and**
- **w) there is no difference in the rating for ‘CONSEQUENCE’ from 2006 and 2011, but**
- **x) the Overall probability of entry, establishment and spread has moved from HIGH (2006) to VERY LOW (2011).**

It is worthy of considering the following scenario

- ➢ The World Trade Organisation Appellate Body ruled in favour of Australia in that the alternative measures proposed by New Zealand had not been proved to meet Australia’s Appropriate Level of Protection.

- ➢ Measure 14, proposed by Biosecurity Australia in 2006, and addressed in the subsequent bullet point of New Zealand's panel request, relates to "*apple leafcurling midge*" and was considered a ‘measure’ by both the World Trade Organisation Panel and Appellate Panel:

  "The requirements of inspection and treatment for apple leafcurling midge, including:

  > the option of inspection of each lot on the basis of a 3000 unit sample selected at random across the whole lot for apple leafcurling midge, symptoms of quarantineable diseases, quarantineable pests, arthropods, trash and weed seeds, with detection of any live quarantineable arthropod resulting in appropriate treatment or rejection for export;
  >
  > the option of inspection of each lot on the basis of a 600 unit sample selected at random across the whole lot for symptoms of quarantineable diseases, trash and weed seeds, plus mandatory appropriate treatment of all lots."

- ➢ The new science incorporated into the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand” offers nothing that should result in the **overall probability of entry, establishment and spread has moved from HIGH (2006) to VERY LOW (2011).**

- ➢ If anything the new science would support the maintenance of the 2006 measures or in fact adding additional measures.

- ➢ The standard orchard practices are no new information as it was in existence back in 1998 and was certainly considered by both industry and Biosecurity Australia in the 2006 Import Risk Analysis.

- The Integrated Fruit Production Manual again is nothing new and certainly the information available to the Australian Apple industry offers nothing that would indicate the Apple Leaf Curling Midge has been eradicated from New Zealand apple growing regions.

- The documentation obtained from the visit by Biosecurity Australia representatives to New Zealand in March 2011 offers nothing new in relation to new science or standard orchard practices that would support the reduction of the unrestricted risk from LOW to NEGLIGIBLE.

In conclusion Apple and Pear Australia Limited find that there is absolutely no new information that justifies the decision by Biosecurity Australia to reduce the unrestricted risk from LOW to NEGLIGIBLE and as a result no reason to allow apples from New Zealand in without any true measures.

Apple and Pear Australia limited would argue that with the carton being the most logical mode of transport for trash Biosecurity Australia MUST include 600 randomly selected cartons per lot to ensure that trash is not present and exported to Australia.

On the finding of any trash within retail-ready packs the full lot needs to be returned to New Zealand, treated or destroyed.

<u>Minimum Measures</u>

As a minimum Apple and Pear Australia Limited believe the following measures should be implemented for managing Apple Leaf Curling Midge:-

- **Implementation of 'pest free place of production' (an accepted SPS process), *or***
- **Fumigation of apples before export, *and***
- **Inspection of 1200 pieces of fruit per 300 Tray Carton Equivalent**
- **Insepction of 600 randomly selected cartons per lot, *and***
- **A maximum pest limit of zero.**

<u>ADDITIONAL INPUTS:</u>

Biosecurity Australia has indicated that the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" is based on a combination of new science, information collected directly from the New Zealand Ministry of Agriculture and Forestry and from a visit by Biosecurity Australia representatives visit to New Zealand in March 2011.

Effectively none of this information is new science and at best is general information.

Notwithstanding that Apple and Pear Australia Limited has made some specific comments about the responses which do not support the position being proposed by Biosecurity Australia in relation to the export of New Zealand apples.

The following is some of the information obtained from the New Zealand Ministry of Agriculture and Forestry:-

Q. *Can you confirm the expected season of trade to Australia? It is current understanding that it may commence in Mid-February with varieties such as Pacific Beauty and extend until perhaps July.*

A. New Zealand could supply the market from mid February (ISO week 5-6) until the next season starts, however; the amount of fruit supplied is expected to tail off to small quantities after a few months (e.g. by ISO week 25). This would reflect New Zealand's weekly export pattern to other markets. A graph of apple exports by ISO week is attached as Attachment 1. The scale of the supplies later in the year will depend on the speed with which the Australian market opens up to northern hemisphere nations. Consigned varieties will likely consist of those either not grown in Australia or varieties not in sufficient supply in Australia.

The reality is that neither New Zealand nor Australia know what the actual trade in fruit might if the market opens. Many factors will determine when and what quantity of fruit might be traded including consumer demand, market opportunities in other markets offering better returns, the exchange rate and availability of stock.

Trade patterns are pure supposition and the suggestion that the exports could tail off after a few months has no scientific substance.

Q. *Discussions with growers suggested that productivity was in the order of 75-100 tonnes per hectare (total yield to the packing house), with some plantings reaching 120 Tonnes per hectare. The WAPA Report indicates that for the 2009 season there was 466,000 Tonnes from 9,061 hectares (51.4t/ha). Are you able to provide any advice on the apparent discrepancy?*

A. This is not a discrepancy but as you point out, the difference between national and regional averages across all varieties, rootstocks, tree age and management. Productivity is actually in the range of 20-120 Tonnes per hectare if individual varieties in all regions are considered. The figures quoted were for specific varieties particularly; Scifresh (Jazz™), Braeburn, Tenroy (Royal Gala) and Fuji on specific rootstocks on the specific orchards visited.

Biosecurity Australia and the New Zealand Industry has consistently promoted that the high level of production per hectare is as a result of the

Integrated Fruit Production Program and the supposed freedom from pests and diseases.

The above information supplied by New Zealand highlights there is a wide variation in the productivity of New Zealand orchards from 20 tonnes to 120 tonnes per hectare.

How many blocks have low production levels like 20 tonnes per hectare?

Why do these blocks have low production levels?

Q. Rootstock use – Is there any industry information on the relative adoption of rootstocks? Which are the most prevalent?

A. Rootstock use is dependent on soil type, scion selection and planting system use.

This section is blocked out by Biosecurity Australia within the document supplied to Apple and Pear Australia Limited.

Q. *IFP – The pest specific extracts from the IFP are all dated 2008. Is this the current version? Is there a statement in the preface to the current version of the manual that states that the recommendations are regularly updated as new information on pests and import requirements becomes available?*

A. The 2008 date is correct for the pest specific extracts.

The IFP manual is a production guide. It is updated as and when research or information becomes available and updates of components are issued to the industry as required. There is no statement in the *Preface* that this happens but it is evidenced by different sections of the IFP manual having different dates. The Contents pages are updated as and when there are amendments or changed to the IFP manual and issued along with the amendments.

Market specific requirements are only included if there are specific changes to the production systems that require specific guidelines. Market specific requirements are usually addressed by market specific work plans with MAF and are additional to the IFP manual which is a series of generic production guidelines.

Biosecurity Australia has contended that the standard orchard practices based on the Integrated Fruit Production Manual are both ‘new’ and ‘innovative’. Reality is that the IFP Manual was developed in 1996. The document made available to Biosecurity Australia is a 2008 version.

More importantly New Zealand Pipfruit describe the manual as ‘a production manual’ and a series of ‘generic production guidelines’.

Q. *What proportion of packing houses use some form of sanitizer in the dump tank and/or subsequent water baths and sprayers?*

A. Sanitizer use is not required by any of the 65 markets New Zealand apples are exported to and is not a requirement under the industry best practice guidelines or MAF Food Safety requirements. However, one form of sanitizer or another is used by in excess of 80% of the industry; some packing houses, especially those that regularly handle organic fruit, have local authority permission to dump water from the packing line on a regular basis. There is no absolute data available but the 80% of packing houses mentioned will process approximately 90% by volume of the exported fruit processed.

Biosecurity Australia has reported that in fact 99% of the export fruit is treated using sanitation (meeting with Apple and Pear Australia Limited, 8th April 2011) which is in variance with the information supplied above by an unidentified officer of the New Zealand Ministry of Agriculture and Forestry.

The unidentified officer also indicates that sanitation is not required by some 65 markets to which New Zealand export so is there circumstances when sanitation is not used for those markets and then utilised only for those markets requiring such treatments?

The unidentified officer also indicates that sanitation is not required *"under the industry best practice guidelines or MAF Food Safety requirements".*

The unidentified officer also indicates that *"there is no absolute data available but the 80% of packing houses mentioned will process approximately 90% by volume of the exported fruit processed".*

Given these discrepancies in information Apple and Pear Australia Limited believes that there is uncertainty that all export fruit to would be sanitised. Biosecurity Australia must

a) **Revisit the aspect of sanitation to obtain a clear understanding of what is implement by ALL New Zealand packing facilities, and**

b) **implement a measure which at minimum ensures all fruit destined for Australia is sanitised and that the sanitation process is recorded and signed off by Australia AQIS auditors.**

Q. *It was indicated that overhead irrigation was not in widespread use in the pipfruit sector (outside of use as a frost management tool in some areas, specifically Central Otago). Is there evidence to support that statement?*

A. No 'data' or publication is available to validate this claim it is just a reflection of regional convention. The irrigation system used is a commercial decision of the grower; frost protection by overhead sprinklers in any region other than Central Otago will lead to potential Apple scab (*Venturia inaequalis*) disease problems very early in the season and is avoided for this reason. Some isolated orchards may use tree-targeted water during summer to minimise sunburn and heat stress in the fruit but this is usually managed on a varietal block basis mindful of disease pressures.

No 'data' or publication is available to validate this claim.

Q. *Have there been significant changes to the management strategy for European canker since the 1999-2005 surveys that last reported rots on fruit? Has the proportion of uptake of the IFP increased since that time?*

A. By 2000 IFP uptake was universal in the export industry. The only variation to that has been the growth of organic production (introduced as a variant of classical IFP in 1997) over the period indicated in the question.

Winter management strategies for European Canker are as outlined in the 2008 IFP Fact Sheet.

It could be assumed that there has been no 'significant changes to the management strategy for European canker' since 2005.

The 2001 fact sheet on European canker offers nothing that would indicate that the disease is completed under control and not likely to be found on fruit exported to Australia.

The 2008 IFP Fact Sheet has only been made available to Apple and Pear Australia Limited on Friday 1st July 2011 and has reviewed the document and has dealt with the relevant aspects within the European Canker section of this submission.

Q. *Are you able to indicate the flowering period in New Zealand for the 'newer' varieties coming into production and those likely to be exported to Australia, including Jazz and the Pacific series? Are these similar or the same to the tradition varieties such as Pink Lady and Braeburn?*

A.

Variety	Flowering Period (May vary by 7-10 days based on seasonal conditions)

Braeburn	Last week Sept to last week Oct
Cox's Orange Pippin	2nd week Sept to end Sept
Fuji	October
Royal Gala	Last week Sept to end October
Sciearly	Last week Sept to 3rd week October
Scifresh	October
Scired	2nd week Oct to 1st week Nov
Sciros	Last week Sept to 3rd week October

Q. *Is information available that demonstrates that the fire blight risk assessment system has been calibrated for New Zealand conditions?*

A. Yes. The industry commissioned a report on the ability of the industry to predict infection conditions and the suitability of various models for New Zealand conditions. In particular Maryblyt and Cougarblight models from the US were reviewed.

The objectives of the report were several fold but the relevant section of that report is attached in Attachment 2.

Q. *Can you confirm that all consignments of fruit for export to Australia will have been tested in accordance with standard procedures to establish that minimum maturity standards have been met?*

A. The industry Best Practice Guidelines for Production, Harvest, Cool-chain and Packing of NZ pipfruit – Industry Quality Recommendations has Recommended Minimum Grade Standards for Class 1 New Zealand apples including specifications for maturity testing. If required by Australia all packing houses exporting to Australia will have such testing procedures in their operations manual.

Have the Industry "Best Practice Guidelines for Production, Harvest, Cool-chain and Packing of NZ pipfruit – Industry Quality Recommendations" been supplied to Biosecurity Australia? If yes, why aren't these documents in the public file?

SECTION D: PROPOSED MEASURES – PEST MANAGEMENT SYSTEMS

The most obvious change in Biosecurity Australia's conclusions is its reliance on New Zealand's Integrated Fruit Production/Pest Management System.

The 2006 IRA in dealing with Integrated Pest Management programs (IPM) correctly and cogently acknowledged:

"That IPM is only a management tool and may not always reduce the opportunities for establishment of pests, for in some seasons no matter what IPM program was in place, if environmental conditions were conducive, pests would occur."

The 2011 Review is silent on whether its authors now disagree with that finding in 2006. Yet, it is irrational for the 2011 Review to adopt the conclusions of the Draft Report unless its authors disagree with that finding. Apple and Pear Australia Ltd are confident that no responsible scientist would disagree with that finding. As a result, the 2011 Review's conclusions based on New Zealand's IPM are irrational and unreasonable.

New Zealand has not found a way to control and/or eliminate Fire Blight or prevent serious outbreaks of the disease and does not pretend that it has.

Very clearly, under the recommendations made by Biosecurity Australia, fruit will, at times, be harvested from orchards with severe outbreaks of Fire Blight. This fruit will be heavily infested with the Fire Blight bacteria. The on line treatment required will not contact or eradicate the bacteria in the calyx and the fruit will arrive with high levels of bacteria in undiluted consignments. There is no measure proposed which would prevent that fruit being imported and distributed very shortly after harvest.

The 2011 Review accurately recorded that:

"Ultimately, economic factors and market access opportunities will determine the market window for New Zealand apple exports to Australia."

No doubt it was on that basis that the review in 2011 preceded on the assumption that the bulk of exports would be from February until August each year.

The 2011 Review's allocation of the likelihood of "extremely low" to the distribution stage, without taking into account the incidence of hail or wind storms or other events causing damage to Australian orchards sufficient to render them highly susceptible to infection, fundamentally undermines the analysis in the

2011 Review.

With a disease such as Fire Blight that Biosecurity Australia itself identifies as one of the most serious diseases of apples, fruit should at the very least be guaranteed to come from a Pest Free Place of Production. While Biosecurity Australia recognises this requirement for the less dangerous and complex insect (Codling moth) for West Australia, it fails to apply the same principle to Fire Blight.

The same scenario outlined will also occur with the other pests and diseases identified.

Further, there is nothing "new" in New Zealand's IFP systems, as far as they have been disclosed to the Australian industry.

At Appendix C to this submission is reproduced APAL's submission to Biosecurity Australia dated 2004 concerning New Zealand's IFP approaches. Those approaches were central to the analysis in the 2006 IRA. Those approaches had been implemented by 2000 and were central to the analysis in the 2006 IRA.

As far as the Australian industry can discern, in its 2011 Review Biosecurity Australia has relied on the same IFP systems as were considered in the 2006 analysis in the 2011 Review as a basis to depart from the 2006 analysis. If that is what has been done, the 2011 Review is demonstrably spurious and the conclusion that the New Zealand IFPsystems provide a reason to depart from the conclusions of the 2006 IRA is irrational and unreasonable.
On the other hand if there is something about those IFP systems which is known to Biosecurity Australia and which is not dealt with in Appendix C and which provides a basis to change the outcome of the risk analysis, the 2011 Review has been conducted denying to Australian industry basic procedural fairness, and through a process whereby the central conclusions of the 2011 Review are based on unpublished data. Not only would such a process be unfair – it would be unscientific – because it would prevent any analyst other than the authors from assessing the conclusions reached.

HISTORY OF PROPOSED MEASURES.

In considering the history of the New Zealand applications to export apples to Australia the following measures have been proposed:-

It draws mainly on a document entitled "*Australia – Measures Affecting the Importation of Apples from New Zealand, First Written Submission of New Zealand'* which was submitted by the New Zealand Government to the WTO Dispute Panel in mid-2008

First request

In 1921, Australia banned New Zealand apples when it was confirmed that the disease Fire Blight had entered and become established in Auckland in 1919.

The first formal New Zealand request for access after that date was made 77 years later, in 1986.

Following a two-year investigation, in 1988 the request was denied on the grounds that imports of apples into Australia from New Zealand would create the potential for latent and symptomless infection of host plants in or near orchards that are free from fire blight.

Second request

New Zealand revised its proposal and resubmitted it in 1989.

New Zealand proposed a combination of conditions:

- **sourcing of apples only from low Fire Blight areas;**
- **visual orchard inspections;**
- **post-harvest chlorine dipping; and**
- **testing of export fruit.**

Following consultation with stakeholders (including the Australian industry) the administering authority recommended that the New Zealand request be denied, on the basis that there were “gaps‟ in research on the effect of Fire Blight. The Australian Government formally rejected New Zealand’s second request in November 1990.

Third request

On 1 January 1995, following the entry into force of the WTO *SPS Agreement,* a new mechanism to resolve the matter became available.

New Zealand’s third request, made in October 1995 under the new WTO mechanism, detailed the considerable research that had been undertaken between 1992 and 1995 following discussions between scientists in New Zealand, the United States, Canada and Australia and made clear the relevant findings that apples sourced from trees with active Fire Blight were not a pathway for the disease, as long as they were free of trash. **In accordance with the relevant scientific material, New Zealand proposed that Australia apply a requirement that all apples be free from trash.**

Nearly two years later, in early April 1997, the Australian Quarantine Inspection Service (AQIS) released a draft “pest risk analysis‟ which alleged that there were “significant areas of scientific uncertainty about certain steps in the possible pathway of [fire blight] disease establishment via trade in apples‟

New Zealand complained that Australia’s draft “pest risk analysis‟ had failed to take account of relevant scientific research provided to Australia. In addition, it referred to even more recent research that had concluded that the risk of the introduction of fire blight through trade in mature apples was once in 11,364 years.

In its final report issued in December 1998, three years after the request was submitted, AQIS rejected New Zealand's third request and determined that the importation of apples from New Zealand, even if free of trash, not be permitted.

Fourth request

New Zealand's fourth request was made in January 1999. By this time WTO Dispute Panels and the Appellate Body had clarified the obligations of signatories under the *SPS Agreement*, including through a case involving Australia's own sanitary and phytosanitary measures.

Consistent with the provisions of the *SPS Agreement*, New Zealand requested that AQIS **"review available risk management options with a view to establishing phytosanitary measures that are the least trade restrictive in respect of New Zealand apple exports while ensuring the level of protection deemed appropriate by Australia is met."**

At a bilateral technical meeting on 4 February 1999, Australia advised New Zealand that "work undertaken on the previous IRA would be utilised in the new IRA where relevant."

While there were a list of measures detailed in the "Final Import Risk Analysis Report for Apples from New Zealand" dated November 2006 New Zealand requested that seventeen (17) be reviewed by the WTO panel. These seventeen measures were:-

The 17 specific measures identified by bullet points in New Zealand's panel request fall into four categories according to their relationship to the three pests relevant for this dispute. For ease of reference, the Panel has chosen to number these 17 measures consecutively, in the order that they appear in the bullet point list in New Zealand's panel request:

(c) Measures 1-8, addressed in the first eight bullet points of New Zealand's panel request, relate to "*fire blight*":

(i) "The requirement that apples be sourced from areas free from fire blight disease symptoms."

(ii) "The requirement that orchards/blocks be inspected for fire blight disease symptoms, including that they be inspected at an inspection intensity that would, at a 95% confidence level, detect visual symptoms if shown by 1% of the trees, and that such inspections take place between 4 to 7 weeks after flowering."

(iii) "The requirement that an orchard/block inspection methodology be developed and approved that addresses issues such as visibility of symptoms in the tops of trees, the inspection time needed and the number of trees to be inspected to meet the efficacy level, and training and certification of inspectors."

(iv) "The requirement that an orchard/block be suspended for the season on the basis that any evidence of pruning or other activities carried out before the inspection could constitute an attempt to remove or hide symptoms of fire blight."

(v) "The requirement that an orchard/block be suspended for the season on the basis of detection of any visual symptoms of fire blight

(vi) "The requirement that apples be subject to disinfection treatment in the packing house."

(vii) "The requirement that all grading and packing equipment that comes in direct contact with apples be cleaned and disinfected (using an approved disinfectant) immediately before each Australian packing run."

(viii) "The requirement that packing houses registered for export of apples process only fruit sourced from registered orchards."

(d) <u>Measures 9-13, addressed in the subsequent five bullet points of New Zealand's panel request, relate to "*European canker*"</u>:

(ix) "The requirement that apples be sourced from export orchards/blocks free of European canker (pest free places of production)."

(x) "The requirement that all trees in export orchards/blocks be inspected for symptoms of European canker, including that orchards/blocks in areas less conducive for disease are inspected for symptoms by walking down every row and visually examining all trees on both sides of each row, and that areas more conducive to the disease are inspected using the same procedure combined with inspection of the upper limbs of each tree using ladders (if needed), and that such inspections take place after leaf fall and before winter pruning."

(xi) "The requirement that all new planting stock be intensively examined and treated for European canker."

(xii) "The requirement that an orchard/block be suspended for the season on the basis that any evidence of pruning or other activities carried out before the inspection could constitute an attempt to remove or hide symptoms of European canker."

(xiii) "The requirement that exports from an orchard/block be suspended for the coming season on the basis of detection of European canker and that reinstatement would require eradication of the disease, confirmed by inspection."

(e) <u>Measure 14, addressed in the subsequent bullet point of New Zealand's panel request, relates to "*apple leafcurling midge*":</u>

(xiv) "The requirements of inspection and treatment for apple leafcurling midge, including:

the option of inspection of each lot on the basis of a 3000 unit sample selected at random across the whole lot for apple leafcurling midge, symptoms of quarantineable diseases, quarantineable pests, arthropods, trash and weed seeds, with detection of any live quarantineable arthropod resulting in appropriate treatment or rejection for export;

the option of inspection of each lot on the basis of a 600 unit sample selected at random across the whole lot for symptoms of quarantineable diseases, trash and weed seeds, plus mandatory appropriate treatment of all lots."

(f) Measures 15-17, addressed in the last three bullet points of New Zealand's panel request, were described by New Zealand as "*general*" measures:

(xv) "The requirement that Australian Quarantine and Inspection Service officers be involved in orchard inspections for European canker and fire blight, in direct verification of packing house procedures, and in fruit inspection and treatment."

(xvi) "The requirement that New Zealand ensure that all orchards registered for export to Australia operate under standard commercial practices."

(xvii) "The requirement that packing houses provide details of the layout of premises."

As part of the initial process measure twelve (12) was effectively withdrawn and the remaining sixteen (16) measures were reviewed.

The Appellate Body made the following rulings:-

1) *upholds the Panel's finding, in paragraphs 7.172 and 8.1(b) of the Panel Report, that the 16 measures at issue, both as a whole and individually, constitute SPS measures within the meaning of Annex A(1) to the SPS Agreement;*

2) *upholds the Panel's finding, in paragraphs 7.906 and 8.1(c) of the Panel Report, that Australia's measures regarding fire blight and ALCM, as well as the general measures relating to these pests, are inconsistent with Articles 5.1 and 5.2 of the SPS Agreement, and that, by implication, these measures are also inconsistent with Article 2.2 of the SPS Agreement;*

In comparing the measures proposed over the years it is interesting to see the following similarities:-

Sourcing of fruit

1989: New Zealand proposed '**sourcing of apples only from a low Fire Blight areas"**

2006: Australia proposed **'the requirement that apples be sourced from areas free from fire blight disease symptoms'.**

Orchard Inspection

1989: New Zealand proposed '**visual orchard inspections';**

2006: Australia proposed **'The requirement that orchards/blocks be inspected for fire blight disease symptoms, including that they be inspected at an inspection intensity that would, at a 95% confidence level, detect visual symptoms if shown by 1% of the trees, and that such inspections take place between 4 to 7 weeks after flowering'.**

Post Harvest treatment

1989: New Zealand proposed '**post-harvest chlorine dipping'**

2006: Australia proposed **'the requirement that apples be subject to disinfection treatment in the packing house'.**

2011: Australia proposes '**maintenance of sanitary conditions in dump tank water'**

and

'high pressure water washing and brushing of fruit in the packing house'.

Testing

1989: New Zealand proposed '**testing of export fruit'**

2011: Australia proposes '**a minimum 600 fruit sample from each lot of fruit packed is inspected and found free of quarantine pests for Australia'**.

And

'Testing to ensure that only mature fruit is exported to Australia'.

Trash

1995: New Zealand proposed that Australia '**apply a requirement that all apples be free from trash'.**

Standard Orchard Practice

2006: Australia proposed **'the requirement that New Zealand ensure that all orchards registered for export to Australia operate under standard commercial practices'.**

2011: Australia proposes **'application of the integrated fruit production system, or an equivalent, to manage pests and diseases in orchard'.**

Apple and Pear Australia Limited would contend that there has been very little change in the proposed measures across the years since 1989. Where there is change it is really a 'tweaking' of words rather than major changes in meaning and process.
Apple and Pear Australia Limited would contend that all of the practices proposed by Biosecurity Australia in the 2011 draft report are, in their own right ,'measures' and should be considered in the same way as to whether they meet the requirements of the SPS Agreement.

Given the assessment by the WTO Panel and the Appellate Body, Apple and Pear Australia Limited would contend that as the original measures were, the current "measures" ***are also inconsistent with Articles 5.1 and 5.2 of the SPS Agreement, and that, by implication, these measures are also inconsistent with Article 2.2 of the SPS Agreement'.*** **Consequently all of the practices proposed by Biosecurity Australia in the 2011 Draft report are in their own right 'measures' and also inconsistent with the relevant Articles of the SPS Agreement.**

In the WT/DS367/11 report Dr Latorre gave an assessment of the original measures proposed by Australia within the 2006 Import Risk Analysis

Measures challenged by New Zealand		Active in risk reduction	To implement or support active measures
Nº	Description		
Fire blight			
1	The requirement that apples be sourced from areas free from fire blight disease symptoms.	Yes	
2	The requirement that orchards/blocks be inspected for fire blight disease symptoms…		Yes
3	The requirement that an orchard/block inspection methodology be developed and approved that addresses issues such as visibility of symptoms in		Yes

	the tops of trees ,…		
4	The requirement that an orchard/block be suspended for the season on the basis that any evidence of pruning …		Yes
5	The requirement that an orchard/block be suspended for the season on the basis of detection of any visual symptoms of fire blight.		Yes
6	The requirement that apples be subject to disinfection treatment in the packing house.	Yes	
7	The requirement that all grading and packing equipment that comes in direct contact with apples be cleaned and disinfected (using an approved disinfectant) immediately before each Australian packing run.	Yes	
8	The requirement that packing houses registered for export of apples process only fruit sourced from registered orchards.		Yes
European canker			
9	The requirement that apples be sourced from export orchards/blocks free of European canker (pest-free places of production).	Yes	
10	The requirement that all trees in export orchards/blocks be inspected for symptoms of European canker,…		Yes
11	The requirement that all new planting stock be intensively examined and treated for European canker	Yes*	
12	The requirement that an orchard/block be suspended for the season on the basis that any evidence of pruning or other activities carried out before the inspection could constitute an attempt to remove or hide symptoms of European canker.		Yes
13	The requirement that exports from an orchard/block be suspended for the coming season on the basis of detection of European canker and …		Yes
Apple leafcurling midge, ALCM			

14	The requirements of inspection and treatment for apple leafcurling midge,…	Yes	
General			
15	The requirement that Australian Quarantine and Inspection Service officers be involved in orchard inspections for European canker and fire blight, in direct verification of packing house procedures, and in fruit inspection and treatment.		Yes
16	The requirement that New Zealand ensure that all orchards registered for export to Australia operate under standard commercial practices.		Yes
17	The requirement that packing houses provide details of the layout of premises.		Yes**

*To my understanding, this measure would prevent further dispersal of European canker; however, it does not directly reduce the risk of fruit contamination. I suggest eliminating this measure.

**To my understanding, this measure does not apply, considering that there is no scientific evidence supporting the possibility that European canker can be disseminated at the packing houses.

Apple and Pear Australia Limited argues that this assessment gave Biosecurity Australia a sound base from which to build their most recent review. It is obvious that they have failed to utilise this expert advice.

As a result Apple and Pear Australia Limited argues that the proposed practices/measures within the 'Draft report for the non-regulated analysis of existing policy for apple from New Zealand' have not been *'supported by adequate scientific evidence and, accordingly, are not coherent and objective'.*

Through the future sections Apple and Pear Australia Limited will provide evidence that supports this assertion.

ALTERNATIVE MEASURES PROPOSED BY NEW ZEALAND:

New Zealand have consistently proposed alternative measures and it appears that Biosecurity Australia has accepted some of these alternative measures as being relevant and therefore have included them in the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand".

In considering the alternative measures the Appellate Body made the following rulings:-

While the Appellate Body reported

> *"that New Zealand had raised a sufficiently convincing presumption that restricting imports of New Zealand apples to mature, symptomless apples was an alternative measure with respect to fire blight that would meet Australia's appropriate level of protection" (Page 20)*

They then went on to report that

> *"The Panel, however, "fundamentally misunderstood" that New Zealand's burden was not to show that its proposed alternative measures "might" or "may" achieve Australia's appropriate level of protection, but that they "would" do so. In Australia's view, therefore, by prematurely shifting the burden to Australia to rebut the presumption of inconsistency, the Panel effectively reversed the burden of proof, and required Australia to prove consistency of its measures upon a showing by New Zealand of no more than "doubt" about whether an alternative measure would achieve the appropriate level of protection".*

They then went on to record that

> *"It is not enough that the alternative measures "could" or "might" achieve the appropriate level of protection. In its anxiousness to avoid impermissible de novo review, the Panel failed to satisfy itself that the evidence and arguments adduced by New Zealand demonstrate that the alternative measures "would achieve" Australia's appropriate level of protection, and instead wrongly relied on its findings under Article 5.1 regarding the inadequacy of the IRA as also establishing inconsistency with Article 5.6."*

Apple and Pear Australia Limited argues that with past applications New Zealand has never shown that their alternative measure(s) *'would'* achieve *'Australia's appropriate level of protection'.*

Apple and Pear Australia Limited also contends that the information within the draft non-regulated document produced by Biosecurity Australia fails to detail how the proposed alternative measure(s) *'would'* achieve *'Australia's appropriate level of protection'.*

As a result Apple and Pear Australia Limited rejects the measures detailed in the 'non-regulated' report produced and released by Biosecurity Australia in May 2011.

<u>Fire Blight</u>

In relation to New Zealand’s claim on alternative measures the Appellate Panel report on the following (Page 111 – 124: Article 5.6 of the SPS Agreement):-

“*At the outset of its analysis of New Zealand's claim under this provision, the Panel stated that, to prove a violation of Article 5.6, a complainant must demonstrate that an alternative measure:*

- *(i) is reasonably available taking into account technical and economic feasibility;*
- *(ii) achieves the importing Member's appropriate level of sanitary or phytosanitary protection; and*
- *(iii) is significantly less restrictive to trade than the SPS measure(s) at issue in the dispute.*

The Panel viewed these three elements as cumulative in nature and noted the parties' agreement to that effect

And

“As an alternative measure to limit the risk of fire blight, the Panel considered the restriction of imports from New Zealand to mature, symptomless apples. As an alternative measure to limit the risk of ALCM, the Panel considered requiring inspection of a 600-fruit sample of each import lot with appropriate treatment or rejection of the lot in the event that ALCM is found in the sample. We note that New Zealand's proposed alternative measure for fire blight—to limit imports of apples to mature, symptomless apples—is the same as the "unrestricted risk" scenario assessed by the IRA”

And

“Furthermore, New Zealand's alternative measure relating to ALCM is the same as the first option of Measure 14, except that the sample size in New Zealand's alternative measure (600 fruit) is smaller than the sample size in the first option of Measure 14 (3000 fruit).”

And

“On the basis of this analysis (Paragraph 331 and 332), the Panel concluded that Australia's measures regarding fire blight and ALCM are more trade restrictive than required and therefore inconsistent with Article 5.6 of the SPS Agreement”

And

“Article 2 of the SPS Agreement, entitled "Basic Rights and Obligations", provides context relevant to the meaning of Article 5.6. In particular, Article 2.2 provides that:

Members shall ensure that any sanitary or phytosanitary measure is applied only to the extent necessary to protect human, animal or plant life or health, is based on scientific principles and is not maintained without sufficient scientific evidence, except as provided for in paragraph 7 of Article 5."

And

"Article 5.1 seeks to ensure that a Member's SPS measure has an appropriate scientific basis, whereas Article 5.6 seeks to ensure that appropriate limits are placed on the trade-restrictiveness of a Member's SPS measure. A complainant may challenge the consistency of a specific SPS measure with either or both of these obligations."

And

" However, the obligations in Article 5.1 and Article 5.6 are not dependent upon each other".

And

"Under Article 5.6, in order to assess whether a significantly less trade-restrictive alternative measure that would meet the appropriate level of protection is available, we consider that a panel must identify both the level of protection that the importing Member has set as its appropriate level, and the level of protection that would be achieved by the alternative measure put forth by the complainant. Thereupon the panel will be able to make the requisite comparison between the level of protection that would be achieved by the alternative measure and the importing Member's appropriate level of protection."

The Panel used a two stage analytical approach that was detailed in Paragraph 350 (Pages 119 and 120). The Appellate Panel detailed its assessment of the two stage approach in 355, 356 and 357 and then made the following rulings:-

: "*For all these reasons, we consider that the Panel's approach to its analysis of New Zealand's Article 5.6 claim was in error. Because the Panel unduly relied on findings that it had made in reviewing the IRA under Article 5.1 and failed to find affirmatively that New Zealand's alternative measures would meet Australia's appropriate level of protection, the Panel's Article 5.6 finding lacks a proper legal basis. We therefore find that the Panel erred in concluding that New Zealand had raised a presumption that restricting imports of New Zealand apples to mature, symptomless apples was an alternative measure with respect to fire blight that would meet Australia's appropriate level of protection and erred in concluding that New Zealand had made a prima facie case that the inspection of a 600-fruit sample of each import lot would be an* *alternative measure with respect to ALCM that would meet Australia's appropriate level of protection."*

And

"Accordingly, we reverse the Panel's finding, in paragraphs 7.1403 and 8.1(e) of its Report, that Australia's measures at issue regarding fire blight and ALCM are inconsistent with Article 5.6 of the SPS Agreement. Having reversed this finding, we must consider whether, in order to promote the prompt settlement of this dispute, we are able to complete the analysis and rule on New Zealand's claim under Article 5.6."

In Completion of the Analysis in relation to Fire Blight (Pages 124 to 134) the Appellate Body recorded the following:-

"At the outset, we recall that under Article 5.6 of the SPS Agreement it is for the complainant to establish a prima facie case that there is an alternative measure that satisfies all three applicable conditions Accordingly, a complainant must demonstrate that a proposed alternative measure to the measure at issue:

(i) is reasonably available taking into account technical and economic feasibility;
(ii) achieves the Member's appropriate level of sanitary or phytosanitary protection; and
(iii) is significantly less restrictive to trade than the contested SPS measure."

And

"The Panel found that the first condition and the third condition were met for both fire blight and ALCM. These findings are not appealed. Therefore, the only question before us is whether New Zealand's alternative measures would achieve Australia's appropriate level of protection."

The Appellate Panel further considered the finer details in relation to Fire Blight in paragraphs 363, 364, 365 and 366. From these considerations the report continues:-

"*New Zealand submitted before the Panel that mature, symptomless apples do not provide a pathway for transmitting fire blight, and that, therefore, the risk that mature, symptomless apples would transmit fire blight is negligible. In particular, New Zealand adduced evidence in support of the following propositions:*

- *Fire blight bacteria are not found internally in mature, symptomless apples; they are only rarely found externally and then only in limited quantities.*

- *Any fire blight bacteria found externally on mature, symptomless apples are unlikely to survive post-harvest handling, storage, and transportation in quantities sufficient to initiate infections.*
- *Fruit would not be contaminated with fire blight during harvest, handling, storage, and transportation*
- *Even if external fire blight bacteria survived handling, processing, and transport of New Zealand apples to Australia, they would not be transmitted to a susceptible host in Australia.*

And

"Australia also emphasized that the Panel's two appointed experts on fire blight, Dr. Paulin and Dr. Deckers, had both expressed the view that restricting imports to mature, symptomless apples would not be sufficient to reduce the risk to a level that would achieve Australia's appropriate level of protection. Australia therefore contended that New Zealand had failed to show that the restriction of imports to mature, symptomless apples would achieve Australia's appropriate level of protection in respect of fire blight."

And

"We note that the Panel record contains numerous pieces of evidence relating to the risk of fire blight, including scientific studies, the IRA's analysis and the evidence it refers to, as well as the testimony of the Panel's appointed experts. Although New Zealand presented to the Panel various pieces of evidence in support of its contention that the risk associated with the alternative measure of restricting imports of apples to mature, symptomless fruit is negligible, the Panel referred, in passing, to only a few of these pieces of evidence, and did not make express findings regarding this evidence in its analysis of whether New Zealand had successfully raised a presumption that the alternative measure concerning the risk of fire blight would meet Australia's appropriate level of protection."

And

"It seems that, in pointing to this testimony, the Panel was inclined to accept New Zealand's first proposition that fire blight bacteria are not found internally in mature, symptomless apples, and that they are rarely found externally and then only in limited quantities. However, the Panel made no explicit finding to that effect."

And

"…New Zealand contended that any residual fire blight bacteria found externally on mature, symptomless apples are unlikely to survive post-harvest handling, storage, and transportation in quantities sufficient to initiate infections.

We note that the Panel found in the context of its analysis under Article 5.1 that evidence cited by the IRA confirms that disinfection—a routine procedure in the packing house—can have a significant impact on reducing bacterial population , and that its appointed experts agreed that disinfection would result in "strongly" reducing the risk of survival of the epiphytic population and a "sharp" decrease in the level of bacterial population. However, it is not clear to us whether, or to what extent, this disinfection is part of standard post-harvest, storage, and transportation procedures. While the Panel's appointed experts agreed that disinfection would result in strongly decreasing bacterial population, the Panel did not make a finding on whether all apples for export from New Zealand are disinfected.

And

"It seems that, in pointing to this testimony, the Panel was inclined to accept New Zealand's third proposition that fruit would not be contaminated with fire blight during harvest, handling, storage, and transportation. However, the Panel made no explicit finding to that effect."

And

". …..we note that the Panel reviewed various statements by Dr. Deckers and Dr. Paulin regarding the potential for transfer and spread of Erwinia amylovora. The experts characterized this in various ways, including "extremely low"·, "hard to imagine", "a difficulty impossible for the bacteria to tackle in natural conditions" , "very low" , "difficult to prove" , "rather low" , "questionable" , and "rather exceptional". The Panel understood these responses to "indicate that the likelihood of fire blight spreading through mature, symptomless apples is very low"

And

"The Panel went on to quote a number of other statements by these two experts downplaying the risk associated with mature, symptomless apples relative to other ways of transmitting fire blight. The Panel then found that, overall, Dr. Deckers' and Dr. Paulin's testimony demonstrates that they consider the overall risk of entry, establishment and spread of fire blight through mature, symptomless apples imported from New Zealand to be "very low". It seems that the Panel may have agreed with this assessment, although it did not affirmatively say so."

And

"New Zealand recognized that fire blight can have serious consequences."

And

"The Panel did not, however, make any finding or express any view of its own on the consequences associated with the entry, establishment and spread of fire blight in Australia."

And

"We note that the Panel also specifically asked the experts the question whether restricting imports to mature, symptomless apples would achieve Australia's appropriate level of protection. We have certain reservations about the Panel having done so, given that this was the ultimate question that the Panel was charged with answering pursuant to Article 5.6. Experts may assist a panel in assessing the level of risk associated with SPS measures and potential alternative measures, but whether or not an alternative measure's level of risk achieves a Member's appropriate level of protection is a question of legal characterization, the answer to which will determine the consistency or inconsistency of a Member's measure with its obligation under Article 5.6. Answering this question is not a task that can be delegated to scientific experts"

And

"We also have more practical concerns, namely, that the Panel did not identify Australia's appropriate level of protection in its question to the experts, or clarify or explain what it understood the content of that level to be. Nor did the experts, in their replies, elaborate their understanding of Australia's appropriate level of protection. In such circumstances, and irrespective of the propriety of the question, the answers provided by the experts can be of only limited utility".

And

"We are, therefore, unable to identify sufficient uncontested facts or factual findings by the Panel to enable us to make a finding on the level of risk associated with New Zealand's alternative measure for fire blight. It follows that we cannot make the necessary comparison between the level of protection offered by New Zealand's alternative measure and Australia's appropriate level of protection, and thus cannot complete the legal analysis with respect to the second condition of Article 5.6 of the SPS Agreement."

Apple and Pear Australia Limited argues that the alternative measures proposed by New Zealand for Fire Blight are clearly not considered as achieving Australia's appropriate level of protection.

As a result the Apple and Pear Australia Limited rejects the proposals within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand.

<u>Apple Leaf Curling Midge</u>

In Completion of the Analysis in relation to Apple Leaf Curling Midge (Pages 134 to 140) the Appellate Body recorded the following:-

> *"Regarding the question of what level of protection could be achieved by the alternative measure, we note that New Zealand submitted before the Panel that there is a negligible risk of transmission and establishment of ALCM with inspection of a 600-fruit sample (and remedial action where appropriate). In particular, New Zealand adduced evidence relating to the following propositions:-*
>
> - *The level of infestation of viable ALCM cocoons on New Zealand apples is not biologically significant.*
> - *Fruit would not become contaminated with ALCM during harvest, handling, and transportation to the packing house.*
> - *Any infestation of New Zealand apples will be at so low a level that the establishment of ALCM in Australia is extremely unlikely.*
>
> *And*
>
> *"In response, New Zealand took issue with the IRA's analysis of the level of unrestricted risk of ALCM and the effect of a 600-fruit sample inspection, highlighting flaws in the methodology of the IRA, as well as the IRA's failure to consider the factors of cocoon viability, ALCM flight range, and normal trade practices."*
>
> *And*
>
> *"In particular, New Zealand contended that Dr. Cross did not express the view that the intensity of any inspection would need to be determined by reference to more reliable data with respect to factors such as viability. He explained that the sample size for inspection should be selected on the basis of the appropriate level of protection, rather than being adjusted to fit the infestation rate."*
>
> *And*
>
> *"The IRA used the infestation level, rather than an identified tolerance level, as the key determinant that led to selection of a risk management measure that would result in fumigation of virtually every apple, effectively taking a zero-risk approach."*
>
> *And*
>
> *"New Zealand argued that the level of infestation of viable ALCM cocoons on New Zealand apples is not biologically significant. More specifically, New Zealand argued that seasonal population development results in a low number of occupied cocoons and that the parasitic wasp Platygaster demades*

negatively affects ALCM in New Zealand resulting in a high number of cocoons that are empty or contain dead pupae."

And

"….the Panel may have been inclined to accept New Zealand's first proposition that the level of infestation of viable ALCM cocoons on New Zealand apples is not biologically significant. Yet it made no express finding on this issue."

And

"……New Zealand submitted that fruit would not become contaminated with ALCM during harvest, handling, and transportation to the packing house, because at the time of harvest, there are few young and actively growing leaves (normally associated with ALCM), ALCM eggs will already have hatched, and most larvae will be in cocoons. The Panel made no findings with respect to this proposition."

And

"The Panel appeared to accept New Zealand's contention that Australia's packing house practices make it "highly unlikely" that a large number of deposited apples would be left uncovered ….."

And

"Thus, the Panel found that New Zealand had demonstrated that with the "worst case" infestation level, several thousand apples (15,000-19,000 apples) imported from New Zealand would need to be deposited uncovered for a sufficiently long period of time for any ALCM transmission to occur. The Panel found that New Zealand had made a "convincing case" that this situation would "probably almost never occur".

And

"We note that the Panel also specifically asked the experts a question concerning the IRA's conclusion that the alternative measure of requiring inspection of a 600-fruit sample from each import lot would not achieve Australia's appropriate level of protection. We have already expressed certain reservations about such questions by the Panel. In any event, the specific question asked by the Panel was a composite one containing various elements. Neither the Panel, in its question, nor the experts, in their responses, identified Australia's appropriate level of protection or clarified what they understood to be the content of that standard. The experts' responses also contained a number of different elements, and it is not readily apparent which parts of them go to the issue of the relationship between the alternative measure and Australia's appropriate level of protection."

And

“Ultimately, however, the Panel discussed, but did not clearly make findings on much of this evidence nor on the specific propositions put forward by New Zealand in support of its claim under Article 5.6. The Panel seems to have considered that, under the alternative measure of requiring inspection of a 600-fruit sample from each import lot, transmission of ALCM to a susceptible host plant would "probably almost never occur".

And

“We are, therefore, unable to identify sufficient uncontested facts or factual findings by the Panel to enable us to make a finding on the level of risk associated with New Zealand's alternative measure for ALCM. It follows that we cannot make the necessary comparison between the level of protection offered by New Zealand's alternative measure and Australia's appropriate level of protection. We therefore cannot complete the legal analysis with respect to the second condition of Article 5.6 of the SPS Agreement.

Apple and Pear Australia Limited argues that the alternative measures proposed by New Zealand for Apple Leaf Curling Midge (ALCM) are clearly not considered as achieving Australia’s appropriate level of protection.

As a result the Apple and Pear Australia Limited rejects the proposals within the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand that relate to alternative measures for ALCM.

NEW ZEALAND INTEGRATED FRUIT PRODUCTION:

Biosecurity Australia has built their change of position in relation to apples from New Zealand from 2006 to 2011 largely on the basis of the New Zealand standard orchard practice as defined within the New Zealand Pipfruit Integrated Fruit Production Manual.

Biosecurity Australia states that *“this draft report takes into account the pre-harvest, harvest and post-harvest practices described as being standard commercial practices for the production of apples for export in New Zealand”*.

Apple and Pear Australia Limited contend that referencing the IFP as a phytosanitary measure has a number of flaws. This includes:

- The IFP is not new information
- The New Zealand confirms that the IFP is merely a production manual
- The content of the 2001 IFP document sighted in relation to Fire Blight has not altered since 2006
- The IFP is not equivalent to a phytosanitary measure

<u>IFP is not new information</u>

Biosecurity Australia has intimated that the standard orchard practice detailed in the New Zealand Integrated Fruit Production Manual is "new information" that has not been considered before.
The reality is quite different. The Australian apple and pear Industry, DAFF, AQIS and Biosecurity Australia have been aware of the Integrated Fruit Production manual and model for well over 20 years since the program was first commenced in late 1996. Knowledge of the IFP system is evidenced by:

(1) The Integrated Fruit Production Manual was raised by Apple and Pear Australia Limited in their technical response in June 2004 as detailed in Appendix C.

(2) Biosecurity Australia in the "Final Import Risk Analysis Report for Apples from New Zealand" (November 2006) reported the following:-

"According to the Integrated Fruit Production Program Manual (MAFNZ, 2005a), standard commercial practice involves a combination of measures recommended for management of fire blight in New Zealand, including:

- *pruning out infected shoots and cankers in the winter*
- *spraying one or more rounds of copper fungicides as bactericides in the winter program from leaf fall as necessary*
- *frequently inspecting the orchard; especially from blossoming to mid-summer for signs of infected blooms or shoots, pruning and burning any infected material upon detection*
  (Note that removal of infected material before the proposed inspection for fire blight will not be permitted in registered export orchards – see later section on risk management and operational framework
- *identifying and removing alternative hosts from within 100 m of the orchard block, and applying copper fungicides if hosts cannot be removed*
- *applying streptomycin 24 to 48 hours before an infection event but no later than 24 hours after*
- *selecting rootstock and scion combinations that are not highly susceptible to E. amylovora*
- *where possible, obtaining nursery stock from areas free of fire blight*
- *avoid overhead irrigation*
- *assessment of fire blight infection periods*
- *avoid fertiliser programs that encourage succulent shoot growth".*

(3) Biosecurity Australia went on to detail information on Standard commercial practice (Page 315 Volume B of the 2006 document):-

"Information provided by New Zealand on orchard and packing house practices and procedures and levels of pest infestation/infection in orchards and on apples, is largely based on data derived from commercial apple production systems used in New Zealand for the production of export grade fruit. Therefore this risk analysis and the recommended risk management measures are based on apples produced under normal commercial production practices (MAFNZ,

2005a). Where relevant, commercial production practices are discussed under specific pests. MAFNZ will ensure that all orchards registered for export to Australia are operating under standard commercial practices. Growers are responsible for maintaining adequate records relating to pest control, orchard monitoring, and spray diaries that confirm that standard commercial practices are being used. These records may be audited by AQIS. In order to ensure fruit is mature and has a minimum level of physical damage, all fruit must meet the Pipfruit New Zealand, Class 1 export standard in regard to the presence of wounds and maturity".

The request to obtain a copy of the New Zealand Pipfruit Integrated Fruit Production Manual has been denied by Biosecurity Australia based on the confidentiality rating placed on the document by Pipfruit New Zealand.

As a result Apple and Pear Australia Limited have been denied access to the most current Integrated Fruit Production Manual and it is therefore not possible for the industry to comprehensively respond.

From the assessment by Apple and Pear Australia Limited of the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand", it is obvious that Biosecurity Australia has used the implementation of this system as the fundamental and major reason for the changes in risks compared to the previous IRA.

The inability of stakeholders to analyse it and comment in an informed manner, significantly impacts on stakeholders ability to respond to the Draft Report.

Apple and Pear Australia Limited argues that Biosecurity Australia has give no scientific support to their decisions and conclusions that the standard orchard practices as established through the implementation of the Integrated Fruit Production manual meets the terms of the SPS Agreement as a 'measure' and/or meets Australia's Appropriate Level of Protection.

<u>IFP is a production guide</u>:

Apple and Pear Australia Limited's view that the IFP is no more than a production guide and is not a pest and disease risk management measure is supported by evidence supplied by the New Zealand Ministry of Agriculture and Forestry on the 8th April 2011 in answer to a question put by Biosecurity Australia. Specifically

Q. *IFP – The pest specific extracts from the IFP are all dated 2008. Is this the current version? Is there a statement in the preface to the current version of the manual that states that the recommendations are regularly updated as new information on pests and import requirements becomes available?*

A. The 2008 date is correct for the pest specific extracts.

The **IFP manual is a production guide**. It is updated as and when research or information becomes available and updates of components are issued to the industry as required. There is no statement in the *Preface* that this happens but it is evidenced by different sections of the IFP manual having different dates. The Contents pages are updated as and when there are amendments or changed to the IFP manual and issued along with the amendments.

Market specific requirements are only included if there are specific changes to the production systems that require specific guidelines. Market specific requirements are usually addressed by market specific work plans with MAF and are additional to **the IFP manual which is a series of generic production guidelines.**

The conclusion from these comments is that 2008 is the date of the most recent document (which is not available for industry to access).
Also the Integrated Fruit Production Manual ***is 'a production guide'*** or more specifically a ***'series of generic production guidelines'***.

Review of past information in relation to Fire Blight.
In relation to Fire Blight Apple and Pear Australia Limited has been informed that the requirements under 2001 edition of the NZ Pipfruit IFP Manual in relation to Infection risk assessment were as follows:-

- *In established orchards, blossom infection poses the greatest risk of crop reduction due to fire blight.*
- *The following criteria must be met for blossom infection:*
    - *Open flowers must be present with stigmas and petals intact;*
    - *Accumulation of at least 110 degree hours > 18.3 ºC after first bloom;*
    - *Occurrence of dew or = 0.25mm rain on the day of infection, or = 3 mm rain the previous day;*
    - *Occurrence of an average daily temperature of = 15.6 ºC.*
    - *The first early symptoms of blossom blight are expected with the accumulation of an additional 57 degree-days above 12.7 ºC. This may be 3-30 days after the occurrence of the infection event depending on the temperature.*

.
Within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" Biosecurity Australia makes the following statement

"*While the IFP program is proprietary information that covers all aspects of pipfruit production in New Zealand, it contains information that is relevant to the management of the pests and diseases considered in this review. Those key aspects of the IFP program are outlined below.*
Fire blight management
In New Zealand, management of fire blight focuses on reducing inoculum levels through cultural practices in the orchard and use of chemical or biological controls during the most susceptible infection period, blossom time. The decision to apply chemical or biological control measures is supported by a

computer model based warning system that considers temperatures, wetness periods and fire blight prevalence in the surrounding area. The model operated by Pipfruit New Zealand is available to registered growers through the Pipfruit New Zealand website and is derived from the Maryblyt and Cougarblyt models developed in the USA and adapted for New Zealand conditions.
The risk period for infection by E. amylovora in New Zealand is during blossom. Unlike some other regions of the world, New Zealand's apple growing areas do not experience severe frosts later in the season that can cause cracking of branches that provide opportunity for secondary infections. The risk factors for fire blight infections are:

- *Open flowers are present with stigmas and petals intact*
- *110 degree hours greater than 18.3°C have accumulated after the first bloom*
- *Dew or at least 0.25mm or rain on the day of infection has occurred; or at least 3mm rain on the previous day*
- *An average daily temperature of 15.6°C".*

It would seem the information in the 2011 version is very similar or the same to what Apple and Pear Australia Limited had access to in 2001.

If one accepts that conclusion then it is logical to assume that the rest of the information relating to Fire Blight within the 2001 version of the IFP Manual is no different. (Refer to Appendix D. of this document)

Apple and Pear Australia Limited would then argue that there is nothing or very little new in the IFP Manual from the 2001 and the 2011 versions. As a result there is no credibility in the assumption by Biosecurity Australia that the implementation of the Integrated Fruit Production Manual has reduced the threat of Fire Blight, Apple Leaf Curling Midge or European Canker to a level that meet Australia's Appropriate Level of Protection.

Further Apple and Pear Australia would argue that the New Zealand Pipfruit Integrated Fruit Production system

a. does not take into account the following:

   - Human error.
   - Human abuse.
   - Changing climatic conditions.
   - Outbreaks of pests or diseases in close proximity to registered orchards.
   - Orchard canopy and design.
   - Historical incidences of pest or disease present in orchards.

b. Has no rigorous independent audit process to ensure strict adherence to the system.
c. Has no exclusion of orchards when severe outbreaks of pests and diseases occur.
d. has failed on numerous occasions
   - Codling Moth in apples to Taiwan.

- Apple Leaf Curling Midge to USA.

Failure of the New Zealand system during a period when Integrated Fruit Production was a standard orchard practice is well documented. Biosecurity Australia reported on the failure of the system as late as 2005 (Page 76, 2011)

> *“**Dasineura mali** is a quarantine pest for the state of California. **Dasineura mali** has been detected during pre-clearance inspection of New Zealand applies destined for the US market (MAFNZ 2005b)”.*
>
> And
>
> “*Data from 2001–2004 from endpoint inspections for the US market indicated average fruit contamination levels ranging from 0.10 per cent to 0.38 per cent, with an average across all years of 0.16 per cent (Pipfruit NZ 2005).*
>
> And
>
> *“**Dasineura mali** has also been detected in several USA ports on New Zealand apples exported to the USA (USDA-APHIS 2003), further indicating that D. mali is, at least occasionally, associated with export consignments and can be detected during quarantine inspections”.*

As Biosecurity Australia has admitted this indicates that levels of infestations can remain associated with fruit after the post-harvest processing of apples in New Zealand.

Media reports (20th April 2007) highlight that MAF Biosecurity New Zealand was required to conduct a full investigation into the interception of a **Codling moth** in a consignment of Fuji apples to Taiwan and a report had to be prepared and sent to Taiwan for their consideration. The Media report indicated that

> *“MAF began the investigation following the detection of the moth on 13 April {2007}, and immediately suspended the export of New Zealand apples to Taiwan.*
>
> *The investigation involved a detailed examination of orchard production and pest management practises, as well as packing, coolstore and exporting procedures. As a result of the investigation MAF has suspended the affected orchard from the Apples to Taiwan programme for the remainder of 2007. In addition it has increased the requirements of codling moth interceptions.”*

The following are additional points of interest that come from this interception:-

- The apple came from an orchard in the Hawke's Bay,
- Codling moth larvae took hold by burrowing into the apple
- MAFBNZ stopped issuing phytosanitary certificates when the suspension notification from Taiwan was received. The orchard from which the codling moth originated and the packhouse/coolstore that packed affected fruit were immediately identified. Other fruit from the same source that was *en route* to

Taiwan was identified and the exporter advised that MAF certification had been withdrawn.

- An in-depth investigation followed to determine where the break-down in the apples to Taiwan compliance programme had occurred. The investigation looked at the orchard and the packhouse/coolstore pathway.
  - **Orchard investigation**
    This investigation focused on the grower's pest management practices, in particular pheromone trapping and pesticide use. Key findings were:

    - Codling moth populations were within normal parameters.
    - A potential window of opportunity for moth egg laying was identified between pesticide applications. The effect of this could not be assessed.
    - A possible window of opportunity of about seven days was identified during which apples may have been unprotected by pesticides. However, pesticide labels give conservative estimates of protection and pesticides were likely to have provided protection during this 'window' period.

  - **Packhouse/coolstore investigation**
    - An apparent discrepancy in labelling was clarified and ruled out as an issue in this case.
    - No non-compliances were identified in the affected packhouse/coolstore.

- Based on the stage of development of the codling moth larva intercepted in Taiwan, the investigation concluded that the codling infestation must have occurred at the orchard.
- New Zealand also agreed to review the science behind pest control measures before the start of the next production season.

Mr Peter Beaven, Chief Executive of Pipfruit New Zealand reported that ***"there are procedures to ensure that this doesn't happen but the system's not 100 per cent full-proof so every now and again you're going to get a system failure of some sort."***

This again highlights a failure in the standard orchard practices by growers and/or packers and/or exporters that results in infested/infected fruit leaving New Zealand and reaching importing countries.

Apple and Pear Australia Limited seeks a full audit of 'failures' (both reported and unreported) in the standard orchard practices. Details of that audit should be made available to the Australian apple and pear Industry prior to the commencement of apple exports from New Zealand.

<u>REVIEW OF THE NEW ZEALAND PIPFRUIT INTEGRATED FRUIT PRODUCTION FACT SHEET:</u>

FIRE BLIGHT:

Comparison of the 2001 and 2008 Fact Sheet on Fire Blight

2001 Document deletions:

Alternative Hosts:

- Remove alternative hosts if fire blight and infected plant material from the orchard and in the vicinity of the orchard. A list of fire blight host material is shown in Table B2.

Seasonal fire blight management programme

- Identify and remove alternative hosts within 100 meters of the orchard block. If hosts cannot be removed, consider applying dormant and blossom copper sprays to them to reduce inoculum potential.

2008 Document additions:

Disease management principles:

- Consider the use of alternative treatments such as Blossom Bless™ which is a sprayable bacteria preparation that competes for sites on the flower with Erwinia amylovora. Note this will need to be ordered with your supplier during winter.

Infection risk assessment:

- Alternatively more detailed weather data are available from automatic electronic weather stations such as those used by the HortResearch and HortPlus systems. Weather data is used to identify fire blight infection periods and possible infection events. These data are available through the Pipfruit NZ website login>tools>fireblight model then choose the appropriate weather station.
- Pipfruit NZ Inc will issue fireblight infection warnings throughout the blossom period for all pipfruit areas via the website. These warnings are based on a combination of predictions from the Cougarblight and Maryblyt models. Growers need to evaluate the temperature given in the report with those of their orchards.

Chemical controls:

- Please note the use of antibiotics such as streptomycin on horticultural crops is being phased out internationally. Only use streptomycin where there is a high risk from fireblight.
- Alternatives to streptomycin are biological products such as Blossom Bless ® and Serenade™ Max. At this time these products are best used to minimise the use of streptomycin as alternating or companion applications.

Seasonal fire blight management programmes:

- Identify and remove alternative hosts in the vicinity of the orchard block. If hosts cannot be removed consider applying dormant and blossom copper sprays to reduce inoculums potential

EUROPEAN CANKER *(Nectria galligena*

Comparison of the 2001 and 2008 Fact Sheet on Fire Blight

2001: European canker of apple and pear is caused by the fungus *Nectria galligena.*

2008: Only apple mentioned – not pear

2001: Causes damage in regions where mean annual rainfall exceeds 1,000 mm.

2008: Actual rainfall measure not given – just mentions it is only a problem in high rainfall areas particularly Auckland and Waikato and periodically Gisbourne and Nelson

2001: Fruit rot seldom a problem

2008: Can cause fruit rot which is not a problem in New Zealand

Disease cycle

2008: This section above is now covered under two headings: Symptoms – and also Sites of Infection.

Symptoms:

- First symptoms are small dark purple/brown sunken areas on the bark.
- The cankered area becomes blackened and sunken with concentric rings of cracking.
- Swelling of the stem occurs above and below the sunken area.
- Flaky bark may be present near the canker, but this is not unique to European canker.
- Staining of vascular strands occurs in the wood below the canker when the bark is cut away.
- White spores (conidia) are produced in the concentric cracks during humid weather, especially in spring and autumn. Conidia are spread by rain splash.
- Dark red fruiting bodies (perithecia) are produced in autumn and winter. These produce ascospores that are released by rain and spread by wind.

Sites of infection:

- Pruning cuts.
- Leaf scars left after autumn leaf fall.
- Growth cracks in the bark where spurs or lateral branches emerge.
- Rubbing wounds.
- Wounds where branch ties have been.

Disease management principles

2001: Previously there was a table of four different wound dressing products – now saying" Enusre pruning wounds are painted with Bacseal™ Super including cargendazim at 25g/l"

2008: Do not prune during rain

2008: it may be necessary to remove a whole limb or the entire tree"

Leaf fall fungicide sprays:

2008: Try to minimize copper use."

Canker removal:

2001: Cankers can be removed by either cutting or scraping with a knife or removed with a chainsaw, followed by application of fungicidal wound dressing. Pieces of wood cut from cankers must be removed from the orchard.

2008: Scraping cankers may not remove all infection

2008: Make pruning cuts at least 10cm below the lowest canker"

destroy infected material by burning".

Chemical controls

2008: Deleted mention of MBC resistance

SECTION E: EXCLUSION OF TRASH

> The scientific community is in agreement that trash is a high risk carrier of Fire Blight.
>
> There are 2 ways that trash could arrive in Australia from New Zealand with apples. The first way is by being attached to individual apples.
>
> The second and most likely way that trash will arrive in a consignment is as debris in cartons. Trash enters cartons as part of the mechanical process of grading and packing and the risks are increased with the use of tray fillers. Tray fillers are a common component of graders in New Zealand.
>
> The 2011 Review does not mention any statistically verifiable inspection system to ensure that trash is excluded from cartons. As such, Australia will be exposed to a risk well in excess of what is acceptable. It is of note that the level of trash in a fruit bin is determined by the quality and experience of the picker. As such, any criteria have to take into account extremes, as these will occur.

Insufficient inspection for trash.

Trash is scientifically recognised as a high risk carrier of Fire Blight and European Canker.

Dr Deckers in his evidence to the WTO panel made the following statement:-

"Class 1 export quality apples are mature apple fruit free of trash and the notion mature symptomless apples corresponds in fact to the same. In the frame of this discussion I think it is important to stick on one definition like "mature apple fruit free of trash". It is important that the fruits are free of trash, because the trash could harbour disease like Erwinia bacteria from infected orchards".

Dr Paulin in his evidence to the WTO panel made the following statements that:-

"i*n my view trashes may be twigs, dried pieces of leaves, plant debris, which could have been infected by E. amylovora before being transformed into trashes, and which could be equivalent of "cankers", which are the natural form of conservation of the disease in the field (Thomson, 2000). Such trashes could serve as vectors because if they result from infection, they may harbour internal population of bacteria"* and *"decaying fruits and trashes would represent a higher risk".*

And

*“The disinfection of apple could be justified when arriving in the packinghouse, if these are sourced from orchards showing fire blight symptoms. In this particular case, external pollution by exudate oozing from active symptoms of the disease is possible on near-by fruits****. In addition, it cannot be ascertain that fruits with symptoms, as well as trashes infected by the bacteria are not mixed with healthy mature fruits during cropping in the orchard. These trashes may carry an internal inoculum which could "leak" into the water used to wash the fruits, and consequently contaminate the fruits to be exported. I see no scientific evidence that the bacterial population will not survive the packinghouse process for some times.*** *Again this is only in the case where fruits are sourced from orchards having shown, or still showing, active symptoms of fire bight.”*

NZ recognised this with their request for access of mature fruit free from trash in 1995.

.

Both Australian and international experience has shown that trash cannot be precluded when harvesting apples.
Any inspection of apple graders in a packing shed confirms this.

While the experts might suggest that fruit packed retail-ready could be free of trash there is no scientific evidence that supports the premise.

At present there is no known process that ensures that all trash is removed or excluded in the grading and packing process. It is common for trash that is dislodged from fruit during the grading process to end up in the carton. Equally trash included in the harvesting process is mechanically transferred by the grading process and also ends up in the carton. The risks of an incidence of trash in cartons increases with the use of tray fillers. Tray fillers are used extensively in NZ.

In the “Final Import Risk Analysis Report for Apples from New Zealand” (Page 318, Vol B, November 2006) Biosecurity indicated that

“All apples for export must be free from trash, foreign matter and pests of quarantine concern to Australia. Freedom from trash will be confirmed by the inspection procedures. MAFNZ must provide details of how inspection for trash will occur before trade commences.”

To this point in time Apple and Pear Australia Limited has not seen any detail on the proposed ‘inspection procedures’ from MAFNZ or Biosecurity Australia. As a result industry is not in a position to now if any procedures are based on true scientific justification and rigour.

With the inspection of 600 pieces of fruit being proposed per consignment, Biosecurity Australia has assumed that apples alone are the carriers of trash.
Again Apple and Pear Australia Limited would argue that this process is

a) Insufficient, and
b) Not supported by any science.

Apple and Pear Australia limited would argue that with the carton being the most logical mode of transport for trash Biosecurity Australia MUST include 600 randomly selected cartons per lot to ensure that trash is not present and exported to Australia.

On the finding of any trash within retail-ready packs the full lot needs to be returned to New Zealand, treated or destroyed.

SECTION F: ADDITIONAL TECHNICAL ISSUES

F 1: Antibiotics

As one of the criteria for a risk analysis is to protect human health, the acceptance by Biosecurity Australia that a proportion of the fruit imported by New Zealand will be treated with antibiotics without assessing the human health consequences is in conflict with this important obligation.

Streptomycin/Biological controls
One of the processes utilised by New Zealand Apple growers for the control of Fire Blight is to use the antibiotic Streptomycin. An alternative is the use of the Biological control – Blossom Bless.

Streptomycin is not registered for use in Australia and as a result would not be available for use in the case of an outbreak of Fire Blight within Australia unless under an emergency permit from APVMA.
Indications are that an emergency permit could take months to achieve.

In addition the industry is not aware of Blossom Bless being registered for use in Australia. Again registration of this may take an extended period of time. Also there is an unknown as to what affect an introduced biological control agent like *Pantoea agglomerans* might have under Australian conditions. Is it possible that it could become a pest with the natural environment within Australia?

Biosecurity Australia reported in the “Final Import Risk Analysis Report for Apples from New Zealand” (November 2006) that

> *“In 2004, an average of 25% of blocks were treated for fire blight, of which 10% used streptomycin, 5% used Blossom BlessTM and 10% used copper. In 2002 and 2003 the average proportion of blocks treated for fire blight was 39% and 22% respectively (MAFNZ, 2005a).*

Biosecurity Australia within the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand” makes the following statement on the use of streptomycin/Blossom Bless:-

> *“For example, a key strategy of the IFP program to control fire blight is the application of sprays to prevent blossom infection based on a predictive model (refer to section 3.2.3 for more detail on IFP). The number of blocks in New Zealand that applied sprays (streptomycin or Blossom Bless) to control fire*

blight infection of blossoms was 9.4%, 10.7%, 11.7% and 8.3% in the seasons of 2006/07, 2007/08, 2008/09 and 2009/10 respectively (BSG 2011). These figures include blocks that sprayed both streptomycin and Blossom Bless and therefore include some double counting (MAFNZ 2011). In addition, the application of sprays only indicates that climatic conditions present a high risk for potential infection events, not actual the actual level of infection".

The information does not indicate what area is covered by the figures but putting that aside what the figures do indicate is that

a) On an average year at least 10% of the blocks in New Zealand have the climatic conditions with a high risk for potential infection
b) Over the period 2006 to 2010 there is a possibility that over 40% of the blocks in New Zealand could have the climatic conditions with a high risk of potential infection one in four years..

The use of **Streptomycin sprays** and other biological controls have some value but do not control ALL phases of Fire Blight.
Streptomycin is known to assist in the disease management of blossom blight and helpful in controlling the trauma blight phase of the disease but ineffective in preventing the shoot blight phase.

Shoot Blight is one of the five phases of infection and is detailed below

"Shoot blight symptoms are also called "blight strikes" and develop on actively growing vegetative shoots.

- *They can be associated with, but not limited to, insect feeding or damage.*
- *Disease occurrence has also been associated with modest wind damage to tender young shoots.*
- *On highly susceptible varieties, infections move rapidly and can invade large supporting limbs.*
- *Depending on the cultivar and stage of development, a single shoot infection can result in the death of an entire limb, or if the central leader of a main trunk is involved, a tree can be lost in a single season".*

"Streptomycin sprays have been found to be ineffective for prevention and control of shoot blight infections." (Douglas, SM., 2006)

Biochemical sprays like Messenger®, a biochemical pesticide containing the harpin protein, has been found to help in control of the blossom blight phase of fire blight, especially when used in combination with streptomycin sprays.

In relation to **Biological sprays** there is limited and inconsistent information is available on the efficacy of compounds such as BlightBan®.

CONCLUSION:

Given that there is serious concern about the use of antibiotics within food production and given the likelihood that antibiotic use on fruit and vegetables islikely to be banned in the coming years Apple and Pear Australia Limited argues that Biosecurity Australia should

- **a)** **Eliminate an orchards for the season that utilises an antibiotic spraywith in that year, or**
- **b)** **Ensure that ALL fruit that is exported from a block/orchard to which the trees/fruit have been sprayed with an antiobiotic MUST be labelled within the Australlain retail shops as have been treated in this manner.**

F 2: Viable But Not Culturable (VBNC)

VBNC was a risk clearly identified by experts at the World Trade Organisation hearing as a risk that was not taken into account in the 2006 analysis. Combined with the new scientific evidence confirming the potential risks of VBNC, Biosecurity Australia has continued to ignore this risk and proposes no measures to minimise this risk.

Relevance of Viable But Not-Culturable (VBNC) and Biofilm.

At the World Trade Organisation Panel hearings the experts were asked if any risks were not considered by Biosecurity Australia. Both experts agreed that the risks of VBNC needed to be considered.

Dr Paulin reported that:

> *"I have personally no idea on the likelihood of the possibility that wastes from fruit packing houses be uncovered and exposed to elements, although I imagine it is low as it should be in any well organized country. This being said, it has been proven that low bacterial populations (Hale et al. 1990) sometimes as VBNC (Ordax et al, 2008) may be present for some times in the calyx of fruits. If these fruits were discarded in the open and exposed to the elements, the decaying fruit could constitute a suitable medium for a multiplication of these low bacterial populations. They could multiply, or resuscitate from the VBNC status, and therefore constitute a potential inoculum for near-by host plants."*

And

"On the other hand the mechanisms described for E. amylovora conservation (EPS, VBNC, quorum sensing, sigma factors) do show accurately that E. amylovora cells may survive in adverse conditions, including on apples sourced from contaminated orchards."

And

"It seems certain that, if conditions in the packing house tend to reduce E. amylovora population, they will not allow the complete disappearance of these bacteria. The fact that VBNC state has been demonstrated in laboratory conditions for E. amylovora adds a potential for survival (whatever the frequency of cells at the VBNC state, and the chance of resuscitation, which is controversial in natural condition)."

And

"Data on preservation of bacterial population on apple surface during cold storage seems to accurately show that there is a decrease in these conditions. It is not possible to know if this decrease is linked with temperature, or only with time: because bacteria are not able to multiply, their population decreases naturally, and this decrease could be faster at room temperature; in the precise case of risk of transport of bacteria with mature symptomless fruits anyhow, this has little influence: the conditions in the packing house will not allow the population to increase, but will not allow the population to disappear within the considered period of time (few days?). ***Especially because of the possibility of VBNC, a time limit cannot be accurately determined for the maximal survival of E. amylovora****."*

And

"In addition the recent information, that E. amylovora is able to turn to the VBNC state under certain conditions, which has been recently checked with E. amylovora placed in calyx of apples, demonstrates that the survival of E. amylovora (even if the resuscitation in natural conditions is unclear for these VBNC) lasts probably longer than initially assumed. Consequently, this evaluation by the IRA is objective and credible. Even if it remains impossible to quantify the importance of this long conservation."

And

"The ability of E. amylovora to enter into the viable but non-cultural state is established according to the standard in that sort of microbiological studies. There is no doubt that VBNC state exists for E. amylovora in the conditions used in the laboratory for this demonstration. That this VBNC state can be obtained with bacterial populations (artificially) placed in apple calyx is an

additional confirmation of this capacity of E. amylovora. This ability is shared by many other bacteria, including Enterobacteriaceae, the taxonomic group in which is placed E. amylovora. The two open questions are: does VBNC occur in natural conditions from the small population of E. amylovora trapped in apple calyx? and, to what extent the resuscitation takes place in natural conditions, and if so, in which quantity? The VBNC state is somewhat a matter of controversy in microbiology, and considered by some as just a "pre-death" stage."

Dr Deckers reported that:

"The VBNC status of the bacteria is a known status that can be present under orchard conditions when Cu treatments are made as a chemical control method. This status can indeed interfere with the detectible level of EA bacteria in the epiphytical populations in the orchard."

Since the last Import Risk Analysis, the position with Fire Blight's ability to enter the VBNC state has been further demonstrated with scientific work. The work undertaken **by Ordax *et al*** clearly demonstrated that the Fire Blight bacteria can enter this state and at a later stage become viable and infect a host plant.

This has further relevance as Biosecurity Australia appear to have only taken into account infections at flowering time when considering this risk. This is far from the conservative approach that they should have taken. The matter of fruit harvested from recently infected orchards was not considered.
With Australia's recognised conservative position in relation to quarantine, there is now sufficient scientific information to demonstrate that the Fire Blight bacteria has the ability to enter the VBNC state and at a later time become viable again. Biosecurity Australia has not recommend procedures to lower this risk.

History and results of research on Viable But Non-Culturable *Erwinia amylovora*

"Occurrence of Viable But Non-Culturable Fire Blight in Apple Calyces" (Wimalajeewa, 2006)

"Recent research has shown that the bacteria that cause fire blight can enter a form of "hibernation" which means that they are still capable of causing infection but cannot be detected by the regular tests. This state is known as "viable but non-culturable" or VBNC."

"Can Erwinia amylovora exist in a viable, but nonculturable state" (Sly, 2006)

Research funded by Horticulture Australia Limited and undertaken at the University of Queensland has independently confirmed overseas research that *Erwinia amylovora*, the causative agent of fire blight of apples and pears, is capable of surviving in the presence of copper. Copper compounds are widely used in agriculture to control outbreaks of diseases including fire blight. The copper induces some cells of *Erwinia amylovora* to enter a Viable but-Non-culturable (VBNC) state, allowing their survival. These results have implications for the detection of *Erwinia amylovora* on fruit and plant material and will require revision of risk assessment protocols. This will be even more important in the light of recent research published by Ordax et al. (Applied and Environmental Microbiology 72, 3482-3488, 2006).

These workers demonstrated that pathogenic *Erwinia amylovora* may be resuscitated with fresh immature pear juice from the copper-induced VBNC state after 9 months. More research will be required to investigate the long term survival and resuscitation of *Erwinia amylovora* in orchards and on fruit under natural conditions. These combined results raise serious questions about the interpretation of epidemiological and ecological data for *Erwinia amylovora* and its control, and the use of such data in risk assessments.

The report indicated that:-

> *"The resuscitated cells retained their pathogenicity when tested up to 9 months in the VBNC state."*
>
> And
>
> *"Now that the conditions for resuscitation of Erwinia amylovora VBNC have been identified, experiments could be undertaken in the field to test various hypotheses on the survival of Erwinia amylovora in symptomless orchards and on fruit."*
>
> And
>
> *"Evidence in the literature has shown that a growing number of other Gram negative bacteria can convert to a VBNC state when the bacteria were nutrient starved or environmentally stressed, and that copper frequently facilitated this process.*
> *Several important plant pathogens including Xanthomonas campestris pv. campestris, causative agent of black rot in brassicas, (Ghezzi and Steck 1999) and Ralstonia solanacearum (Grey and Steck 2001) are amongst the wide range of bacteria now demonstrated to be capable of entering the VBNC state."*
>
> And

"……*conditions found to trigger entry to the VBNC state such as copper, nutrient stress and osmotic stress are all factors expected to be present in apples in orchards."*

Copper is regularly applied to apple trees at budburst and the sugar content/osmotic stress in apples increases with age of the fruit, thus *Erwinia amylovora* is likely to encounter the conditions which can induce the VBNC state in apples during the growing season.

"Contribution of Erwinia amylovora Exopolysaccharides Amylovoran and Levan to Biofilm Formation: Implications in Pathogenicity." (Koczan et al. 2009)

The following are extracts from this scientific paper:-

"An in vitro crystal violet staining and a bright-field microscopy method were used to demonstrate that E. amylovora is capable of forming a biofilm on solid surfaces."

And

"These results demonstrate that biofilm formation plays a critical role in the pathogenesis of E. amylovora."

And

"The highly virulent fire blight pathogen moves rapidly both within susceptible plants and between trees in orchards, resulting in significant losses when environmental conditions favor infection."

And

"A biofilm has the ability to act as a buffer, protecting associated bacterial cells from rapid fluctuations in environmental conditions. Biofilms also enable an accelerated rate of horizontal genetic exchange, and bacteria in biofilms may be protected from both antibiotics and host defences (30, 38)."

And

"The vascular tissue of plants is an additional site of biofilm formation by plant pathogens such as Pantoea stewartii subsp. stewartii, Xanthomonas campestris pv. campestris and Xylella fastidiosa (20, 31, 32)

And

"Although amylovoran has long been known as a pathogenicity factor in E. amylovora, the connection between amylovoran production, biofilm formation, and pathogenesis has not yet been established."

And

“This work also implies that biofilm formation may play a significant role in the pathogenesis of E. amylovora and in the movement of E. amylovora cells via apple xylem.”

And

“Biofilms in more advanced stages of development comprised greater numbers of cells and associated fibrillar material retaining linkages to wall-attached cells (Fig. 6C). In some cases, the xylem vessels were completely filled with the bacterial biofilm, which also included the apparent extrusion of cells outside of individual vessels.”

And

“The results of our in vitro and in planta experiments demonstrated that E. amylovora cells form biofilms and that biofilm growth may play an important role in host plant colonization.”

And

“The transcriptome of biofilm-associated cells differs from that of free-living planktonic cells, and biofilm-associated cells are also more resistant to antibiotics and potentially less susceptible to detection by host surveillance mechanisms (23). Thus, the importance of biofilms to pathogenesis is an emerging concept in both animal and plant pathology.”

And

“In summary, we demonstrated that E. amylovora forms a biofilm and the importance of biofilm formation to the fire blight infection. We were also able to provide evidence that amylovoran, the main EPS component, is necessary for biofilm formation and that levan, a minor EPS component, also plays a role in biofilm formation. Our results imply that biofilm formation and pathogenesis are linked; however, further experimentation is needed to confirm this hypothesis.”

“Survival of Erwinia amylovora in mature apple fruit calyces through the viable but nonculturable (VBNC) state.” (Ordax et al, 2009)

“Its dissemination via fruit has not been demonstrated yet (Temple et al. 2007; Roberts and Sawyer 2008); however, E. amylovora has been detected by different techniques in calyces of symptomless apples from severely infected plants (Hale et al. 1987; van der Zwet et al. 1990), and even from some asymptomatic trees (Clark et al. 1993). There is considerable disagreement among plant pathologists as to whether the fruit can act as a vehicle in the long-distance spread of the pathogen.”

And

“However, the calyx sinus is considered a nonconductive environment for E. amylovora, as it mainly consists of dead plant tissue without nutrients or adequate humidity (Taylor et al. 2002, 2003).”

And

“In most of the studies reported on the survival of E. amylovora inside the calyx of mature apple fruits, the viability of the pathogen was assessed only on the basis of its recovery by cultural methods. When E. amylovora failed to form visible colonies on growth media, it was concluded that the pathogen did not survive in the calyx. This methodology could underestimate the viability of E. amylovora and, consequently, its survival ability in apple calyces. This conclusion is supported by the ability of this pathogen to adopt the viable but nonculturable (VBNC) state in vitro under some stress conditions like presence of copper ions or starvation (Biosca et al. 2006; Ordax et al. 2006a; b; Biosca et al. 2008, 2009).”

And

“In fact, it has been proven that VBNC E. amylovora cells can persist for long periods of time maintaining their ability to resuscitate and regain culturability and pathogenicity as soon as the environmental conditions become favourable (Ordax et al. 2006a; b). If entry of E. amylovora into this state occurs in nature, then the VBNC cells could represent a potential risk for the import ⁄ export of pome fruit (Roberts and Sawyer 2008), playing a role in the spread of the disease and thus becoming a significant factor in the disease risk assessments.”

And

“Low temperatures and copper treatments are common in fruit storage and packaging for long-distance transport (Swindeman 2002), whereas in short distances fruit is usually transported at warmer temperatures.”

And

“Two strains of E. amylovora from different geographical origins were assayed: CFBP1430 (isolated in France) and NCPPB2080 (isolated in New Zealand).”

And

“Since no significant differences (P > 0Æ05) in the survival trends were observed among strains CFBP1430, 1430-GFP1, NCPPB2080 and 2080-GFP3 for each condition assayed (temperature, inoculums dose and copper concentration), only those results obtained with the type strain CFBP1430 are represented in both figures.”

And

“Unlike apple fruit kept at 26ºC, in those stored under cold conditions (Fig. 2), the total and viable cell numbers remained nearly stable over the experimental period, regardless of the inoculum doses of E. amylovora and the copper concentration sprayed.”

And

“At the lowest inoculum level (Fig. 2e,f), pathogen entry into the VBNC state occurred 2 weeks later for both copper concentrations than at 26ºC, being on day 35 with 0Æ01 mmol l)1 CuSO4, and on day 21 with 0Æ1 mmol l)1 CuSO4.”

And

“The culturability of VBNC cells from several calyx extracts from fruits subjected to different conditions (inoculum dose of the pathogen, storage temperature and copper treatment or not) were recovered in vitro (in KB broth; Fig. 3) and in vivo (from detached young pear shoots maintained in agar; Fig. 4).”

And

“In both conditions, in vitro and in vivo, VBNC E. amylovora cells from calyces were able to recover their culturability.”

And

“These shoots showed a slight necrosis, as a typical early symptom of fire blight, 14 days after the inoculation of calyx extracts containing VBNC cells.”

And

“*The VBNC cells were able to cause fire blight symptoms (necrosis between 2 and 10 mm radius, and one to four drops of exudate of 1–2 mm diameter) on immature pear and loquat fruits only during the first six days after the entry into this state. However, recovered cells were always pathogenic, causing the typical symptoms (necrosis >10 mm for fruits or >30mm length for shoots, and >4 drops of exudate of 1–4 mm diameter) even when they came from 28-day-old VBNC cells.”*

And

“Erwinia amylovora cells surviving in the calyx sinus were located mainly attached to the stamens and forming cellular groups, independently of temperature and copper presence, as revealed by FM and CLSM microscopy. At the inoculation time, the GFP-marked E. amylovora cells appeared as an undefined cellular mass in the surrounding area of the stamens by FM. However, from the first week to day 35, bacterial cells appeared distributed in discrete groups as a discontinuous layer along the stamens (Fig. 5a). Three-

dimensional view by CLSM revealed that these cellular groups consisted of several cell layers (Fig. 5b, c), suggesting a biofilm-like structure."

And

"This study has demonstrated that E. amylovora can survive in the calyx environment of mature apple fruit and cope with the starvation and desiccation conditions present, maintaining its culturability and ⁄ or adopting the VBNC state depending on the inoculum dose, temperature, copper presence and time elapsed after the inoculation. Hitherto, the induction of the VBNC state in E. amylovora as a survival strategy had been shown only in minimal medium supplemented with copper (Ordax et al. 2006a,b), and in natural water (Biosca et al. 2006, 2008, 2009), but not in plant material.

In apples stored at 26 ºC, a significant fraction of the stressed E. amylovora cell population from the calyces untreated with copper entered into the VBNC state, the fraction being higher for low inoculum doses. This is especially relevant because these low inoculum levels are closer to those found in natural conditions at which E. amylovora persists in mature apples (Taylor et al. 2003). Further, in copper-treated fruits, the whole viable population present inside the calyx sinus adopted the VBNC state, consistent with the previous results obtained in minimal liquid media (Ordax et al. 2006a, b). In contrast, in noncoppertreated calyces at 5 ºC, E. amylovora cells retained their culturability on KB medium throughout the experimental period. These results agree with those obtained by Ceroni et al. (2004) who proved that the reisolation of E. amylovora cells from pear calyces stored under cold conditions was successful even after 101 days. The fact that cold conditions can induce certain cell changes that protect the cell against other stress factors has been reported for several bacterial species (Gounot 1991; Beales 2004; Phadtare 2004; Vorob'eva 2004). We have already demonstrated that low temperatures can prolong the culturability period of E. amylovora under nutrient deprivation in natural water, preventing its entry into the VBNC state (Biosca et al. 2006, 2009). However, the possible protective effect of cold conditions to face other stressful factors, such as the presence of copper or reduced humidity, had not been previously studied for E. amylovora.

In copper-treated calyces stored at 5ºC, the whole viable population of E. amylovora entered into the VBNC state, although these cold conditions delayed significantly the entry into the VBNC state in comparison with the time taken for such entry in treated calyces at 26 ºC. This result is in accordance with previous studies that have shown that survival ability of E. amylovora in apples is enhanced under cold conditions (Dueck 1974; Taylor and Hale 2003; Tsukamoto et al. 2005). The VBNC induction of E. amylovora, which has been shown in apple calyces subjected to conditions usually employed in the longdistance transport of fruit such as low temperatures and copper treatments

(Swindeman 2002), could increase the risk of pathogen dissemination in the fruit.

In this work it has been shown that most, or even the whole of the viable population of E. amylovora enters into the VBNC state inside the calyx sinus of mature apples depending on the different conditions applied to the fruit, except for the higher inoculum dose at 5 ºC. This means that these stressed cells could not be detected in apples analysed only using cultural methods. In addition, if the only growth medium employed is the semi-selective medium CCT, the risk of underestimation of the pathogen present would be higher than on the nonselective KB medium. This is because stressed E. amylovora cells from the calyx sinus lost their culturability on CCT after 1 and 2 weeks at 26 ºC and 5 ºC, respectively. This confirms our previous results obtained with CCT solid medium that also showed a low recovery efficiency of E. amylovora cells subjected to other stressful conditions (Ordax 2008; Biosca et al. 2008). It is well known that some selective media are not suitable for the growth of stressed bacterial cells (Bissonnette et al. 1975; Rocelle et al. 1995; Liao and Shollenberger 2004). Since the calyx sinus of mature apples is a nonconducive environment for this pathogen, the possible difficulty in isolating and culturing E. amylovora cells from this site on CCT (Taylor and Hale 2003; Taylor et al. 2003; Temple et al. 2007) or other semi-selective media (van der Zwet et al. 1990) should be considered in future studies with the apple fruit.

The survival ability of E. amylovora inside the calyx sinus shown in our study is even more remarkable because the recovery of calyx-induced VBNC cells proved successful under favourable conditions, whether in response to nutrients under in vitro conditions or to susceptible host plant material like young pear shoots. Furthermore, the counts of recovered cells were revealed as high enough to initiate disease and cause fire blight symptoms, either in fruits or shoots. For the first time, VBNC E. amylovora cells were able to recover their culturability and pathogenicity through the direct contact with host plant material. Similar evidence was reported by Grey and Steck (2001) for the copper-induced VBNC Ralstonia solanacearum cells, concluding that the VBNC condition could be involved in the persistent nature of some infections.

The optimization of protocols for detecting E. amylovora is essential in obtaining an accurate result in the analysis of asymptomatic parts of the plant (Lopez et al. 2003). Since it is well known that cultural methods often recover only 0Æ01–10% of the total cells (Montesinos 2003), the detection of the pathogen should not be based only on its isolation (Lopez et al. 2003; Montesinos 2003; EPPO 2004). The difference between the studies that have reported that E. amylovora has a reduced ability to survive in mature apple calyces (Dueck 1974; Taylor and Hale 2003; Taylor et al. 2002, 2003; Temple et al. 2007) and this work, which has proved the opposite, is probably because of differences in experimental conditions. The use of an antioxidant buffer, the *nonselective medium KB, the monitoring of total and viable cells, and the recovery experiments of the VBNC cells from calyx extracts in vitro and in vivo has revealed to be appropriate for the detection of viable E. amylovora cells at low levels in symptomless apples. In fact, such methodology has also proved to be valid under other stressful conditions (Ordax et al. 2006a, b).*

Interestingly, the microscopy studies have shown that stressed E. amylovora cells could reside inside the calyx forming cellular groups attached to the stamens. This suggests the possible formation of biofilms in the calyces, as a bacterial adaptive response that mediates survival under adverse conditions (Webb et al. 2003). In fact, biofilm formation by this pathogen has been recently proved (Koczan et al. 2008), although not in fruits, to our knowledge.

Overall, although it is generally considered that the likelihood of successful introduction of fire blight by fruit to a new area is very low or negligible (Roberts et al. 1998; World Trade Organization 2003, 2005), in the light of results obtained in this study, the need to exercise caution in this regard seems evident. Erwinia amylovora has revealed a remarkable ability to survive over the experimental period in mature apple calyces subjected to different conditions, and without showing fire blight symptoms.

Thus, E. amylovora could go unnoticed in the fruit, which means that its healthy appearance is not evidence that it is free of the pathogen, as concluded by other authors (Tsukamoto et al. 2005; Azegami et al. 2006). In addition, we have shown that cold conditions, used in the long distance transport of fruit, increase the survival ability of the pathogen in mature apple calyces. Despite the fact that a contaminated fruit would represent a source for new fire blight infections only in the case that such fruit comes in contact with susceptible hosts or vector insects (Taylor et al. 2003), rare possibilities of entry and spread of E. amylovora by fruit importation should not be ignored (Billing and Berrie 2002), because once the pathogen enters into a country free of fire blight the eradication is very difficult (EPPO／CABI 1997). In conclusion, since it has been shown that calyx-stressed E. amylovora cells can remain undetected by cultural methods, but viable for at least 1 month, and further, that these VBNC cells can regain culturability and pathogenicity, the potential risk of fruit as possible carrier of this pathogen, although low, should be considered."

"Exopolysaccharides favour the survival of Erwinia amylovora under copper stress through different stages." (Ordax et al, 2010)

"Copper compounds are widely employed for its control, especially in the European Union, where the use of antibiotics in plants is forbidden (Anonymous, 1999)."

And

"Moreover, several phytopathogenic bacteria have developed different strategies to protect themselves from copper to some extent (Kidambi et al., 1995; Kazy et al., 1999; Grey and Steck, 2001). In the case of E. amylovora, the pathogen enters into the viable-but-nonculturable (VBNC) state when exposed to this metal (Ordax et al., 2006, 2009)."

And

"The VBNC state and other bacterial strategies for confronting copper could contribute to persistent infections often observed in copper-treated plants."

And

"In contrast, little is known about the protective effects that amylovoran and/or levan may provide to E. amylovora cells under adverse conditions. It was pointed out that amylovoran protects the bacterium from desiccation and changes in salinity (Geider, 2000, 2009) and levan from plant defense mechanisms (Geier and Geider, 1993).

And

"Bacterial EPSs have long been related to protection against metals (Wolfaardt et al., 1999), but their role against long-term copper stress had not yet been explored in E. amylovora despite recurrent infections in copper-treated plants (Grey and Steck, 2001). The results of the three approaches used in this work, with the aim of studying the role of the major EPSs of E. amylovora on its survival in the presence of toxic copper ions, have demonstrated that both amylovoran and levan provide significant advantages for survival of this bacterium under stressful conditions.

And

"When copper was present, the culturability of the viable population of E. amylovora significantly decreased, indicating a VBNC state induction as previously reported (Ordax et al., 2006, 2009). Interestingly, a larger fraction of the viable population entered into the VBNC state in EPS-deficient mutants and earlier than the wt strains did. Thus, both amylovoran and levan are required for longer survival of E. amylovora in a culturable and pathogenic state in the presence of copper, probably by precluding its toxicity through its binding."

And

"In general, with and without copper, the levels of EPSs extracts added decreased more in EPS mutants than in the wt strains, probably due to their EPS deficiency and/or higher susceptibilty to the stressful conditions assayed."

And

"In the present work, we demonstrated that both amylovoran and levan were able to complex copper ions and that both EPSs favor long-term persistence of E. amylovora in a culturable state, thus maintaining pathogenicity. Furthermore, through the addition of EPS extracts to E. amylovora cells exposed to copper, we showed a double protective effect: amylovoran and levan can complex copper ions and also be used as a carbon supply under carbon deprivation conditions, traits unknown in this bacterium. This double effect of the major EPSs of E. amylovora could contribute to the persistence of the pathogen in plants under unfavorable conditions imposed after application of copper treatments and/or when nutrients are scarce during host dormancy. Recently, it has been shown that amylovoran and levan contribute to biofilm formation in E. amylovora (Koczan et al., 2009), and, in fact, we observed biofilm-like structures formed by this bacterium on apple fruits (Ordax et al., 2009). These findings coupled with the present results suggest that biofilm lifestyle could be a survival strategy for E. amylovora against environmental stresses in plant material such as copper or starvation, but this hypothesis requires investigation.

Overall, the benefits that amylovoran and levan provide to E. amylovora under prolonged copper stress provide new insights into survival strategies developed by this plant pathogen which could explain, at least in part, the recurrent fire blight infections in copper-treated plants."

"Recovery of Erwinia amylovora Viable but Non-Culturable Cells in Pear Plantlets." (Santander et al, 2011).

"Understanding the persistence of E. amylovora under adverse conditions would improve the control strategies against fire blight. Nevertheless, the survival mechanisms of E. amylovora outside its hosts are barely known, although it has been demonstrated that it enters into the viable but non-culturable state (VBNC) when exposed to diverse types of stress (Biosca et al., 2006, 2008, 2009; Ordax et al., 2006, 2009, 2010; Santander et al., 2009a,b). In this physiological state, bacterial cells remain viable but unable to grow on the solid general media where they usually do, being undetectable by conventional culture-dependent methods (Roszak and Colwell, 1987).
However, in some cases, VBNC cells can regain their culturability and pathogenicity under favorable conditions (Oliver, 2010). Common strategies to recover E. amylovora
VBNC cells include incubation in liquid media and/or inoculation in host detached organs (Ordax et al., 2006, 2009), but it is not always successful (Santander et al., 2009a, b). In other pathogenic bacteria the possibility has been described to recover VBNC cells by host passage (Oliver, 2010). The aim of this study was to evaluate the recovery of E. amylovora VBNC cells by passage through pear plantlets, as well as to compare it with other recovery methods commonly used for the pathogen."

And

"We evaluated the recovery of E. amylovora VBNC cells by using pear plantlets, comparing with the other methods frequently used for this purpose (Ordax et al., 2006, 2009; Santander et al., 2009a, b). Results from the recovery assays revealed that, in all positive cases, it was possible to recover E. amylovora culturable cells on plates from KB broth or symptomatic detached fruits and plantlets briefly after inoculation (Table 1), being E. amylovora colonies identified by PCR."

And

"In most cases, the recovery of VBNC cells was more effective in plantlets than with KB broth or detached immature pears (Table 1). VBNC E. amylovora cells after nine weeks in natural water and five weeks in distilled water at 26°C were not recovered in KB broth neither in detached fruits, but they regained culturability in plantlets (Table 1)."

And

"Moreover, recovery in plantlets appears to be more similar to the conditions that the bacterium would find in nature."

And

"Finally, our results support the hypothesis of the VBNC state as a part of the E. amylovora life cycle, and it should be taken in consideration in epidemiological studies about the fire blight, with the aim to optimize the management and control of the disease."

"Colonisation of Pear Plantlets Inoculated with Erwinia amlyovora by Soil Irrigation". (Santander et al. 2011).

From this scientific paper the following information has been extracted:-

"Difficulties to control fire blight (Norelli et al., 2003) have been mostly related with the ability of the causative agent of this disease, Erwinia amylovora, to persist in different reservoirs and to spread by different means (Thomson, 2000). Nevertheless, little is known about alternative dissemination routes and putative reservoirs outside host plants for this pathogen. In non-host environments, such as water, bacterial persistence is mainly affected by nutrient limitation. Recent studies have shown that E. amylovora may survive under prevailing oligotrophic conditions of natural water by adopting a starvation response and the viable-but-non-culturable (VBNC) state (Biosca et al., 2006, 2008, 2009). Further, this pathogen is able to retain its pathogenic potential for susceptible hosts in different types of environmental water (Biosca et al., 2006, 2008, 2009). However, the risk of waterborne transmission is commonly underestimated."

And

“The results obtained have shown that infection of roots and systemic colonization occurred in both wounded and unwounded pear plantlets inoculated by soil irrigation with E. amylovora. The pathogen was able to enter plantlets probably through wounded roots but also by natural openings, as previously described for other phytopathogenic bacteria (Adams, 1975; Hayward, 1991). Bacterial cells were able to move to the upper parts of the plantlets through the vascular system, generating typical fire blight symptoms in wounded plants within 1-2 weeks, and in unwounded plantlets within 3-4 weeks. The symptoms consisted in necrosis of leaves, petioles and/or the stem (Fig. 1A), which progressed to the rest of the plant (Fig. 1B), similarly to that observed in positive control plants.”

And

“Further, in plantlets inoculated with the GFP-marked strain, it was possible to visualize bacterial cells inside root and stem tissues by EFM, confirming that E. amylovora was able to infect and multiply inside roots, gaining access to the vascular system and finally, to the rest of the plant, causing blight symptoms in aerial parts.”

And

“Accordingly, E. amylovora might be able to infect roots and colonize host plants irrigated with water with the pathogen, suggesting that the transmission of the bacterium by irrigation water is possible. This raises new concerns on the dissemination routes of E. amylovora that should be necessarily taken into consideration to improve preventive and control measures against fire blight.”

“Recent findings on the viable but nonculturable state in pathogenic bacteria”. (Oliver, 2009)

From this scientific paper the following information has been extracted:-

“Bacteria in the viable but nonculturable (VBNC) state fail to grow on the routine bacteriological media on which they would normally grow and develop into colonies, but are still alive (Oliver, 2000). Despite their typically low levels of metabolic activity, they are again culturable upon resuscitation.

Since the pioneering study by Xu et al. (1982) over 25 years ago, a large body of literature has evolved from researchers worldwide documenting the existence of a VBNC state in a wide variety of bacteria. Most investigators believe it to be a survival strategy in response to harsh environmental conditions, and it is now clear that the VBNC state constitutes an important reservoir of pathogens in the environment (Lleo` et al., 2007a).”

And

“The existence of a VBNC state has been debated for many years (Bogosian & Bourneuf, 2001; Nystr¨om, 2001; Oliver, 2005a, b; Barcina & Arana, 2009). At least some of the disagreement revolved around the phrase ‘viable but nonculturable’, which is most commonly used to describe this phenomenon (Barer & Harwood, 1997; Kell et al., 1998; Colwell & Grimes, 2000). However, the debate over whether a VBNC state truly exists has largely been put to rest, largely as a result of numerous molecular studies reported in recent years (discussed below).”

And

“A list of factors, both chemical and environmental, which have been reported to induce the VBNC state, are varied and numerous. It includes nutrient starvation (e.g. Cook & Bolster, 2007), incubation outside the normal temperature range of growth (e.g. Besnard et al., 2002; Maalej et al., 2004; Wong & Wang, 2004), elevated or lowered osmotic concentrations (e.g. Asakura et al., 2008; Wong & Liu, 2008), oxygen concentrations (Kana et al., 2008), commonly used food preservatives (Cunningham et al., 2009; Quir ´ os et al., 2009), heavy metals (Ghezzi & Steck, 1999) and even exposure to white light (Gourmelon et al., 1994). A common response to such stresses by bacterial cells is their ultimate inability to develop into colonies on routine culture media (Fig. 1), even though the cells may remain viable for long periods of time.”

And

“In fact, it seems most likely that pathogens are not generally able to initiate disease when present in the VBNC state, but that virulence is retained and infection can be initiated following their resuscitation to the actively metabolizing state.”

And

“One of the interesting and significant consequences of entry of pathogens into the VBNC state includes its effects on antibiotic resistance when pathogens are in this state (often in biofilms).”

And

“It seems likely that, because VBNC cells demonstrate such low metabolic activity, they effectively become resistant to antibiotics, and yet are able to resuscitate and reinitiate infections.”

And

“Whether or not VBNC cells remain capable of attaching to surfaces appears to be species or strain dependent.”

And

"We found that Pseudomonas fluorescens cells can remain in this state in soil for over a year (Bunker et al., 2004),….."

And

"Some of the most exciting studies in the desire to understand the biology of cells in the VBNC state have been elucidated by investigations into various molecular aspects of these cells. This is exemplified by the use of RT-PCR to demonstrate continued gene expression in VBNC cells (e.g. Lleo` et al., 2000, 2001). In addition to providing an essential insight into factors regulating the VBNC state, such studies have offered definitive proof that such cells remain metabolically active and are not dead"

And

"The VBNC state can only be a significant means of survival if the cells are able to increase metabolic activity and again become culturable."

And

"Numerous studies have found that a simple reversal of this stress (e.g. a temperature upshift) is sufficient to allow their resuscitation from the VBNC state (Gupte et al., 2003; Wong et al., 2004; Du et al., 2007a, b).

And

"That a temperature upshift resulted in true resuscitation, as opposed to regrowth of undetected culturable cells, was shown conclusively by Whitesides & Oliver (1997)."

And

"Thus, a wide variety of bacterial–host associations may have special value in influencing the survival of bacteria, including those in the VBNC state."

And

"Another exciting development in the reactivation of dormant cells is the role of a group of extracellular bacterial proteins, known as 'resuscitation-promoting factors' (Rpfs), which have been shown to induce resuscitation in M. tuberculosis and M. smegmatis (Mukamolova et al.,1998a, 2002; Shleeva et al., 2004)"

And

"It has been recognized for many years that H_2O_2 might play a significant role in inducing the VBNC state in a variety of bacteria, including E. coli (Mizunoe et al., 1999)"

And

"This observation suggested that one aspect of the VBNC state in this pathogen likely involves H_2O_2,…."

And

"The exact role of the VBNC state in bacteria is yet to be elucidated. It is likely that its role and significance differ from bacterium to bacterium. Most investigators believe it to be a response to certain environmental stresses that allows the cell's survival."

And

"Or, as recently suggested by Epstein (2009), dormancy, and 'waking up' from this state, could be a method analogous to 'sending out scouts' to 'test the environment' for its suitability for growth of the entire population."

And

"Regardless of the role that the VBNC state plays, it is clear that a large number of non-spore-forming bacteria, most notably a large number of human pathogens, are capable of entering this state, maintaining cellular structure and biology and continuing significant gene expression while otherwise nonculturable by 'standard' laboratory methods. That they can exit from this state, and become culturable again, is also undeniable. Finally, it can no longer be questioned that the VBNC state plays a critical role in the survival of important human (and other) pathogens, and possibly in their ability to produce disease.

NEW SCIENCE IN RELATION TO VBNC THAT HAS NOT BEEN CONSIDERED:

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Anuchin AM, Mulyukin AL, Suzina NE, Duda VI, El-Registan GI & Kaprelyants AS (2009) Dormant forms of Mycobacterium smegmatis with distinct morphology. Microbiology 155: 1071–1079.

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Cook KL & Bolster CH (2007) Survival of Campylobacter jejuni and Escherichia coli in groundwater during prolonged starvation at low temperatures. J Appl Microbiol 103: 573–583.

Cunningham E, O'Byrne C & Oliver JD (2009) Effect of weak acids on Listeria monocytogenes survival: evidence for a viable but nonculturable state in response to low pH. Food Control 20: 1141–1144.

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del Mar Lleo M, Benedetti D, Tafi MC, Signoretto C & Canepari P (2007) Inhibition of the resuscitation from the viable but nonculturable state in Enterococcus faecalis. Environ Microbiol 9: 2313–2320.

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CONCLUSION.

Apple and Pear Australia Limited contends that there is an ever increasing body of evidence that confirms that Erwinia amylovora

- **a) can exists in a Viable But Non-Culturable state.**
- **b) can exist in a Viable But Non-Culturable state in the calyx of mature apples, and**
- **c) can be transferred in mature apples,**
- **d) in a Viable But Non-Culturable state can be returned to a culturable state, and**
- **e) in a returned culturable state be transferred to living tissue.**

Oliver (2009) in his paper concluded that:-

> *"Regardless of the role that the VBNC state plays, it is clear that a large number of non-spore-forming bacteria, most notably a large number of human pathogens, are capable of entering this state, maintaining cellular structure and biology and continuing significant gene expression while otherwise nonculturable by 'standard' laboratory methods. That they can exit from this state, and become culturable again, is also undeniable. Finally, it can no longer be questioned that the VBNC state plays a critical role in the survival of important human (and other) pathogens, and possibly in their ability to produce disease.*

Apple and Pear Australia Limited argues that Biosecurity Australia must give due recognition to the existence if Viable But Non-Culturable Erwinia amylovora. As a result Bisecurity Australia must develop appropriate measures for apple exports from New Zealand including:-

- **a) Pre harvest orchard inspection with the elimination of an orchards for the season with an outbreak of Fire Blight, and**

b) **Disease latency infection test on each lot before export to prove freedom from Fire Blight.**

F 3: <u>Insects</u>

"A potential vector for Erwinia amylovora in mature apples: the Mediterranean fruit fly Ceratitis capitata." (Ordax et al, 2009)

"Thus, E. amylovora has been found to contaminate apple fruits, being isolated from the calyces in severely infected orchards [Hale et al., 1987; van der Zwet et al., 1990] and occasionally in immature fruit from some asymptomatic trees [Clark et al.,1993]. Moreover, it has been reported that this pathogen can survive in inoculated apple and pear calyces [Taylor et al., 2002; 2003; Taylor and Hale, 2003; Temple et al., 2007], as well as in apple pedicels [Azegami et al., 2004; Tsukamoto et al., 2005], but in low culturable numbers and only for short periods. More recently, we have demonstrated that E. amylovora adopts the 'viable but not culturable' (VBNC) state in the calyx of inoculated mature apples without showing symptoms, and that the pathogen remains undetectable by isolation but with the ability to resuscitate under favourable conditions [Ordax et al, 2009b]. This indicates that the healthy appearance of the fruit is not an evidence of the pathogen absence, and that mature apples can be a carrier of the pathogen. Therefore, asymptomatic contaminated mature apples could be an unnoticed inoculum source for new fire blight infections by contact with susceptible hosts or vector insects [Taylor et al., 2003]."

"….any insect that visits infected plant material can disseminate the pathogen [Schroth et al., 1974]. Thus, several non-pollinating insects like some flies or aphids have been reported as potential fire blight vectors [Ark and Thomas, 1936; Miller and Schroth, 1972; Bellemann et al., 1994; Hildebrand et al., 2000]."

And

"In spite of the great relevance of medfly for the fruit industry, its role as a vector involved in the E. amylovora transmission has not been studied up to date. Indeed, far as we know, C. capitata has been reported as a plant disease vector only in the case of the fruit-decaying fungus Rhizopus stolonifer [Cayol et al., 1994]."

And

"Due to the high mortality rate of C. capitata observed in presence of intact apples, survival ability of E. amylovora was only checked in disinfected damaged fruits. Our purpose was to establish the best experimental conditions for the viability of both insect and bacterium for the subsequent transmission

assays. Moreover, it has already been proved that the persistence of E. amylovora on fruit skin is very short [Ceroni et al., 2004; Temple et al., 2007]. The bacterium was able to retain their culturability in cuts and small peeled areas on disinfected mature apples at similar inoculums levels during the first 5 days (around 10^7 cfu/ml) regardless the area of the fruit in where the cuts or the peelings were performed. In spite of the high concentration of E. amylovora cells per fruit, the climatic favourable conditions for the pathogen, and the high susceptibility of the variety Royal Gala to fire blight, any kind of symptom was observed, even after a period of 15 days. It is known that mature fruit is not frequently infected by this bacterium [EPPO, 2004]."

And

"This is the first report on E. amylovora transmission by C. capitata under in vitro conditions, and is also the first time that the medfly is shown as a potential vector of a phytopathogenic bacterium. We have demonstrated that significant doses of active E. amylovora cells may be transmitted from contaminated to healthy apples by C. capitata (10^3-10^5 cfu/fruit) even with only 5 medflies and with no development of symptoms.

Pollinating insects, like bees and wasps, are considered as the most important agents for the dissemination of E. amylovora [van der Zwet and Keil, 1979; Thomson, 2000]. However, although these insects can transmit up to 10^3 cfu/pear flower in only 48h, the pathogen could no persist more than this time period on their bodies [Alexandrova et al., 2002]. Interestingly, we have proved that E. amylovora is able to persist in C. capitata for at least 15 days, that is, more than half of the medfly life cycle, and in addition to that, in a range of around 10^4-10^6 cfu/medfly. These data point out the potential of C. capitata as an efficient vector for E. amylovora in comparison with other insects studied [Ark and Thomas, 1936; Bellemann et al., 1994, Hildebrand et al., 2000, Alexandrova et al., 2002]. However, some authors have considered that flies may not frequently transmit fire blight because they neither visit blossoms [Steward and Leonard, 1916; Thomson et al., 1975]. But in contrast, adult fruit flies feed predominantly on ripe and wounded fruits [Hendrichs and Hendrichs, 1990], and their high numbers has been related with the fire blight distribution in infected orchards [Hildebrand et al., 2000]. In the case of C. capitata, its common presence in fruit fields, and the relevant dose of E. amylovora cells that it may carry (at least when the inoculum level is high) could contribute to the pathogen dissemination in nature at short and middle distances. In fact, the potential capacity of C. capitata as a vector of plant and even human diseases has already been proved [Cayol et al., 1994; Sela et al., 2005]. Since in all cases the contaminated fruits were maintained as asymptomatic despite containing a quite relevant concentration of transmitted E. amylovora cells, two potential carriers of fire blight arise from our results, medflies and the mature.

The likelihood of mature apple fruit as a vehicle for dissemination of E. amylovora has been the subject of considerable research and risk assessment proceedings [summarized in Temple et al., 2007]. However, it was concluded that there is no evidence that asymptomatic apple fruit could be a carrier of E. amylovora [WTO, 2003; Temple et al. 2007; Roberts and Sawyer, 2008].

Nevertheless, the controversy on this topic continues in the scientific literature, and some recent studies have proved the possibility of mature apples as carriers of the pathogen under in vitro conditions [Kimura et al., 2005; Txukamoto et al., 2005a; 2005b; Ordax et al., 2009b]. Further, our new results support the idea of mature fruit as a plant material that could be playing some role in the epidemiology of fire blight. Thus, it seems that asymptomatic but contaminated mature fruit can act as an unnoticed dissemination vehicle, at least, in presence of insect vectors and under favourable conditions. This should be considered in future pest risk assessments.

Overall, our findings highlight the high potential of C. capitata to carry E. amylovora and to act as a vector of the fire blight disease, as well as the great survival ability of this plant pathogen to persist in an environment so much different to a plant as it is a fly. This could require the rigorous application of strict protection and sanitation measurements to reach and efficient control for both quarantine organisms, E. amylovora and C. capitata."

CONCLUSION

Apple and Pear Australia Limited argue that Mediterranean Fruit Fly must be treated as a real vector for Fire Blight and that this should alter the potential indirect impact.

F 4: <u>Sanitation</u>

Information supplied by New Zealand

The following is some of the information obtained from the New Zealand Ministry of Agriculture and Forestry (2011):-

Q. *What proportion of packing houses use some form of sanitizer in the dump tank and/or subsequent water baths and sprayers?*

A. Sanitizer use is not required by any of the 65 markets New Zealand apples are exported to and is not a requirement under the industry best practice guidelines or MAF Food Safety requirements. However, one form of sanitizer or another is used by in excess of 80% of the industry; some packing houses, especially those that regularly handle organic fruit, have local authority permission to dump water from the packing line on a regular basis. There is no absolute data available but the 80% of packing houses mentioned will process approximately 90% by volume of the exported fruit processed.

Biosecurity Australia has reported that in fact 99% of the export fruit is treated using sanitation (meeting with Apple and Pear Australia Limited, 8th April 2011) which is in variance with the information supplied above

by an unidentified officer of the New Zealand Ministry of Agriculture and Forestry.

The unidentified officer also indicates that sanitation is not required by some 65 markets to which New Zealand export so is there circumstances when sanitation is not used for those markets and then utilised only for those markets requiring such treatments?

The unidentified officer also indicates that sanitation is not required *"under the industry best practice guidelines or MAF Food Safety requirements".*

The unidentified officer also indicates that *"there is no absolute data available but the 80% of packing houses mentioned will process approximately 90% by volume of the exported fruit processed".*

Given these discrepancies in information Apple and Pear Australia Limited believes that there is uncertainty that all export fruit to would be sanitised. Biosecurity Australia must

a) **Revisit the aspect of sanitation to obtain a clear understanding of what is implement by ALL New Zealand packing facilities, and**
b) **implement a measure which at minimum ensures all fruit destined for Australia is sanitised and that the sanitation process is recorded and signed off by Australia AQIS auditors.**

<u>Additional information from scientific references.</u>

"The incidence of storage rots after Postharvest apple washing" (Scheper et al, 2007).

From this scientific paper the following information has been extracted:-

"It is, therefore, possible that postharvest apple washing increases storage rots in apples. In particular, the concentration of fungi and yeasts in the washing water, may affect storage rots in apples by changing the microflora on the apple surface."

And

"Apples washed in water with a low concentration of fungi and yeasts (treatment B) had very low storage rot incidence and there was no significant difference between the punctured and the uninjured apples. A high incidence of storage rot was observed in apples that were washed in water with a high concentration of fungi and yeasts (treatments C, D and E). In these treatments,

punctured apples had a significantly higher incidence of storage rot than did the uninjured control apples (P<0.01).”

And

“The majority of the fungi that were isolated from apple surfaces were Cladosporium spp. and unidentified mycelia sterilia. Other commonly isolated fungi included Alternaria spp., Penicillium spp., Epicoccum spp., Phomopsis spp., Mucor spp., Phoma spp. and Fusarium spp. The same fungal species were found on apples that had been washed as on those that had remained unwashed. These fungi were also isolated from the washing water.”

And

“Postharvest washing did not alter the incidence of storage rots of uninjured apples, regardless of the concentration of fungal pathogens in the water. In contrast, there was a high correlation between the concentration of fungi in washing water and the subsequent storage rot incidence of punctured apples washed in this water.”

And

“This indicates that rot-causing fungi can be introduced to wounds in fruit during wash treatments and subsequently cause decay.”

And

“Despite the observation that washing significantly reduced the number of fungi on the apple surface, both the incidence of storage rot and the remaining fungal population on the apple surface were larger when punctured apples were washed in water containing high fungal concentrations, than when washed in water containing few fungi.”

Apple and Pear Australia Limited would seek clarification from Biosecurity Australia as to whether they have investigated the “*unidentified mycelia sterilia*” referred to by the scientists undertaking this work.

Apple and Pear Australia Limited would seek clarification from Biosecurity Australia as to

g) how they will ensure that ALL wash water ALL of the time will be free of fungal pathogens, and

h) what tests will be undertaken on wash water, and

i) how regularly will they be taken, and

j) how the results will be recorded, and

k) who will audit those results, and

l) how will non conformance be dealt with?

Given that there is *"a high correlation between the concentration of fungi in washing water and the subsequent storage rot incidence of punctured apples washed in this water" and "this indicates that rot-causing fungi can be introduced to wounds in fruit during wash treatments and subsequently cause decay"* **how will Biosecurity Australia guarantee no punctured fruit carrying rot-causing fungi will not reach Australia in export packs?**

If punctured fruit is found on inspection what action will be taken by AQIS and Biosecurity Australia?

F 5: POLLINATION:

Biosecurity Australia report within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" that

> *"Most orchards, if not all, grow a number of different varieties of apples and may have multiple plantings of a particular variety in different areas within the orchard. Within an orchard, each continuous planting of a single variety of apple is defined as an orchard block or variety block."*

Can Biosecurity Australia confirm that "each continuous planting of a single variety of apple" is the case within each orchard block or variety block?

Can Biosecurity Australia confirm if within "each continuous planting of a single variety of apple" there are pollinators? If so are those pollinator's different varieties of apples? Is it possible these pollinators could be more susceptible to diseases like Fire Blight and that they could harbour these diseases?

F 6: <u>WESTERN AUSTRALIA/CODLING MOTH/MEALYBUG.</u>

Beresford and Kim in their report to the World Trade Organisation titled "An analysis of climatic requirements for establishment of European Canker" report that

> "As Western Australia is not being considered for importation of New Zealand apples, the highest risk of European canker development there is only of academic interest".

Can Biosecurity Australia confirm that this is their understanding of the situation?

ADDITIONAL PESTS FOR WESTERN AUSTRALIA:

Mealybugs

Biosecurity Australia have recommended the following management for mealybugs

Option 1: *Withdrawl of export lots found to be infested with mealybugs*

Option 2: *Methyl bromide fumigation of export lots found to be infested with mealybugs*

Codling Moth:

Biosecurity Australia made the following statement in relation to Codling moth

> "The 2006 final IRA report recommended three alternate measures for codling moth: sourcing fruit from pest free areas, pest free places of production or pest free production sites; sourcing fruit from areas of low pest prevalence; or methyl bromide fumigation. Visual inspection was not assessed as an effective measure due to the potential for infestations to be undetectable by visual means"

Biosecurity Australia has recommended the following management for Codling Moth.

Option 1: *Area freedom*
Option 2: *Areas of low pest prevalence*
Option 3: *Methyl bromide fumigation*

Biosecurity Australia then concludes that:-

> "The objective of these measures is to reduce the likelihood of importation for codling moth to at least "very low" . The restricted risk would then be reduced to at least "very low" , which would achieve Australia's ALOP."

CONCLUSION:

Apple and Pear Australia Limited agrees that the measures are acceptable for Mealybug and Codling moth BUT finds it totally unacceptable that these same or similar measures are not used for more destructive pests like Fire Blight, European Canker and Apple Leaf Curling Midge.

F 7: ECONOMIC IMPACT AT NATIONAL, REGIONAL AND LOCAL

In the document titled "*Estimating the Social Welfare Effects of New Zealand Apple Import"* (Cook et al 2009) consideration of the economic welfare consequence for Australia allowing quarantine-restricted trade in New Zealand apples.

"Using the theoretical framework developed in Cook and Fraser (2008) an empirical estimation is made of the economic welfare consequences for Australia of allowing quarantine-restricted trade in New Zealand apples to take place. The results suggest the returns to Australian society from importing New Zealand apples are likely to be negative. The price differential between the landed product with SPS measures in place and the autarkic price is insufficient to outweigh the increase in expected damage resulting from increased fire blight risk. As a consequence, this empirical analysis does not support the opening up of this trade."

And

"The likelihood of fire blight establishment in Australia has recently been shown to be very high using self organising map (SOM) analysis, which is a type of artificial neural network. This technique uses worldwide species associations to determine which species have the highest likelihood of establishing (Worner and Gevrey, 2006). A SOM analysis was performed on the worldwide distribution of 131 bacterial pathogens (CABI/EPPO, 2003), of which 71 are currently absent from Australia. The analysis ranked fire blight 17th in this list (Paini et al., in press)"

Table 1. The Gains from Trade Resulting from Apple Imports from New Zealand

	5% Confidence Interval	Mean	95% Confidence Interval
Change in Consumer Surplus (ΔCS)	\$43,775,310	\$46,343,070	\$48,947,360
Change in Producer Surplus (ΔPS)	-\$30,073,040	-\$30,731,670	-\$31,373,100
Gains from Trade (GT)	\$13,702,270	\$15,611,400	\$17,574,260

"If uncontrolled, fire blight will continue to spread to the point where it becomes naturalised. Naturalisation is complete when a species spreads to its full capacity within an environment, such that descendents of the original specimens introduced into that environment become permanent, non-spreading members of the flora/fauna (Mack, 1996; Mack and Lonsdale, 2001)."

And

"The model simulates two types of economic costs attributable to fire blight incursions over time. Firstly, revenue losses are comprised of direct losses of marketable product despite control and eradication efforts. This effect may be

as high as 100 per cent in some cases, while in others it may be negligible. Secondly, management costs are determined from necessary control activities."

And

"The importance of potential economic costs of non-market (e.g. impact on native biota) and indirect market (e.g. impacts on fertilizer sale after a major industry is devastated by an invader) impacts is acknowledged. However, it is difficult to incorporate these costs due to high level of uncertainty. Our model only captures impacts on market goods."

And

"The total invasion costs over a 30-year period were calculated for both the quarantine restricted trade and Autarchic trade, and then the difference between them taken to give the change in expected impact."

Table 3. Expected damage per year from fire blight incursions

	5% Confidence Interval	Mean	95% Confidence Interval
Expected Impact Under Autarchy (EI_A)	$33,195,360	$51,389,040	$73,048,980
Expected Impact Under Quarantine-Restricted Trade (EI_Q)	$49,986,540	$70,230,220	$95,792,360
Change in Expected Impact (EI^*)	$16,791,180	$18,841,180	$22,743,380

"It is apparent that the increase in expected losses from fire blight incursions resulting from contaminated NZ apple imports will be negligible until year 15, after which they increase dramatically. This lag period is attributable to the SPS measures imposed on apple imports being relatively effective. Under the SPS-restricted trade scenario the model predicts an incursion event will occur approximately two years earlier than under an autarchy situation. However, despite the difference in expected impact occurring well into the future (and hence being subject to the erosive effects of an 8 per cent discount rate), the damage caused is on a very large scale."

And

"This paper has provided a demonstration of how a comprehensive economic framework, which takes into account both the gains from trade and the costs of

invasive species outbreaks, can inform decision-makers when making quarantine decisions. In particular, this paper has utilised the framework developed in Cook and Fraser (2008) to make an empirical estimation of the economic welfare consequences for Australia of allowing quarantine-restricted trade in New Zealand apples to take place."

CONCLUSION:

Apple and Pear Australia Limited argues that the economic impact at National, Regional and Local levels need to be adjusted to a high classification based on the known costs of eradication of the alleged Fire Blight outbreak (1997), Citrus Canker and Myrtle Rust.

F 8: EQUIVALENCE:

Apple and Pear Australia Limited seeks clarification from Biosecurity Australia as to why 'equivalence' in relation to specific measures has not been utilised and detailed within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand".

Examples of measures utilised by New Zealand and Australia are detailed below and these should have been used as 'minimum measures'. The concept of equivalence is an accepted by the World Trade Organisation within their SPS Agreement.

New Zealand/Japan:

- Plant shall be the fresh fruits of apples produced in those areas in New Zealand designated by the Plant Quarantine Authorities of New Zealand as areas where intensive pests control is enforced against Codling moth.
- The fresh fruits are not infested with Codling moths and Fire blight.
- The fresh fruits shall be disinfested against Codling moth at fumigation facilities using methyl bromide and thereafter shall be disinfested at cold treatment facilities at the innermost fresh fruit pulp temperature of 2.0 degrees Centigrade or below for 25 days.
- Confirmation of correct application of inspection in Article 3(1) and disinfestation in Article 4 shall be made by the Plant Protection Officer [of Japan].
- The fresh fruits shall be packed in materials that are deemed to not allow entry by Codling moth.
- Packing in (1) shall take place at a packing site which is deemed to not allow entry by Codling moth.

New Zealand/Taiwan:

- Implement a Phytosanitary Compliance Program for

  - Growers
  - Packers
  - Cool rooms
  - Exporters
- 3 module integrated systems' approach implemented
- Registered growers to apply to register production sites by 8th September each year
- Previous season phytosanitary inspection records determine risk status of the production site
- Growers to attend a PNZI coordinated pre-season workshop on the program
- Traps in orchard with weekly verification checks
- Compliance monitoring of registered growers at least twice during the season, 10% of sites operating in March will have a third audit.
- Production sites to be minimum of 1 hectare and trapped and managed for Quarantine pests including Codling Moth in its entirety (Taiwan and non-Taiwan varieties)
- Apples to be harvested & packed as separate lines
- If Quarantine pests including Codling Moth are found during harvest/packing (irrelevant of market packed for) only affected Taiwan production site will be removed from the program.
- Institute a compulsory codling moth pest management program
- Inspection for the presence of codling moth and other quarantine pest is a minimum of 1200 apples from every 300 Tray Carton Equivalents
- Reject the grower line from export when a live codling moth larva is found in fruit from Taiwan registered varieties and Taiwan registered production sites
- Reject a consignment for export to Taiwan when the acceptance level for quarantine pests is exceeded in the lot
- Specific guidelines to define a production site
- Must be produced and inspected in accordance with a system equivalent to the requirements of "Taiwan's Codling Moth Regulations".
- Apples are thoroughly inspected and found free from *Erwinia amylovora*"
- The unique Biosecurity New Zealand packhouse alpha/numerical identifier which has been assigned to the specific facility which packed the export consignment is to be inserted in place of the XX.
- If fruit within the consignment has been packed at multiple packhouses, ensure ALL packhouse identifiers are stated within this additional declaration
- MAFBNZ approved production sites RPINs are inserted on packaging
- For all consignments Phytosanitary inspection dates must be inserted.
- For all commodities exported to Taiwan requiring MAF phytosanitary certification the following Maximum Pest Limit levels requirements for specified quarantine pests must be
    - Quarantine pests specified by Taiwan - 0.5%
    - Codling Moth the MPL is NIL

Australia/China:

The following conditions, or equivalent measures, are required for importation of fruit of ya pear from China.

- registration of export orchards
- pest surveillance and management programs in the production areas
- inspection at blossoming (petal tests)
- bagging of fruit
- fruit fly monitoring
- area freedom from specified pests and diseases
- audit of available disease survey data
- pre-harvest visit by Australian plant pathologist
- disease latency infection tests
- pre-harvest inspection of orchards and packing houses by AQIS inspection
- pre-clearance inspection jointly by SAIQ and AQIS
- phytosanitary certification jointly by SAIQ and AQIS
- verification of certification of consignment in Australia

Fruit will not be permitted into Western Australia as apples and pears from any source are currently prohibited entry under WA State legislation. However, there will be no restrictions imposed by AQIS on other ports of entry.

To address the issues raised by the lack of complete survey data and possible latent infection on fruit AQIS has altered several conditions which were referred to in the risk analysis. The principal changes are:

- pre-harvest visit by Australian plant pathologist in the first year of trade
- disease latency infection tests
- pre-clearance inspection jointly by SAIQ and AQIS
- removal of requirement for on-arrival inspection of fruit

The revised phytosanitary requirements for the importation of ya pear fruit are given in Section 6-Phytosanitary Requirements.

CONCLUSION:

Apple and Pear Australia Limited has detailed a number of examples of protocols/measures that have been implemented by New Zealand and/or Australia which represent appropriate 'equivalence' measures.

Apple and Pear Australia Limited contends that Biosecurity Australia has failed in its 'duty of care' in not considering and/or utilising some of the appropriate 'equivalent' measures.

SECTION G: PROCEDURAL FAIRNESS

Apple and Pear Australia Limited and other stake holders have been prejudiced by their inability to access critical information that Biosecurity Australia has used in its risk analysis.

Stake holders at the outset were informed that this analysis would be undertaken to the same standards as an import risk assessment. Those standards included transparency and a public file.

Apple and Pear Australia Limited has been advised there is no public file and as such have been put in the position of having to second guess Biosecurity Australia. We have no way of testing or making informed comment on the information that Biosecurity Australia used in making its decision.

The inability of stake holders to access the New Zealand Integrated Fruit Production/ Pest Management Manual has precluded Apple and Pear Australia Limited from making fully informed comments and providing advice on the most critical component of Biosecurity Australia's assessment. As this manual and it's purported efficacy relates to the technical side of fruit growing, Apple and Pear Australia Limited believes it is in a better position than Biosecurity Australia to test and comment on the manual's ability to achieve the outcomes found by Biosecurity Australia.

Biosecurity Australia's insistence that the New Zealand manual is confidential is unsustainable. The 2011 Review was conducted according to the standards of an IRA. Those standards include the provision, by an import proponent, of information on its production and processing methods.[22] Biosecurity Australia was entitled to refuse to conduct a further review if complete information on New Zealand's production and processing methods were not provided to it.

The provision of the New Zealand manual to Biosecurity Australia could not have been on the basis that Biosecurity Australia would keep it confidential. Once again the standards that apply to an IRA apply:

> *"If a submission is used in Biosecurity Australia's decision making process, Biosecurity Australia cannot guarantee its confidentiality."*[23]

Biosecurity Australia purports to put the New Zealand manual at the centre of its decision making processes. That being the case, Biosecurity Australia cannot, and has not, provided any guarantee as to its confidentiality.

[22] IRA Handbook annex 7 page 39.

[23] IRA Handbook annex 9 page 42.

The document has been provided to Biosecurity Australia by one or more New Zealand parties in the face of the express statement that *Biosecurity Australia cannot guarantee its confidentiality*. It can, and should, have been published by Biosecurity Australia for assessment by the Australian industry.

Had Biosecurity Australia informed stakeholders in December 2010 that there would be no public file, Apple and Pear Australia Ltd would have requested access to the New Zealand manual, at that time, under both Australian and New Zealand Freedom of Information laws. There would thereby have been the prospect of the document being available to Australian industry before we were called on to respond to the Draft Report. It was Biosecurity Australia's misleading statement that it would conduct the 2011 Review to the standards of an IRA, when it did not propose to maintain a public file that has disadvantaged the Australian industry.

EXAMPLES OF WHERE INFORMATION HAS BEEN DENIED AND/OR DELAYED.

Integrated Fruit Production.

Biosecurity Australia indicated in a verbal presentation and within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand that 100% of export fruit from New Zealand is produced utilising the New Zealand Pipfruit Integrated Fruit Production system Within the Draft Report there is constant reference to the document.

Apple and Pear Australia Limited has sought access to this document through a formal request to Biosecurity Australia but the request has been denied based on instruction from New Zealand Pipfruit that this is a ' commercial and in-confidence' document.

Apple and Pear Australia Limited was under the impression that this document had been cited by Biosecurity Australia.

In a recent response from Senator Ludwig, Minister for Agriculture, Fisheries and Forestry it has been reported that

> "*A full copy of the integrated fruit manual has not been provided to Australia by the New Zealand authorities. The relevant extracts of the Integrated Fruit Production manual as cited in the 'Draft report for the non-regulated analysis of existing policy for apples from New Zealand' (draft report) of 4 May 2011are enclosed."*

If in fact Biosecurity Australia has not cited and reviewed the FULL New Zealand Pipfruit Integrated Fruit Production Manual how can they justify the conclusions

reached within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand".

This aspect is even more concerning when the response from an unidentified representative of the New Zealand Ministry of Agriculture and Forestry says:-

Q. *IFP – The pest specific extracts from the IFP are all dated 2008. Is this the current version? Is there a statement in the preface to the current version of the manual that states that the recommendations are regularly updated as new information on pests and import requirements becomes available?*

A. The 2008 date is correct for the pest specific extracts.

The IFP manual is a production guide. It is updated as and when research or information becomes available and updates of components are issued to the industry as required. There is no statement in the *Preface* that this happens but it is evidenced by different sections of the IFP manual having different dates. The Contents pages are updated as and when there are amendments or changed to the IFP manual and issued along with the amendments.

Market specific requirements are only included if there are specific changes to the production systems that require specific guidelines. Market specific requirements are usually addressed by market specific work plans with MAF and are additional to the IFP manual which is a series of generic production guidelines.

Biosecurity Australia has contended that the standard orchard practices based on the Integrated Fruit Production Manual are both 'new' and 'innovative'. Reality is that the IFP Manual was developed in 1996. The document made available to Biosecurity Australia is a 2008 version.

More importantly New Zealand MAF describe the manual as 'a production manual' and a series of 'generic production guidelines'.

<u>Information supplied to Apple and Pear Australia Limited by Biosecurity Australia.</u>

In the information supplied to Biosecurity Australia by the New Zealand Ministry of Agriculture and Forestry on the 8th April 2011 industry has been denied access.

a) The name of the resource in the New Zealand Ministry of Agriculture and Forestry has been blocked out by Biosecurity Australia.

b) Q. Rootstock use – Is there any industry information on the relative adoption of rootstocks? Which are the most prevalent?

A. Rootstock use is dependent on soil type, scion selection and planting system use.

This rest of the section was blocked out denying industry the information to assess.

FACT SHEETS:

The 2008 Integrated Fruit Production Fact Sheets on Fire Blight, European Canker and Apple Leaf Curling Midge were only made available to Apple and Pear Australia Limited on Friday 1st July 2011 and only as a result of a standing order of the Australian Senate.

EXAMPLES OF WHERE INFORMATION HAS BEEN ALTERED WITHOUT NOTIFICATION.

European Canker

Throughout the whole process since 1999 European Canker has been referred to *Neonectria galligena.* All of the research documents and the World Trade Organisation documents use that terminology.

Within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" Biosecurity Australia has moved to referring to European Canker as *Neonectria ditissima*.

The European Canker fact sheet from the New Zealand Pipfruit IFP Manual refers to European Canker as *Neonectria galligena.*

Neonectria ditissima is described in the literature as Beech canker.

Why has Biosecurity Australia altered the terminology?

Why did Biosecurity Australia not inform stakeholders of this change?

Conclusion:

In a recent response from Senator Ludwig, Minister for Agriculture, Fisheries and Forestry it has been reported that

> ***"A full copy of the integrated fruit manual has not been provided to Australia by the New Zealand authorities. The relevant extracts of the Integrated Fruit Production manual as cited in the 'Draft report for the non-regulated analysis of existing policy for apples from New Zealand' (draft report) of 4 May 2011are enclosed."***

As Apple and Pear Australia Limited has no reason to doubt the accuracy of this statement it concludes that Biosecurity Australia has not in fact been supplied and/or cited a FULL copy of the New Zealand Pipfruit Integrated Fruit

Production Manual and has only been given access to three pest/disease fact sheets

If this in fact the case Biosecurity Australia has

- **a)** **given misleading information to stakeholders, and**
- **b)** **failed in their 'duty of care' in preparing the Draft Report.**

SECTION H: TIMEFRAME FOR DIRECTOR MAKING A FINAL DECISION

Apple and Pear Australia Limited is very concerned with the time frame for the Director of Quarantine's decision on revised measures taken.
Apple and Pear Australia Limited have been informed that the timetable for the Director making his decision is August 17th 2011.

Biosecurity Australia cannot commence any analysis until the majority of submissions are received.

Therefore from the 5th of July the following process has to be completed.

- Biosecurity Australia to review submissions.
- Then Biosecurity Australia needs to identify relevant issues raised by stake holders and assess if they should be taken into account in the analysis.
- Biosecurity Australia to revise or otherwise its analysis and complete a final risk analysis.
- Biosecurity Australia to complete document and present to Director.
- Director to consider relevance of issues that stake holders have identified as shortcomings in Biosecurity Australia's analysis.
- Director to make his final decision

The time given to undertake this complex process is 43 days or 31 days if the people involved do not work weekends. This assumes that there are no other distractions for the people involved.

By any reasonable standard, to make the decision that the process will be completed in the timeframe decided does not give stake holders any confidence that their views will be adequately considered, or they were considered at the outset to be irrelevant.

SECTION I: SCIENTIFIC PAPERS NOT CONSIDERED BY BIOSECURITY AUSTRALIA.

The following are scientific papers not considered by Biosecurity Australia that have relevance to the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand”:-

Alexandrova, M., Cimini, B., Bazzi, C., Carpana, E., Massi, S., and Sabatini, A.G. (2002) The role of honeybees in spreading *Erwinia amylovora*. Acta Horticulturae 590: 55-60.

Biosca, E.G., Santander, R.D., Ordax, M., Marco-Noales, E. and López, M.M. 2008. *Erwinia amylovora* survives in natural water. Acta Hort. 793:83-87.

Biosca, E.G., Santander, R.D., Ordax, M., Marco-Noales, E., Águila, B., Flores, A. and López, M.M. 2009. Survival of *Erwinia amylovora* in rain water at low temperatures. p.88-91. In: A. Méndez-Vilas (ed.), Current Research Topics in Applied Microbiology and Microbial Biotechnology. World Scientific Publishing Co. Pte. Ltd., Singapore.

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CONCLUSION:

Apple and Pear Australia Limited contends that there is a body of evidence in both a general sense and also related to Viable But Non-Culturable that Biosecurity Australia has failed to consider (as detailed within the relevant parts of this submission).

Biosecurity Australia has justified the decisions of the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" on the citing of 'new science' but it is obvious that not all new and available science has been considered.

Apple and Pear Australia Limited assumes that this material has been not cited because Biosecurity Australia has not been aware of the scientific papers and not because Biosecurity Australia has pre-determined the result.

APPENDIX A: NEW REFERENCES WITHIN THE DRAFT REPORT: DATED 2007 THROUGH TO 2011

Given that Department of Agriculture, Fisheries and Forestry handed down their final report in 2006 it was felt that any reference within the current draft document date 2007 to 2011 would be considered as new information. Apple and Pear Australia Limited have sourced all the references within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand" during that period have now collated all of those as new references.

All those references are listed below.

Apple and Pear Australia have categorised each of them in the following way:-

- ***General information with no new science.***
- ***New scientific reference for review.***
- ***Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science.***
- ***Expert comment in the proceedings of the Panel's meeting with the experts: Australia – measures affecting the importation of apples from New Zealand. World Trade Organization WT/DS367/12 but no new science.***

Those classified as 'new scientific reference for review' have been extracted and place in Appendix B and the appropriate scientific papers reviewed and the comments are detailed within the body of this submission.

Apple and Pear Australia Limited has not specifically commented on each and every one of the new references in the Draft

FIRE BLIGHT

Existing Policy - International policy

Import policy also exists for apples from China (**BA 2010)**

General information with no new science.

Method for pest risk analysis

A PRA is "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‟ **(FAO 2009).**

General information with no new science.

A pest is “any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products‟ **(FAO 2009).**

General information with no new science.

A phytosanitary measure is “any legislation, regulation or official procedure having the purpose to prevent the introduction and spread of quarantine pests, or to limit the economic impact of regulated nonquarantine pests‟ **(FAO 2009).**

General information with no new science.

Stage 2: Pest Risk assessment

A pest risk assessment (for quarantine pests) is: “the evaluation of the probability of the introduction and spread of a pest and of the likelihood of associated potential economic consequences‟ **(FAO 2009).**

General information with no new science.

Assessment of potential consequences

The requirements for assessing potential consequences are given in Article 5.3 of the SPS Agreement (WTO 1995), **ISPM 5 (FAO 2009**) and ISPM 11 (FAO 2004).

General information with no new science.

Cultivars

In 2010 there was 9 061 hectares of apple and pear production in New Zealand, with 60 per cent of this in the Hawke’s Bay district and 28 per cent in the Nelson district **(Pipfruit NZ 2010).**

General information with no new science.

While a range of apple varieties are available in New Zealand, the varieties with the greatest planted area in 2010 were Royal Gala (27 per cent), Braeburn (21 per cent), Jazz™ (11 per cent), and Fuji (11 per cent). Other varieties include Cox, Cripps Pink (Pink Lady), Granny Smith, Pacific Beauty™, Pacific Queen™, and Pacific Rose™ **(Pipfruit NZ 2010).**

General information with no new science.

Cultivation practices

While a range of rootstocks are available, the New Zealand industry indicated that the M9 variety is most commonly used for new plantings **(BSG 2011).**

General information with no new science.

Orchard irrigation is most commonly delivered by drip irrigation **(BSG 2011).**

General information with no new science.

Use of overhead irrigation in other regions is avoided due to the potential to result in problems with apple scab (caused by *Venturia inaequalis*) early in the season **(MAFNZ 2011)**

General information with no new science.

According to the **Pipfruit Industry Statistical Annual the 2009** export production was 302 075 tonnes from 8 484 hectares, or an export yield of around 35 tonnes per hectare across all varieties of apples.

General information with no new science.

In addition to this there was an export yield of 5 421 tonnes of pears from 412 hectares **(Pipfruit NZ 2010)**.

General information with no new science.

The World Apple and Pear Association reported a total 2009 New Zealand production of 466 000 tonnes (**WAPA 2010),** or around 54 tonnes per hectare.

General information with no new science.

However, these figures are inferred values from export volumes and average pack-out **(MAFNZ 2011).**

General information with no new science.

Significantly higher yields are reported in a number of the orchards visited in March 2011, with yields of 75–100 tonnes per hectare expected from recently established orchards **(BSG 2011)**.

General information with no new science.

Pest Management

The IFP program has been further developed with the Apple Futures program **(Pipfruit NZ 2008a)** with an emphasis on managing chemical residues to the lowest levels possible.

General information with no new science.

In 2010, 87 per cent of total planted area was managed under IFP (including Apple Futures), 11 per cent as organic; while only 2 per cent of the total planted area produced solely for the domestic market **(Pipfruit NZ 2010).**

General information with no new science.

Fire Blight Management

According to orchard managers streptomycin use is limited due to chemical residue restrictions imposed by markets such as Europe **(BSG 2011).**

Data from the 2009–10 season indicates that of all registered apple production blocks in New Zealand, 3.3 per cent received at least one streptomycin spray and 5.0 per cent received at least one Blossom Bless spray.

During a **verification visit in March 2011**, officials from the Biosecurity Services Group had the opportunity to discuss the recommendations of the Pipfruit IFP program with orchard owners, orchard managers, and pest control consultants in both the Hawke's Bay and Nelson districts.

Some orchard managers stated their experience that immediate pruning of "shepherd's crooks‟ was not necessary in their orchards where the incidence of symptomatic tissue was extremely low **(BSG 2011).**

European Canker

During site visits in March 2011, orchard managers in the Nelson region reported that European canker was known from the region, but uncommon in orchards.

Apple Leaf Curling Midge

During the March 2011 visit, orchard managers explained that apple leaf curling midge is not an issue in mature trees as they don't produce the required fresh growth for apple leaf curling midge throughout the season.

Harvesting and handling procedures

The apple harvest season in New Zealand can commence from early February with varieties like Pacific Beauty™ and Royal Gala. The season extends until mid-late April with varieties like Cripps Pink (Pink Lady), Braeburn, and Fuji **(Pipfruit NZ 2008c).**

General information with no new science.

Prior to harvest, maturity is monitored by sampling twenty fruit per variety per block from the orchard and subjecting them to a series of tests: starch pattern index; background and foreground colour; fruit penetrometer; and soluble sugars (brix). The results of these laboratory tests indicate that fruit is either ready for harvest, or recommended to be re-tested after a nominated period of time **(BSG 2011).**

Packing House

During the March 2011 verification visit, it was observed that each apple was subject to the high pressure spray for between 30 and 60 seconds whilst being continually turned due to the counter rotating rollers.

Bulk bins are utilised where receiving markets specifically prefer to re-pack on arrival, with packing into small “clamshells” each with six fruit being an example of such packaging **(BSG 2011).**

For the 2009–10 season, only 0.19 per cent of fruit was exported in bulk bins, and only to the UK and France **(MAFNZ 2011).**

General information with no new science.

Storage

Apples stored for extended period of time are reinspected and/or tested for flesh firmness, sugar levels and any evidence of post-harvest degradation to ensure that the fruit still meets phytosanitary standards of the importing country and the quality standards expected by the importer **(MAFNZ 2011).**

Production and export statistics

In the 2009 season, New Zealand is reported to have a total apple production of 466 000 tonnes **(WAPA 2010).**

General information with no new science.

Of this, the Pipfruit Industry Statistical Annual 2009 reported a 2009 export apple production of 302 705 tonnes, an approximately 16 per cent increase over the 2008 season **(Pipfruit NZ 2010).**

General information with no new science.

New Zealand apple producers are heavily export focussed. Important markets include the United Kingdom, the United States of America, the Netherlands, Belgium, Taiwan, and Hong Kong. Each of those markets imported over 10,000 tonnes of New Zealand apples in 2009 **(Pipfruit NZ 2010).**

General information with no new science.

Table 3.1: Export volume and percentages of each variety of fruit for exports from New Zealand's three main apple production regions **(Pipfruit NZ 2010)**

General information with no new science.

Export season

New Zealand's primary export markets are in the Northern Hemisphere and include the United States of America, the Netherlands, Belgium, Germany, Taiwan, Hong Kong, Thailand, and the United Arab Emirates **(Pipfruit NZ 2010).**

General information with no new science.

Apple exports begin almost immediately with the first harvest of apples in February and continue in significant volumes until around July **(MAFNZ 2011).**

While most exports to the Australian market would likely occur between late February and late August, it is possible that New Zealand apples could arrive in Australia all year round. However, it is understood that the majority of large cool store facilities in New Zealand do not operate all year round, with most produce having been exported prior to the southern hemisphere's spring **(BSG 2011).**

Probability of entry

Probability of importation.

The disease {Fire Blight} is more common in regions on the North Island (particularly Hawke's Bay, where 66 % of export fruit is produced **(Pipfruit NZ 2010),** than it is in the cooler areas on the South Island.

Japan has a significant pome fruit industry **(Apple University 2010)** and as a result of negotiations since the Japan-USA apple dispute at the WTO, New Zealand now has access to the Japan market without specific risk management measures for fire blight **(Japan Apple Regulations 2007).**

Since the adoption of the IFP program, symptoms of fire blight have become less common and growers do not consider it to be an important disease limiting production **(BSG 2011).**

The number of blocks in New Zealand that applied sprays (streptomycin or Blossom Bless) to control fire blight infection of blossoms was 9.4%, 10.7%, 11.7% and 8.3% in the seasons of 2006/07, 2007/08, 2008/09 and 2009/10 respectively **(BSG 2011).**

These figures include blocks that sprayed both streptomycin and Blossom Bless and therefore include some double counting **(MAFNZ 2011).**

The incidence of fire blight from year to year mainly depends on spring seasonal conditions **(APPS 2009).**

Since 1997, before the start of the IFP program, to 2009, productivity (tonnes/ha) of export quality apple varieties has increased on average by 80% **(Wilton 2010)**

General information with no new science.

Even for newer varieties, such as Jazz™, that have an extended flowering period and are considered more susceptible to fire blight **(BSG 2011),** productivity has more than doubled from 2005 to 2009 **(Wilton 2010).**

Association of the pest with the commodity pathway-calyx infestation

Erwinia amylovora predominantly colonise flowers (Thomson, 1986; Thomson, 2000) and only relatively low bacterial numbers have been recorded on dried remnant flower parts subsumed into the calyx sinus of mature fruit (Hale *et al.* 1987; Sholberg *et al.* 1988; **Temple *et al.* 2007**).

New scientific reference for review

Fruit enters export packing houses once compliance with the IFP program spray recommendations has been confirmed following examination of the growers spray diary by auditing organisations independent of the industry **(MAFNZ 2011).**

A later publication revised this estimate down based on new evidence and clarification or correction of previously misinterpreted data present in the literature **(Roberts and Sawyer 2008).**

New scientific reference for review

This later work now reports no *E. amylovora* were detected in apple fruit from orchards without fire blight symptoms and 1.3% of apple fruit are infested from orchards with fire blight symptoms. Many apple fruit samples from orchards with symptoms detected no *E. amylovora* **(Roberts and Sawyer 2008).**

New scientific reference for review

More recently, **Ordax *et al.* (2010b)** reported no *E. amylovora* could be detected from 100 apples immediately after harvest from a severely infected fire blight orchard. Sensitive detection methods were employed that could detect < 1 cfu/ml of calyx extract and would have detected live or dead bacteria including those in a viable but non-culturable (VBNC) state.

New scientific reference for review

In the USA, numbers of bacteria on blossoms of apple and pear inoculated with *E. amylovora* bacteria decline to very low levels in the calyx of the subsequent mature fruit. In apples, no fire blight could be detected at harvest **(Temple *et al.* 2007).**

New scientific reference for review

In a sample of commercial pear orchards, where disease incidence is typically higher than on apples (Agrios 1997; Paulin 2010a), of the orchards sampled, 27% had fire blight symptoms and only 1 fruit of 5600 sampled at harvest had *E. amylovora* with 32 cfu detected **(Temple *et al.* 2007).**

New scientific reference for review

Association of the pest with the commodity pathway – infection

However, the inoculation experiments of Tsukamoto *et al.* (2005) and Azegami *et al.*(2004; 2006) that report fruit infection were criticised because of their highly artificial nature and they do not support fruit infection under field conditions **(Paulin 2010a).** There is not sufficient information to support infection of mature apple fruit **(Deckers 2010).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Tests conducted to examine the presence of bacteria within ovules and seeds of a range of plant species identified *E. amylovora* as one of the bacterial species (Mundt and Hinkle 1976). The authors have not linked the different species of bacteria obtained to the different plant species tested, but apple and crab-apple were the only Rosaceae species tested and it is possible that the detection of *E. amylovora* is from the seeds of these species. The tested seeds were surface-sterilised, indicating that the bacterium was present inside the seed. However, this work has been criticised as the methods employed do not confirm the presence of *E. amylovora (***Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

A recent review of the evidence supports the view that *E. amylovora* can occur in xylem vessels **(Billing 2011).** It is further stated that *E. amylovora* can multiply in the xylem and may survive latently for many years, expressing symptoms once the xylem vessel is damaged and bacteria are released into the parenchyma **(Billing 2011).**

New scientific reference for review

It is considered there are no reports of true infection in mature apples under natural conditions as they are resistant to infection **(Paulin 2010a).** Even if fruit are artificially inoculated, they do not develop symptoms of fire blight because the bacteria do not readily multiply in the mature fruit due to an absence of the required carbohydrate source **(Deckers 2010; Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Ability of the pest to survive adverse conditions – viable but non-culturable state

A recent study has confirmed that *E. amylovora* can enter a VBNC state in the calyx of apple fruit in response to copper and then infect receptive host tissue after periods of 7–28 days post calyx inoculation under favourable laboratory conditions **(Ordax *et al.* 2009).** The level of infection recorded in this experiment was low and the culturing of *E. amylovora* from infected tissue was several orders of magnitude lower than bacteria that had not entered the VBNC state.

New scientific reference for review

For VBNC to be a risk pathway, bacteria would need to enter the VBNC state in the orchard and would need to resuscitate before, or during, an infection event in Australia for infection to occur. Copper is known to induce the VBNC state in the laboratory, but it is not generally applied at flowering because of plant phytotoxicity **(APPS 2009)** and there is still no evidence to confirm resuscitation can occur under natural conditions **(Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Ability of the pest to survive adverse conditions–Exopolysaccharides and biofilms

Bacteria that may be superficially attached to fruit leaving the dump tank would be washed off by the high-volume high-pressure water wash systems installed in all New Zealand export packing houses **(MAFNZ 2011).**

Under laboratory conditions, the EPS of *E. amylovora* (amylovoran and levan) can be used as carbon sources by the bacteria during periods of starvation **(Ordax *et al.* 2010a).** The utilisation of EPS may assist in the survival of *E. amylovora* during periods of starvation and this factor would be taken into account during the many studies of *E. amylovora* survival in the calyx.

New scientific reference for review

More recently it has been shown that EPS contributes to the formation of biofilms and plays an important role in the pathogenesis and disease development of *E. amylovora* in plants (Koczan *et al.* 2009; **Lee *et al.* 2010**).

New scientific reference for review

Ability of the pest to survive epiphytically

Later, the work by Temple and colleagues were published as a full text article that comprehensively described the experimental methods. Under field conditions, immature pear or apple fruit on the tree were artificially covered by an inoculum suspension with 10^7 cfu per ml, or calyces infested with inoculum from ooze (10^8–10^9 cfu) **(Temple *et al.* 2007).** Populations of *E. amylovora* declined by an order of magnitude every three to four days in the first two weeks after inoculation. From a starting population of 1.6 x 10^7 cfu, by day 56, only one pear fruit of 450 tested positive and had only four cfu **(Temple *et al.* 2007).** This study confirmed the poor survival and rapid decline of *E. amylovora* bacteria, even from very high levels, on the surface of fruit.

New scientific reference for review

It is considered epiphytic bacteria outside the calyx are very unlikely to contribute to the importation of *E. amylovora* into Australia **(Paulin 2010a; Deckers 2010).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Ability of the pest to survive packing, transport and storage conditions.

In 2005, only 53% of pack houses used disinfectants. In 2011, 99% of export fruit produced under the IFP program are disinfected **(MAFNZ 2011).**

For fruit produced under organic methods, contributing approximately 8% of exports **(Pipfruit NZ 2010),** fruit wash tank water is regularly replaced to remove contaminating material **(MAFNZ 2011).**

Although, wash water for organic fruit does not contain a sanitiser, exopolysaccharides (EPS) of *E. amylovora* are water soluble (Maas Geesteranus and de vries 1984; **Ordax *etal.* 2010a).**

New scientific reference for review

The main EPS of *E. amylovora* (amylovoran) is an acidic polysaccharide with strong water-binding activity with strong water-binding activity, i.e., it is a typical hydrophilic EPS of the kind found among many Gram-negative bacteria; EPS with these properties form loose slime layers which readily disperse in water (Ayres *et al.* 1979; Politis and Goodman 1980; Belleman *et al*. 1994; Nimtz *et al*. 1996; **Pers comm.; Dr Chris Hayward April 2011).**

High pressure washing is now standard practice and is used at 100% of export packing houses **(MAFNZ 2011).**

Although it is recognised disinfectants will not kill 100% of any remaining bacteria, they would reduce their numbers **(Deckers 2010; Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Mature fruit inoculated with a suspension of 10^7 cfu, less than 10^0 cfu per fruit could be detected after 4 weeks, and no bacteria could be detected after eight weeks in cold storage using a sensitive detection method that could detect as little as 2 cfu **(Temple *et al.* 2007).**

New scientific reference for review

Recent work in Spain has shown that no *E. amylovora* could be detected from 300 mature apples after 10 months in cold store. Sensitive detection methods were employed that could detect < 1 cfu/ml of calyx extract and would have detected live or dead bacteria including those in a viable but non-culturable (VBNC) state **(Ordax *et al.* 2010b).**

New scientific reference for review

Probability of distribution

Distribution of imported commodity in the PRA area.

Fruit is typically stored and transported in refrigerated containers maintained at cool temperatures and receival temperatures in the range of 1–10 ºC are required by a major retailer **(Woolworths 2010)**

General information with no new science.

However, the export data from New Zealand shows that the majority of fruit exported (99.8% in 2009–10) is in retail-ready boxes or trays that will not require repacking in Australia **(MAFNZ 2011).**

Availability of hosts

Many suitable hosts are commonly grown in Australia and are present in areas where apples would be sold and consumed. However, host susceptibility of all hosts is variable throughout the year and only some of these host species are highly susceptible to *E. amylovora* and would play a role in the distribution of the pathogen **(Paulin 2010a).**

> ***Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science***

Risks from by-products and waste

The multiplication of *E. amylovora* on apple waste is considered possible **(Paulin 2010a)** but this has never been observed and there is no evidence to support this can occur.

> ***Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science***

Erwinia amylovora is not considered a good competitor against other epiphytic bacteria that are naturally found on surface of apple or pear fruit (Roberts *et al.* 1989; **Temple *et al.* 2007; Paulin 2010a).**

> ***New scientific reference for review***
>
> ***Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science***

The epiphytic bacterium *Pantoea agglomerans* has been shown to survive at significantly higher numbers than *E. amylovora* during fruit maturation to harvest **(Temple *et al.* 2007).**

> ***New scientific reference for review***

Pantoea agglomerans is likely to be associated with New Zealand apple fruit as it is the biological control agent in the widely used commercial product Blossom Bless **(MAFNZ 2011).**

Blossom Bless is used to manage *E. amylovora* blossom infections and is applied when a computer model predicts climatic conditions are suitable **(MAFNZ 2011).**

Pantoea agglomerans is also known to reduce the pH of its environment **(Pusey *et al.* 2008)** to levels that are known to reduce, or even stop, *E. amylovora* growth (Shreatha *et al.* 2005).

New scientific reference for review

Erwinia amylovora is known to be nutritionally fastidious (Schroth *et al.* 1974), uses a much smaller range of carbon sources than saprophytes **(Cabrefiga *et al.* 2007),** and therefore specific nutrients or carbon sources may not be available for growth to occur in waste material.

New scientific reference for review

Ability of the pest to move from the pathway to a suitable host

However, this situation relates to insects attracted to active cankers on a host with bacterial ooze, that is known to be attractive to, and readily sticks to, insects **(Paulin 2010a; Paulin 2010b).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Expert comment in the proceedings of the Panel's meeting with the experts: Australia – measures affecting the importation of apples from New Zealand. World Trade Organization WT/DS367/12 but no new science

It has been speculated that birds, particularly starlings could be involved in fire blight transmission (Billing and Berrie 2002). Although they are known to inhabit landfill sites and are capable of pecking fruit, no evidence is found in the literature to confirm their involvement **(Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

The most likely mechanism of transfer of bacteria from discarded apples to a receptive site in a susceptible host is by browsing insects (AQIS 1998a; Deckers 2010; **Paulin 2010a**).

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Bacteria in the calyx are unlikely to be in a metabolic state to produce extra cellular polysaccharides (EPS) that are fresh, and therefore "sticky" and also attractive to potential insect vectors **(Paulin 2010a; Paulin 2010b).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Expert comment in the proceedings of the Panel's meeting with the experts: Australia – measures affecting the importation of apples from New Zealand. World Trade Organization WT/DS367/12 but no new science

In addition, the majority of fruit will be imported during autumn and winter, well before host flowering **(MAFNZ 2011),** when hosts are most receptive to infection.

The vector transmission of *E. amylovora* from apple waste is considered a particularly unlikely occurrence **(Paulin 2010a),** there is no evidence to support this can happen and therefore the likelihood of this occurring is rather small **(Deckers 2010).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

A recent laboratory experiment has shown that Mediterranean fruit fly can act as a vector of *E. amylovora* from infested apple fruit **(Ordax *et al.* 2010b).**

New scientific reference for review

This study showed transmission could occur under favourable artificial conditions, which do not replicate conditions that would occur with imported apple fruit. In the pathway considered in this review of policy, bacteria are within the adverse environment of the calyx, in low numbers and in an attenuated state. The experiment of **Ordax *et al.* (2010b)** is more closely aligned to the vector transfer of *E. amylovora* from oozing cankers on plant material, a method of dispersal that is already well known in the epidemiology of the fire blight (van der Zwet and Keil 1979).

New scientific reference for review

However, mature fruit do not have a suitable carbohydrate source (amylum) necessary for rapid bacterial growth and there is no evidence to support the bacterial growth of *E. amylovora* in apple waste (**Deckers 2010; Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

A recent study has reaffirmed that the flesh of fresh apple fruit does not lead to the multiplication of *E. amylovora* to produce symptoms or bacterial ooze **(Ordax *et al.* 2010b).**

New scientific reference for review

Mechanical transfer from apple fruit is not considered relevant for the distribution of fire blight **(Deckers 2010; Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Ability of the pest to initiate infection of a suitable host.

There is no accepted threshold number of bacteria required to initiate an infection, and this may vary with environmental and host factors. One cell of *E. amylovora* can potentially infect pomaceous flowers through the hypanthium. However, the minimum infective dose generally depends on environmental conditions, pathogen aggressiveness, and host susceptibility. The likelihood of infection increases with inoculum load and high levels of fresh inoculum (>10^4 cfu) are required for high rates of infection (Cabrefiga and Montesinos 2005; **Pusey and Smith 2008**).

New scientific reference for review

Hildebrand (1939) reported that a single bacterium, from an active culture, was sufficient to cause infection in detached flowers when placed directly in the hypanthium and incubated under optimal conditions in the greenhouse, and that this success rate increased with higher doses of inoculum. However, this experiment occurred under conditions to maximise infection with bacteria in optimal condition and directly inoculating the hypanthium; a process that would not occur during the importation of apples **(Deckers 2010; Paulin 2010a)**. It has also been reported that experiments that manipulate bacteria to very low numbers are extremely difficult to perform and results from these manipulations should be considered with caution **(Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

In contrast, stigmas of crab-apple trees supported bacterial growth in 4- to 10-day-old flowers, depending on temperature and pollination. However, disease incidence was relatively high only when hypanthia were inoculated at ages between 0 to 4 days (Pusey 2004). Later it was shown infection rates steadily decreased over a 10 day period from flower opening **(Pusey and Smith 2008).**

New scientific reference for review

There are also several species of amenity trees that are sparsely distributed but able to produce flowers almost throughout the year (Merriman 1996). However, trade data indicates the majority of imported fruit will arrive in Australia before spring **(MAFNZ 2011)**, separating the importation of inoculum temporally from the most likely point of infection.

The climatic requirements of fire blight would limit the number of suitable infection periods during a year. For example, in winter when temperatures are too low for bacterial growth and in summer when moisture can be limiting factor (Van Der Zwet and Keil 1979; Steiner 1990; **Deckers 2010; Paulin 2010a**).

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

There is currently no evidence that supports the hypothesis that *E. amylovora* located in a calyx of an imported apple can initiate an infection in a suitable host under natural or experimental conditions. It is considered the likelihood of this occurring would be exceptional (**Deckers 2010)** or extremely low **(Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

New Zealand has been exporting apples to Taiwan and China for several years without specific risk management measures for fire blight **(MAFNZ 2011).**

Probability of establishment

Availability of suitable hosts, alternative hosts in the PRA area.

Of the recorded hosts, fire blight is a serious bacterial disease affecting apple, pear, quince, loquat, hawthorn, cotoneaster and firethorn. It is considered these primary hosts will provide the highest chance of fire blight establishing in Australia **(Paulin 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Detailed information on exact flowering times for pome fruit production areas is not available. Flowering patterns vary with latitude and altitude. However, it has been shown for the Goulburn Valley that the flowering period for apple and pear coincides with suitable infection periods for *E. amylovora* **(Gouk 2008).**

New scientific reference for review

Suitability of the environment

Erwinia amylovora is native to North America and was initially recorded from England in 1958 (van der Zwet and Kiel 1979). Since then is has established across continental Europe and to Mediterranean countries in Europe, Middle East and North Africa (CABI 2002; Bonn and van der Zwet 2000). Many of these countries, particularly the Mediterranean countries, have climates broadly similar to temperate regions of Australia **(Peel *et al.* 2007).**

New scientific reference for review

A recent study has confirmed that the Goulburn Valley in Victoria, the main pome fruit region of Australia, has suitable climatic conditions for inoculum production and infection in spring that coincide with the main blossom period and results in many potential high risk infection events **(Gouk 2008).** This study used the two most important predictive models for blossom infection that have been used effectively in North America and New Zealand to predict infective events and manage blossom infection (Steiner 1990; van der Zwet *et al.* 1994; Biggs *et al.* 2008; Manktelov and Tate 2001).

New scientific reference for review

Reproductive strategy and the potential for adaption

The stigmas of blossoms are the most receptive sites for initiation of new infections, where bacteria can multiply rapidly. Bacterial populations often reach 10^6 to 10^7 cfu per healthy flower (Thomson 1986; **Johnson *et al.* 2009**).

New scientific reference for review

More recent information, over a period from 2006/07 to 2009/10, has reported on average, only 6.3% of blocks applied streptomycin **(BSG 2011).**

This is not new science and the information is only documentation collated by Biosecurity Australia. More importantly this in contradiction of other material within the 'Draft' document.

"For example, a key strategy of the IFP program to control fire blight is the application of sprays to prevent blossom infection based on a predictive model (refer to section 3.2.3 for more detail on IFP). The number of blocks in New Zealand that applied sprays (streptomycin or Blossom Bless) to control fire blight infection of blossoms was 9.4%, 10.7%, 11.7% and 8.3% in the seasons of 2006/07, 2007/08, 2008/09 and 2009/10 respectively (BSG 2011). These figures include blocks that sprayed both streptomycin and Blossom Bless and therefore include

some double counting (MAFNZ 2011). In addition, the application of sprays only indicates that climatic conditions present a high risk for potential infection events, not actual the actual level of infection".

Cultural practices and control measures

Naturally occurring bacterial antagonists (for example, *Pantoea agglomerans* [synonym: *Erwinia herbicola*] and *Pseudomonas fluorescens*) have proven to be effective against blossom infection (Johnson and Stockwell 2000; **Cabrefiga *et al*. 2007)** although results can be variable in some locations **(Sundan *et al.* 2009)**.

New scientific reference for review

Probability of spread

Suitability of the natural/or managed environment.

Many of these countries, particularly the Mediterranean countries, have climates broadly similar to temperate regions of Australia **(Peel *et al.* 2007).**

New scientific reference for review

More recently, fire blight has continued to spread in the Mediterranean region and has now been recorded from Syria and Morocco **(Ammouneh *et al.* 2007**; **Fatmi and Bougsiba 2008**).

New scientific reference for review

Most years, environmental conditions in many Australian apple and pear growing areas (notably the Goulburn Valley) are favourable for infection and spread of *E. amylovora* (Penrose *et al.* 1988; Wimalajeewa and Atley 1990; Fahy *et al.* 1991; **Gouk 2008**).

New scientific reference for review

Recent research has identified the effectiveness of kasugamycin as a product that controls blossom infestation and subsequent shoot infection in apple and pears **(McGhee and Sundin 2011: Adaskaveg *et al.* 2011).** However, this product is not currently a registered chemical in Australia.

New scientific reference for review

Potential for movement with commodities, conveyances or vectors

A recent review has stated *E. amylovora* can survive for many years in the xylem tissue and symptoms do not express until the xylem is damaged and the bacteria invade the parenchyma tissue **(Billing 2011).** These are factors that could assist in the spread of *E. amylovora* in planting material.

New scientific reference for review

Potential natural enemies

It has been reported that one reason why Australian orchards have remained free of fire blight is in part due to natural antagonists **(Sosnowski *et al.* 2009).**

New scientific reference for review

There is evidence for a unique microflora consisting of closely related saprophytic *Erwinia* species in Australian orchards, which requires further investigation **(Sosnowski *et al.* 2009)**

New scientific reference for review

Consequences

Significant at the national level

The Australian pome fruit industry is highly valuable. For example, the gross value of industry by State for the 2006/2007 financial year is **(ABS 2008)**;

- o Victoria, $330 million
- o South Australia, $80 million
- o NSW, $77.5 million
- o Queensland, $33.9 million
- o Western Australia, $41 million
- o Tasmania, $38.5 million

General information with no new science.

More recently a study has estimated the consequences of *E. amylovora* in Australia could in the range of $33 to $95 million per year depending on the model used to estimate consequences and confidence assigned to those estimates **(Cooke *et al.* 2009).**

New scientific reference for review

Further, the major pome fruit producing region in Australia is reported to have a very suitable climate based on fire blight predictive models **(Gouk 2008).**

New scientific reference for review

The consequence of fire blight establishing in Australia has been considered and the direct impact of fire blight is unlikely to be highly significant at the regional level **(Paulin 2010a).** However, alternative opinions support the contention that the consequences of fire blight to plant health are high **(Deckers 2010; Schrader 2010)** and this is equivalent to the rating considered for consequences expected in other regions **(Sgrillo 2010)**. Further, it is recognised that it is very difficult to quantify the disease development in terms of economic loss **(Paulin 2010b).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Expert comment in the proceedings of the Panel's meeting with the experts: Australia – measures affecting the importation of apples from New Zealand. World Trade Organization WT/DS367/12 but no new science

Significant at the regional level

Eradication of *E. amylovora* has also been tried in other countries without success and high light the difficulty and expense involved **(Sosnoski *et al.* 2009).** However, in Norway eradication events continue as the program has severely reduced the prevalence of the disease in combination with unfavourable seasonal conditions **(Sosnoski *et al.* 2009).**

New scientific reference for review

APPLE LEAF CURLING MIDGE

Dasineura mali

This species is native to northern Europe, and has been introduced to both North America and New Zealand **(Gagné 2007).**

New scientific reference for review

When fully grown, larvae are 1.5–2.5 mm long **(LaGasa 2007).**

New scientific reference for review

Pupation takes place in a white silken cocoon 2–2.5 mm in length **(LaGasa 2007)**

New scientific reference for review

The adult female deposits eggs in the leaf folds or along the margins of immature apple leaves **(LaGasa 2007).**

New scientific reference for review

In New Zealand, apple leaf curling midge is known to occur from Clyde in the Central Otago district, to Auckland on the north island. At its southernmost distribution apple leaf curling midge is thought to have only two generations per year, while up to seven generations are reported in Hamilton on the north island

(Tomkins 1998), although that latter figure is debated and four to five generations are considered more likely **(Cross 2010).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Probability of Entry

Ability of the pest to survive existing pest management

Insecticides are not recommended for control of *D.mali* in producing blocks of mature trees as biological control is considered more effective **(Pipfruit NZ 2008b).**

Control of *D. mali* in New Zealand involves a range of biological control agents such as the egg parasitoid *Platygaster demades* (Hymenoptera: Platygasteridae) and predatory mites such as *Anystis* spp. (Acarina: Anystidae) **(Shaw and Wallis 2008).**

New scientific reference for review

The mirid bug *Sejanus albisignata* (Hemiptera: Anthocoridae) is also noted as a predator of *D. mali* eggs **(Shaw and Wallis 2008).**

New scientific reference for review

Similar parasitism results were found in the North Palmerston district, which is between Wellington and Hawke's Bay. In that study, the parasitism rates were 55, 41, 68 and 73 per cent of the first, second, third and fourth (overwintering) generations respectively **(He and Wang 2007).**

New scientific reference for review

Association of the pest with the commodity pathway

If a pupa did not move when prodded it was considered to be dead. Expressed as a proportion of occupied cocoons, 75 per cent contained dead pupae **(Rogers 2008)**

New scientific reference for review

Ability of the pest to survive packing, transport and storage conditions.

Commercially, apples are cold stored to maintain freshness and reduce loss in quality. For example, a storage temperature range between 1°C and 10°C is recommended by one retailer **(Woolworths 2010),** though it is expected that any extended period of storage would occur at the lower end of this temperature range.

Probability of distribution

Distribution of the imported commodities in the PRA area

Fruit is typically stored and transported in refrigerated containers maintained at cool temperatures and receival temperatures in the range of 1– 10 ºC are required by a major retailer **(Woolworths 2010).**

However, export data from New Zealand shows that the majority of fruit exported is in retail-ready boxes or trays that do not require repacking **(MAFNZ 2011).**

Completion of development

A lower developmental threshold has not been specifically determined for *D. mali*, but recent evidence suggested that midges would complete pupation after 295 degree-days were accumulated above 6.44°C **(Cross 2010),** based on the data presented by Shaw *et al.* (2005).

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Following any cold storage, late stage larvae and pupae would need to complete development. Given the potential range of ages in any midges on imported apples, it would be expected that the emergence of adult midges would occur over a period of time. An emergence period spanning six to eight six weeks has been recorded for field populations of midges pupating in the soil (Tomkins *et al*. 2006). If any imported midges were to enter diapause due to cold storage conditions, suitable conditions to break diapause would need to occur. If suitable conditions did not occur, pupae may remain in diapause until the following year **(Cross 2010).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

If any midge pupae entering Australia were not to be exposed to suitable environmental conditions for a sufficient length of time, it is likely that they would not be able to complete their development. The length of time necessary would be dependent on how far developed the pupae are, but if they were developed, it has been suggested that adult emergence could occur almost as soon as environmental conditions were suitable **(Cross 2010).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

In that study, the parasitism rates were 55, 41, 68 and 73 per cent of the first, second, third and fourth (overwintering) generations respectively **(He and Wang 2007).**

New scientific reference for review

Ability of the pest to move from the pathway to a suitable host

Adult male *D. mali* have been recorded to fly distances of at least 50 metres **(Cross and Hall 2009)**, though longer distance flight may also be possible **(Cross 2010**). While specific studies on the flight potential of females have not been conducted, similar flight distances would be expected.

New scientific reference for review

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Suckling *et al.* (2007) further reported that the maximum colonisation distance for females was 30m.

New scientific reference for review

Ability of the pest to initiate infestation of a suitable host

Adult female midges held at 4°C with moisture available survive 4–5 days, and rarely 6 days. Further, most male and female midges held at 18–20°C in a low airflow environment survived less than one day **(Cross 2010).** A shorter life span of 1–2 days has also been reported **(Suckling *et al.* 2007).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

New scientific reference for review

Probability of establishment

Suitability of the environment

In Europe, *D. mali* is reported as present in Finland, Norway and Sweden in the north and Bulgaria, Italy, and Macedonia in the south **(CABI CPC 2008).**

General information with no new science.

Extended cold conditions may be required to break any diapause in midges entering the Australian environment **(Cross 2010).** Diapause is known for other species of *Dasineura* (Axelsen *et al.* 1997), though definitive studies have not been completed for *D. mali* **(Cross 2010).** Cold storage during transport of apples may be sufficient to break diapause.

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Dasineura mali is established in Washington State, USA, **(CABI CPC 2008)**, but only in coastal areas west of the Rocky Mountain **(Cross 2010).**
The absence of sufficient summer rainfall has been proposed as the reason why *D. mali* has not established in inland Washington State **(Cross 2010).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

It is possible that the relatively dry environmental conditions in many regions of Australia where apple and crab-apple trees are grown would be unsuitable for *D. mali* to survive long enough to establish a persistent population. This, along with potential absence of suitable conditions to enter or break diapauses, would appear to be the case in countries such as Greece, Turkey and Spain that produce apples, but have no records of *D. mali* **(CABI CPC 2008).**

Reproduction strategy and the potential for adaptation

Females are reported to commence “calling” for mates two hours after emerging from pupation **(Suckling *et al.* 2007).**

New scientific reference for review

The pheromone has subsequently been utilised to develop a trap for male *D. mali* **(Cross and Hall 2009).**

New scientific reference for review

Cultural practices and control measures

Generalist predators such as *Anystis sp*. and *Sejanus albisignata* also provide some control of *D. mali* in New Zealand **(Shaw and Wallis 2008).** While *Sejanus* species are not recorded from Australia, there are two species of *Anystis* in Australia, *A. wallacei* and *A. baccarum* (AICN 2005). These species, or other generalist predators, may result in some mortality in any *D. mali* populations. However, it is not considered that they would prevent *D. mali* from establishing a founding population

New scientific reference for review

European earwig (*Forficula auricularia*) has also been established as a predator of *D. mali* larvae and will bite through leaves to access its prey (**He *et al.* 2008).**

New scientific reference for review

Probability of spread

Suitability of the natural/or managed environment

From Europe, *D. mali* is reported as present in Finland, Norway and Sweden in the north and Bulgaria, Italy, and Macedonia in the South **(CABI CPC 2008).**

General information with no new science.

The distribution of *D. mali* appears to have reached an equilibrium with the pest spanning the northern latitudes from 38°N to 65°N **(CABI CPC 2008; Cross 2010)**

General information with no new science.

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

While definitive studies have not been conducted to establish the conditions required to break diapause in *D. mali*, an extended period of exposure to cold temperatures is believed to be necessary **(Cross 2010).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Presence of natural barriers

Adult *D. mali* is capable of independent flight. Adult males have been trapped with pheromone lures at distances up to 50m **(Cross and Hall 2009)** though longer distances were not tested.

New scientific reference for review

Consequences

Plant Life or health - Significant at the district level

Fruit damage has been reported to occur if populations are high (HortResearch 1999b), particularly during flowering (Tomkins 1998), though such reports appear to be rare **(Cross 2010).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Eradication, control, etc - Significant at the district level

Control programs, in the absence of effective natural enemies have relied upon chemical spray programs, particularly early in the season, although these are not considered as effective as biological control (Shaw *et al.* 2003; **Pipfruit NZ 2008).**

Domestic trade – Significant at the district level

Damage to fruit has been reported, including the skin being distorted by bumps (Tomkins 1998) caused by high populations of apple leaf curling midge affecting developing fruitlets. While such damage is apparently rare **(Cross 2010)**, a reduction in the aesthetic quality could result in of fruit not meeting consumer expectations and result in reduced acceptance of fruit that is slightly affected right through to outright rejection of imperfect fruit.

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

EUROPEAN CANKER
Neonectria ditissima

Under field conditions, temperatures of 11–16°C with a measure of leaf wetness provide the best predictors of disease prevalence **(Beresford and Kim 2011).**

New scientific reference for review

Probability of entry
Association of the pest with the crop

However, annual rainfall alone is considered a poor predictor of disease prevalence **(Latorre 2010; Swinburne 2010a)** and duration of leaf wetness in combination with suitable temperature provide a more reliable predictor of European canker **(Swinburne 2010a).** Recent work predicts disease prevalence under field conditions is best predicted by temperatures of 11^{o}C–16^{o} C and a measure of leaf wetness (number of rainfall days per month) **(Beresford and Kim 2011).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

New scientific reference for review

Later work predicts the current distribution of European canker in New Zealand based on temperature and leaf wetness **(Beresford and Kim 2011).**

New scientific reference for review

In Nelson, where the disease occurs sporadically in wet seasons, 28% of the total export trade is produced **(Pipfruit NZ 2010).**

Association of the pest with the commodity pathway

In France, the rot has been recorded from fruit, and has been observed to spread to the seed cavity, and the fungus has been isolated from the mycelium surrounding the seeds (Bondoux and Bulit 1959), but this has not been observed in California (McCartney 1967).In dessert varieties of fruit, infection can lead to the development of rot before harvest (Swinburne 1964; Swinburne 1971a; Swinburne 1975), but infection usually remains latent and generally develops into a rot during storage (Bondoux and Bulit 1959; **Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

The typical rainfall and temperature patterns of major New Zealand apple export areas would suggest latent infection is very unlikely to occur as conditions during fruiting are not favourable for conidia production and subsequent fruit infection **(Beresford and Kim 2011).**

New scientific reference for review

For fruit to become infected with *N. ditissima*, prolonged periods of wetness in the Summer months is required for (a) the production of spores (conidia) on active stem cankers, (b) the dissemination of those spores in run-off from cankers onto the developing fruit and (c) a sufficient period of leaf-wetness to allow the deposited spores to germinate and colonise limited areas within the calyx or lenticels. All three events need to occur for fruit to become infected **(Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

In the south east of England, under artificial conditions with high inoculum and humidity, fruit infection has been recorded to occur most readily up to four weeks after flowering and infection can continue to occur on fruit one week before harvest under suitable conditions **(Xu and Robinson 2010).**

New scientific reference for review

Overhead irrigation that could assist in disseminating spores and cause fruit infection is only used for frost management and is only common in the Otago district where European canker has never been recorded **(MAFNZ 2011).**

In addition, low temperatures that would justify frost management are not conducive to European canker **(Beresford and Kim 2011**) if *N. ditissima* was recorded from the region in the future.

New scientific reference for review

Recent research has supported the suitability of the Auckland region for European canker disease based on a worldwide comparison of climate suitability **(Beresford and Kim 2011).**

New scientific reference for review

Ability of the pest to survive existing pest management

These programs provide guidance for targeted management of a range of pathogens including European canker and other fungi such as those that cause mildew and apple scab that would limit the prevalence of European canker in trees **(Latorre 2010; Swinburne 2010a).**

> ***Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science***

Fruit can only enter export packing houses once compliance with the IFP program spray recommendations have been confirmed by spray diary clearance by auditing organisations independent of the industry **(MAFNZ 2011).**

European canker rots were last reported in New Zealand from a survey conducted from 1999 to 2005 (MAFNZ 2005a). During this time, the IFP program has been adopted by New Zealand growers (Wiltshire 2003) and further refined by Pipfruit NZ Inc **(MAFNZ 2011).**

A recent study on fruit rots in New Zealand sampled over 12,000 apples from the Hawke's Bay area, that included treatments to promote rot development (wounding, cold storage), and found no European canker rots **(Scheper *et al.* 2007).**

> ***New scientific reference for review***

Ability of the pest to survive packing, transport and storage conditions

Packing houses utilise disinfectants such as chlorine or Tsunami® and, increasingly, Nylate® during water washing procedures and in dump tanks. In 2005, only 53% of pack houses used disinfectants. In 2011, 99% of export fruit produced under the IFP program are disinfected **(MAFNZ 2011).**

For fruit produced under organic methods, contributing approximately 8% of exports **(Pipfruit NZ 2010),** fruit wash tank water is regularly replaced to remove contaminating material **(MAFNZ 2011).**

In 2005, 93% of packing houses used high pressures washing (MAFNZ 2005a). High pressure washing is now standard practice and is used at 100% of export packing houses **(MAFNZ 2011).**

It is likely the use of disinfectants, when used on non organic fruit, will kill the majority of conidia **(Swinburne 2010a).**

> ***Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science***

Neonectria ditissima conidia from various inoculum sources that could contaminate fruit or survive disinfectants and washing are unlikely to be a source for infection as they are sensitive to desiccation even at high relative humidity **(Latorre 2010; Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Standard packing house procedures will remove fruit that does not meet export quality requirements, including fruit rots **(MAFNZ 2011).** Only latent infections in fruit are likely to pass undetected during packing and sorting procedures.

For fruit that is stored for a significant time, re-inspection occurs to ensure fruit meets market requirements **(MAFNZ 2011).**

It is likely that latently infected fruits that can develop rots during this time **(Berrie *et al.* 2007)** will be removed during this inspection.

New scientific reference for review

Probability of distribution

Distribution of the imported commodity in the PRA area

Neonectria ditissima would need to survive transportation and storage within the PRA area. Fruit is typically stored and transported in refrigerated containers maintained at cool temperatures and receival temperatures in the range of 1–10 ºC are required by a major retailer (**Woolworths 2010).**

However, data from New Zealand shows that the majority of fruit exported is in retail ready boxes or trays that will not require repacking in Australia **(MAFNZ 2011).**

Ability of the pest to move the pathway to a suitable host

Ascospores are more likely to form on cankers on woody parts of plants (Swinburne 1975) and have only rarely been recorded on fruits under specific favourable conditions (Dillon-Weston 1927; **Swinburne 2010a**).

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

The production of ascospores on fruit does not feature in any subsequent epidemiological study **(Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

There is no evidence that perithecia would fully develop and produce ascospores on fruit under the typically drier conditions experienced in Australia **(Latorre 2010; Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Although wind disperses some conidia in the absence of rain (Swinburne 1971b) they are mainly splash-dispersed (Munson 1939) and this is considered the only realistic mode of dispersal for conidia from infected apples **(Latorre 2010; Swinburne 2010a)**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

That small proportion of remaining fruit will require extended periods of suitable temperature and moisture for this to occur (Swinburne 1971b) and prolonged periods of 100% humidity are considered necessary for conidia production **(Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Fruit rotting in retail packs or in a domestic environment at less than 100% relative humidity is unlikely to produce conidia **(Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

When conidia are formed from rots they do so in relatively small numbers **(Swinburne 2010b).**

Expert comment in the proceedings of the Panel's meeting with the experts: Australia – measures affecting the importation of apples from New Zealand. World Trade Organization WT/DS367/12 but no new science

Once conidia are produced from rots they will only survive for short periods of time without moisture **(Latorre 2010; Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

It has been reported that in East Malling, England, approximately 50kg of discarded canker wood were pulverized and placed under potted trees of a highly susceptible apple variety, Spartan **(Swinburne 2010b).** No cankers were observed on the trees subsequently; suggesting it is very unlikely conidia produced near the ground will transfer to a host and cause infection.

Expert comment in the proceedings of the Panel's meeting with the experts: Australia – measures affecting the importation of apples from New Zealand. World Trade Organization WT/DS367/12 but no new science

Vectors

The role of vectors transferring conidia from fruit has been considered recently and there is no supporting evidence this can occur **(Latorre 2010; Swinburne 2010a)**. In the absence of supporting evidence, vector transmission of conidia is considered to be extremely unlikely.

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Ability of the pest to initiate infection of a suitable host

However, under field conditions, temperatures in the range of 11 ºC –16 ºC are a better predictor of disease prevalence **(Swinburne 2010a; Beresford and Kim 2011).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

New scientific reference for review

In summer, low rainfall and high temperatures are unfavourable for disease development **(Beresford and Kim 2008; Beresford and Kim 2011).**

New scientific reference for review

Probability of establishment

Availability of suitable hosts, alternative hosts in the PRA area

Granny Smith is still a major variety of apple grown in Australia. For example, Victoria produces 39% of Australia's apples and 22% of these are Granny Smith **(APAL 2008).**

Suitability of the environment

However, successful infection depends on the existence of receptive infection sites synchronized with adequate moisture and suitable temperature **(Latorre 2010; Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Recent climate models have confirmed Tasmania as marginal for European canker **(Beresford and Kim 2011).** This work predicts with some accuracy the suitability of the climate for European canker around the world. Although this work does not cover other areas of Australia, an earlier version of this work presented information that predicts other apple growing regions of Australia would also be marginally suitable for European canker **(Beresford and Kim 2008).**

New scientific reference for review

Another climate model predicted a greater range of locations that would be suitable for European canker in Australia **(Baker and Mewett 2009).** However, this study noted that conditions in Australia are typically less conducive (warmer and drier) than regions of the world where European canker is highly prevalent. The model also predicts regions of New Zealand are very suitable for European canker where the disease is rarely present or absent. This work may be considered a more conservative model in predicting European canker establishment.

New scientific reference for review

Reproductive strategy and the potential for adaption

Ascospores have only been recorded from the most suitable climatic regions in New Zealand (Brook and Bailey 1965**)** that are considered more suitable for European canker than regions in Australia **(Beresford and Kim 2011).**

New scientific reference for review

The latent infection of trees may be the reason for the length of time required to achieve eradication in Tasmania **(Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Probability of spread

Suitability of the natural/or managed environment

The lack of spread may have been because of the absence of airborne ascospores which are better suited to long-distance dispersal than conidia (Ransom 1997), combined with marginal climatic conditions **(Beresford and Kim 2011).** The use of chemicals to control apple scab may also have limited disease spread **(Latorre 2010; Swinburne 2010a).**

New scientific reference for review

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Potential for movement with commodities, conveyances or vectors

Conidia can develop in rotted fruit but whether this contributes to local spread has never been demonstrated **(Latorre 2010; Swinburne 2010a).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Consequences

Plant life or health – Significant at the district level

The climatic conditions that allow for significant fruit rots in Northern Ireland include summer rainfall that promotes fruit infection **(Swinburne 2010a).** This is unlikely to occur in the typically drier and hotter climate of Australia compared to Northern Ireland.

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

In Australia, recent climate models have confirmed Tasmania as marginal for European canker **(Beresford and Kim 2011).** This work predicts with some accuracy the suitability of the climate for European canker around the world. Although this work does not cover other areas of Australia, an earlier version of this work presented information that predicts that most other apple growing regions of Australia would be marginally suitable for European canker **(Beresford and Kim 2008).** These apple growing areas include the major production area of the Goulburn Valley in Victoria. The marginal climatic suitability of Australia will limit any potential impact *N. ditissima* may have on host plants.

New scientific reference for review

APPENDIX B: NEW SCIENCE FROM THE DRAFT

Given that Department of Agriculture, Fisheries and Forestry handed down their final report in 2006 it was felt that any reference within the current draft document date 2007 to 2011 would be considered as new information. Apple and Pear Australia limited having sourced all the references within the “Draft report for the non-regulated analysis of existing policy for apples from New Zealand” during that period have now collated all of those that have been sourced from new scientific papers. This material could be considered as ‘NEW SCIENCE” in relation to the Import Risk Analysis being undertaken by Biosecurity Australia.

All those references are listed below.

Apple and Pear Australia Limited has reviewed each of the scientific papers and drawn the appropriate and relevant conclusions from these papers.

FIRE BLIGHT – Erwinia amylovora

Probability of entry

Probability of importation.

Japan has a significant pome fruit industry **(Apple University 2010)** and as a result of negotiations since the Japan-USA apple dispute at the WTO, New Zealand now has access to the Japan market without specific risk management measures for fire blight **(Japan Apple Regulations 2007).**

Apple and Pear Australia Limited seeks clarification from Biosecurity Australia as to how the Japanese within their protocol confirm that New Zealand fresh fruit is not infested with Fire Blight.

Apple and Pear Australia Limited seeks clarification from Biosecurity Australia that the Japan Apple Regulation 2007 is in fact the same document as supplied from the public file that is ‘MAFF Ministerial Notification No 353 of 10th March 2997.

The incidence of fire blight from year to year mainly depends on spring seasonal conditions **(APPS 2009).**

Apple and Pear Australia Limited argues that this is not new science.

Association of the pest with the commodity pathway-calyx infestation

Erwinia amylovora predominantly colonise flowers (Thomson, 1986; Thomson, 2000) and only relatively low bacterial numbers have been recorded on dried remnant flower parts subsumed into the calyx sinus of mature fruit (Hale *et al.* 1987; Sholberg *et al.* 1988; **Temple *et al.* 2007**).

New scientific reference for review

Biosecurity Australia has not indicated what the 'relatively low bacterial numbers' are in numerical terms.

Apple and Pear Australia Limited would contend that the research emphatically highlights that Erwina amylovora will colonise the '*dried remnant flower parts subsumed into the calyx sinus of mature fruit'* which must lead to the potential for calyx infection.

A later publication revised this estimate down based on new evidence and clarification or correction of previously misinterpreted data present in the literature **(Roberts and Sawyer 2008).**

New scientific reference for review

While the research gives an estimation down Apple and Pear Australia Limited would highlight the following issues from within the scientific paper:-

> ***"By using the corrected and newly published data and by making assumptions based upon documented pathogen biology, the model gives more robust statistical support to the opinion that the risk of importing Ea on commercial apple fruit and the concomitant risk of establishing new outbreaks of fire blight is so small as to be insignificant."***
>
> ***And***
>
> ***"In all scenarios, the risk was found to be so small as to be ''insignificant''.***
>
> ***And***
>
> ***"Thus, Roberts et al. (1998) used non-zero estimates for nodes, even those for which there was no evidence a step in the hypothetical pathway could be completed. Even using these inflated hypothetical values the theoretical probabilities were extraordinarily low."***
>
> ***And***
>
> ***"Thus, the values for number of fruit assayed changed from 80 to 20 because none of the Rome apple fruit were mature at the times of assay, and only the last harvest of Red Delicious may have been mature (S. Thomson, personal communication)."***
>
> ***And***

"To date no information or data are available that would establish the existence of this state for Ea in nature; only laboratory induction of the VBNC state has been reported. Given that there are no data on the incidence of VBNC cells of Ea on mature apple fruit (or anywhere else in nature) or any evidence that such a state is epidemiologically significant with regards to natural populations of Ea or the initiation of fire blight disease, there is no path to inclusion of VBNC cells of Ea in the PRA other than speculation, which would be inappropriate and contrary to the stated goal of providing a quantitative assessment of risk."

And

"From nine trials marked S3 but not S2 or S1, 3144 mature fruit were tested and 63 were found to be externally contaminated with Ea,….."

And

"Live Ea cells were detected on 2 of 570 contaminated fruit assayed after cool storage for 25 d plus 14 d at room temperature, again from fruit with the highest initial infestation levels.

And

"The mean infestation rate from Table 1 is therefore a biased estimate for the production areas of concern in this trade issue."

And

"Yamamura et al. (2001) additionally stated, 'our results are not conclusive …..'. Results based on sampling, statistics and modelling are never certain and, in this sense, are never 'conclusive.' However, at any given level of knowledge, conclusions can be drawn."

Apple and Pear Australia Limited would make the following assessments of this work:-

- **e) The research is still based on 'making assumptions'.**
- **f) The research admits to a 'biased estimate'.**
- **g) The research highlights that in as number of the research projects considered that there was mature 'contaminated fruit' with 'live Ea'.**
- **h) This research lacks validity given that it was undertaken in 2007 and there has been substantial new research on VBNC and Biofilms in relation to Erwinia amylovora.**

Apple and Pear Australia Limited would contend that the results of this research are not 'conclusive'.

Apple and Pear Australia Limited was also contend that the model has still failed to consider
d) Clustering, and
e) Severe outbreaks of Fire Blight in an orchard, and
f) Severe climatic events like hail and wind storms.

This later work now reports no *E. amylovora* were detected in apple fruit from orchards without fire blight symptoms and 1.3% of apple fruit are infested from orchards with fire blight symptoms. Many apple fruit samples from orchards with symptoms detected no *E. amylovora* **(Roberts and Sawyer 2008).**

New scientific reference for review

Apple and Pear Australia Limited highlights the statement from Roberts and Sawyer in that "1*.3% of apple fruit are infested from orchards with fire blight symptoms". This confirms that apple fruit can be 'infested with Fire Blight.*

More recently, **Ordax *et al.* (2010b)** reported no *E. amylovora* could be detected from 100 apples immediately after harvest from a severely infected fire blight orchard. Sensitive detection methods were employed that could detect < 1 cfu/ml of calyx extract and would have detected live or dead bacteria including those in a viable but non-culturable (VBNC) state.

New scientific reference for review

Apple and Pear Australia Limited argues that this extraction from the scientific reference has been taken out of context of the total research undertaken.
The research was in relation to *"looking for Erwinia amylovora in asymptomatic fruits from trees naturally infected by fire blight"* and the following are additional extracts from the paper:-

> ***"In this report it has been shown that more than 400 calyces from asymptomatic mature apples harvested from trees naturally infected by E. amylovora gave negative results for the presence of the pathogen. Our high detection limit (<1cfu/ml), and the use of big Petri dishes incubated up to one week, suggest that probably there were not culturable E. amylovora cells in the calyx of these apples."***
>
> ***And***
>
> ***"As in that year there were no fireblight outbreaks in Spanish apple orchards, other symptomless fruits from other naturally infected trees were harvested, over 250 azarole fruits. Interestingly, the analysis of these fruits evidenced that 12% of the collected azaroles were latently infected, remaining E. amylovora cells alive***

inside the fruits, and going unnoticed due to the absence of symptoms."

And

"Besides, we have developed an appropriate methodology for the detection of E. amylovora in asymptomatic fruits in spite of the low pathogen doses usually present in them, which could be very useful in surveys of plants from naturally infected orchards."

In the USA, numbers of bacteria on blossoms of apple and pear inoculated with *E. amylovora* bacteria decline to very low levels in the calyx of the subsequent mature fruit. In apples, no fire blight could be detected at harvest **(Temple *et al.* 2007).**

New scientific reference for review

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'. As a result the statement above must be considered in the context of the report and not just a single statement drawn from a complex scientific experiment.

In a sample of commercial pear orchards, where disease incidence is typically higher than on apples (Agrios 1997; Paulin 2010a), of the orchards sampled, 27% had fire blight symptoms and only 1 fruit of 5600 sampled at harvest had *E. amylovora* with 32 cfu detected **(Temple *et al.* 2007).**

New scientific reference for review

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.
The above reference relates to pears and Apple and Pear Australia Limited argues that the statement has no relevance to the export of apples.
Notwithstanding this reference does highlight that mature pears can be infected/infested with *Erwinia amylovora*.

Association of the pest with the commodity pathway – infection

A recent review of the evidence supports the view that *E. amylovora* can occur in xylem vessels **(Billing 2011).** It is further stated that *E. amylovora* can multiply in the xylem and may survive latently for many years, expressing symptoms once the xylem vessel is damaged and bacteria are released into the parenchyma **(Billing 2011).**

New scientific reference for review

Apple and Pear Australia Limited would agree that the assessment made Billing (2011) gives an accurate position of the past science in relation to movement through the xylem.

The following are extracts from the paper which give further insight into the science relating to Fire Blight:-

> ***"No one since 1981 has retested the xylem-vessel hypothesis, but evidence presented in this review shows that there is no doubt that E. amylovora can and does enter xylem vessels and multiply there, and may remain viable in mature vessels for long periods, possibly several growing seasons. Storm damage or pruning tools may allow escape of the pathogen to external surfaces, but other means of escape from mature xylem vessels into bark tissue, where typical symptoms are expressed in the growing tree, have so far eluded discovery."***
>
> ***And***
>
> ***"Studies on mature trees are rarely feasible, so young plants need to be used."***
>
> ***And***
>
> ***"Evidence presented in this report strongly suggests (but does not prove) that the main route for systemic migration of E. amylovora is in the intercellular spaces of the parenchymal bark tissue. The pathogen can also invade and multiply in mature xylem vessels for long distances down the tree. How far suction pressure is involved in that movement is not known. If this is to be an important migration route, the bacteria need a ready means of escape from the vessels into the bark tissue. How this might be achieved also remains unknown."***

Ability of the pest to survive adverse conditions – viable but non-culturable state

A recent study has confirmed that *E. amylovora* can enter a VBNC state in the calyx of apple fruit in response to copper and then infect receptive host tissue after periods of 7–28 days post calyx inoculation under favourable laboratory conditions **(Ordax *et al.* 2009).** The level of infection recorded in this experiment was low and the culturing of *E. amylovora* from infected tissue was several orders of magnitude lower than bacteria that had not entered the VBNC state.

> ***New scientific reference for review***

Apple and Pear Australia Limited argues that this is important new science that Biosecurity Australia has failed to give adequate consideration.
This research would highlight the ability of Fire Blight to survive in a Viable But Non-Culturable form as well as a Biofilm.

The addition scientific work done and reported on during the period since 2009 give further understanding of the ability of Fire Blight to enter a Viable But Non-Culturable state.

For VBNC to be a risk pathway, bacteria would need to enter the VBNC state in the orchard and would need to resuscitate before, or during, an infection event in Australia for infection to occur. Copper is known to induce the VBNC state in the laboratory, but it is not generally applied at flowering because of plant phytotoxicity **(APPS 2009)** and there is still no evidence to confirm resuscitation can occur under natural conditions **(Paulin 2010a).**

> ***Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science***

Ability of the pest to survive adverse conditions–Exopolysaccharides and biofilms

Under laboratory conditions, the EPS of *E. amylovora* (amylovoran and levan) can be used as carbon sources by the bacteria during periods of starvation **(Ordax *et al.* 2010a).** The utilisation of EPS may assist in the survival of *E. amylovora* during periods of starvation and this factor would be taken into account during the many studies of *E. amylovora* survival in the calyx.

> ***New scientific reference for review***

Apple and Pear Australia Limited argues that this is important new science that Biosecurity Australia has failed to give adequate consideration.
This research would highlight the ability of Fire Blight to survive in a Viable But Non-Culturable form as well as a Biofilm.

More recently it has been shown that EPS contributes to the formation of biofilms and plays an important role in the pathogenesis and disease development of *E. amylovora* in plants (Koczan *et al.* 2009; **Lee *et al.* 2010**).

> ***New scientific reference for review***

Apple and Pear Australia Limited strongly believes that Biosecurity Australia has not given sufficient credence to the aspect of biofilms when considering the export of apples from New Zealand.

Apple and Pear Australia Limited would direct Biosecurity Australia to the sections on Pathogenecity/Strains and Viable But Non-Culturable within this submission

Ability of the pest to survive epiphytically

Later, the work by Temple and colleagues were published as a full text article that comprehensively described the experimental methods. Under field conditions, immature pear or apple fruit on the tree were artificially covered by an inoculum suspension with 10^7 cfu per ml, or calyces infested with inoculum from ooze (10^8–10^9 cfu) **(Temple *et al.* 2007).** Populations of *E. amylovora* declined by an order of magnitude every three to four days in the first two weeks after inoculation. From a starting population of 1.6 x 10^7 cfu, by day 56, only one pear fruit of 450 tested positive and had only four cfu **(Temple *et al.* 2007).** This study confirmed the poor survival and rapid decline of *E. amylovora* bacteria, even from very high levels, on the surface of fruit.

New scientific reference for review

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.
The research utilised a process of 'artificially' covering the trees and fruit with inoculum suspension.
Would this same situation happen in normal natural conditions particularly as Erwinia amylovora does infect/infest immature apples and pears? (As consistently reported in many scientific papers.)

Ability of the pest to survive packing, transport and storage conditions.

Although, wash water for organic fruit does not contain a sanitiser, exopolysaccharides (EPS) of *E. amylovora* are water soluble (Maas Geesteranus and de vries 1984; **Ordax *etal.* 2010a).**

New scientific reference for review

Can Biosecurity Australia confirm that because the EPS is water soluble this it has any effect on Viable But NonCoulturable bacteria and/or Biofilms?

The main EPS of *E. amylovora* (amylovoran) is an acidic polysaccharide with strong water-binding activity with strong water-binding activity, i.e., it is a typical hydrophilic EPS of the kind found among many Gram-negative bacteria; EPS with these properties form loose slime layers which readily disperse in water (Ayres *et al.* 1979; Politis and Goodman 1980; Belleman *et al*. 1994; Nimtz *et al*. 1996; **Pers comm.; Dr Chris Hayward April 2011).**

This reference is a 'personal communication'.

Mature fruit inoculated with a suspension of 10^7 cfu, less than 10^0 cfu per fruit could be detected after 4 weeks, and no bacteria could be detected after eight weeks in cold storage using a sensitive detection method that could detect as little as 2 cfu **(Temple *et al.* 2007).**

New scientific reference for review

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.
The research utilised a process of 'artificially' covering the fruit with inoculum suspension as referenced by the following extract:-

> ***"Survival of E. amylovora on stored fruit.***
> ***A suspension of fresh Ea153N cells scraped from agar cultures was prepared at 5 × 10^7 CFU/ml and sprayed with a hand pump sprayer to runoff onto 240 fruit."***

Would this same situation happen in normal natural conditions?

Recent work in Spain has shown that no *E. amylovora* could be detected from 300 mature apples after 10 months in cold store. Sensitive detection methods were employed that could detect < 1 cfu/ml of calyx extract and would have detected live or dead bacteria including those in a viable but non-culturable (VBNC) state **(Ordax *et al.* 2010b).**

New scientific reference for review

Apple and Pear Australia Limited argues that this extraction from the scientific reference has been taken out of context of the total research undertaken.
The research was in relation to *"looking for Erwinia amylovora in asymptomatic fruits from trees naturally infected by fire blight"* and the following are additional extracts from the paper:-

> ***"In this report it has been shown that more than 400 calyces from asymptomatic mature apples harvested from trees naturally infected by E. amylovora gave negative results for the presence of the pathogen. Our high detection limit (<1cfu/ml), and the use of big Petri dishes incubated up to one week, suggest that probably there were not culturable E. amylovora cells in the calyx of these apples."***
>
> ***And***
>
> ***"As in that year there were no fireblight outbreaks in Spanish apple orchards, other symptomless fruits from other naturally infected trees were harvested, over 250 azarole fruits. Interestingly, the analysis of these fruits evidenced that 12% of the collected azaroles were latently infected, remaining E. amylovora cells alive***

inside the fruits, and going unnoticed due to the absence of symptoms."

And

"Besides, we have developed an appropriate methodology for the detection of E. amylovora in asymptomatic fruits in spite of the low pathogen doses usually present in them, which could be very useful in surveys of plants from naturally infected orchards."

Probability of distribution

Risks from by-products and waste

Erwinia amylovora is not considered a good competitor against other epiphytic bacteria that are naturally found on surface of apple or pear fruit (Roberts *et al.* 1989; **Temple *et al.* 2007; Paulin 2010a).**

New scientific reference for review

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.
This statement appears to be based on the fact that *"1 of 5,600 pear fruits sampled from commercial orchards yielded 32 CFU of E. amylovora".*
The majority of the bacteria that were recovered from the 'surveys for E. amylovora on fruit from commercial orchards' were not Erwinia amylovora but other orchard bacteria.

The following are extracts from the scientific paper that are worthy of highlighting:-

"Subsamples of fruit tissues revealed that surviving cells were associated with the calyx".

And

"The calyx survival studies provided evidence that floral populations of E. amylovora can persist on pear and apple fruit for a period of time after bloom".

And

"one fruit was found to harbor a small epiphytic population of the pathogen".

And

"fire blight lesions on the external surface of nearly mature fruit of summer pear cv. Bartlett, however, has been reported from Washington State".

And

"For both pear and apple, the data also showed small but consistent increases in pathogen population size over the first 7 to 14 days of cold storage".

All of these extracts highlight was is possible and likely within the natural environment.

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

The epiphytic bacterium *Pantoea agglomerans* has been shown to survive at significantly higher numbers than *E. amylovora* during fruit maturation to harvest **(Temple *et al.* 2007).**

New scientific reference for review

This particular research paper is titled "Evaluation of Likelihood of co-occurrence of *Erwinia amylovora* with Mature Fruit of Winter Pear" and the use of Gala apples was as a 'control'.

The following is an extract from the scientific paper:-

"*Surveys for E. amylovora on fruit from commercial orchards.*

Of the 56 surveyed orchards, at the time of harvest, 15 (27%) had fire blight symptoms present in the orchard or in an adjacent block of a different cultivar; whereas the remaining 41 orchards (73%) were apparently disease free as determined by visual inspection. At least some bacteria were recovered on filter membranes of nearly all fruit washings, many of which were green-colored on MS medium and fluoresced when transferred to PAF medium, indicative of Pseudomonas spp. Orange to red colonies with resemblance to E. amylovora on MS medium were recovered from 15% of washed fruit; a subset of 179 orange/red colonies were selected and tested for identification (Table 2).
Partial identification of the orange/red-colored isolates by fatty acid analysis (GC-FAME) most frequently yielded Enterobacter (8%), Pantoea (12%), and Pseudomonas spp. (8%), and a few nonpathogenic Erwinia spp. (2%) (E. rhapontici and E. persicina). A total of 3 of 179 orange/red isolates produced a hypersensitive reaction (HR) in tobacco leaves, indicative of a type III secretion

system. Partial sequences of the 16S rDNA of these isolates yielded (with >99% similarity in GenBank) E. amylovora, E. persicina, and Citrobacter freundii. The one isolate identified as E. amylovora by its 16S rDNA sequence also was positive for production of ooze on immature pear and for presence of pEA29; all other isolates were negative for these tests (Table 2). Consequently, 1 (0.02%) of 5,600 pear fruits sampled from commercial orchards yielded 32 CFU of E. amylovora (Table 3)."

What this would highlight is that there is a wide variety of bacteria at the time of this experiment on the surface of fruit.

What is not clear from the research is whether the apple fruit were tested in this part of the experiment or whether the above results are only related to pears.
Biosecurity Australia needs to clarify this point.

Pantoea agglomerans is also known to reduce the pH of its environment **(Pusey *et al.* 2008)** to levels that are known to reduce, or even stop, *E. amylovora* growth (Shreatha *et al.* 2005).

New scientific reference for review

While there may be some substance to this assessment of the science it is worth considering the following extract and the final conclusion to this particular scientific paper:-

"Under ideal laboratory conditions for bacterial colonization of flowers, we found that P. agglomerans strain E325 exhibited a capacity to reduce the pH on stigmas to levels that could reduce growth of E. amylovora. Conversely, an increase in pH was observed on flowers inoculated with E. amylovora alone and was comparable to previous results with pear fruit tissue inoculated with the pathogen (51)."

And

"Two separate data sets, one dealing with pH on the stigma and the other with antibiotic production in a partial stigma-based medium, were not shown to be directly related, but both have possible implications in biological control of fire blight with P. agglomerans strain E325. Analysis of exudates from inoculated stigmas indicated that strain E325 may lower the pH on stigmas, which to some degree, may reduce growth of E. amylovora. Secondly, assuming pH values are close to those actually occurring on flower stigmas, results indicate a pH range on the stigma favorable for antibiotic activity, which was found in vitro to be pH sensitive. Work is in progress to further investigate acidification and antibiosis and their possible roles and

interrelationship in the suppression of E. amylovora by P. agglomerans E325 on stigmatic surfaces of apple and pear."

Erwinia amylovora is known to be nutritionally fastidious (Schroth *et al.* 1974), uses a much smaller range of carbon sources than saprophytes **(Cabrefiga *et al.* 2007),** and therefore specific nutrients or carbon sources may not be available for growth to occur in waste material.

New scientific reference for review

The scientific paper titled 'Mechanisms of antagonism of *Pseudomonas fluorescens* EPS62e against *Erwinia amylovora*, the casual agent of fire blight" was a report on the work undertaken on pears.
Apple and Pear Australia Limited seeks confirmation from Biosecurity Australia that the information in this scientific paper can be extrapolated to apples.

The following is extract from the scientific paper:-

"Table 3 shows the carbon sources that have been reported as more abundant in pear and pome fruits [12, 14, 45] in relation to the ability of EPS62e and E. amylovora to utilize them. Nine of these carbon sources were tested in this study, and eight of these sources were used by EPS62e whereas only five were used by E. amylovora. Globally, the most abundant carbon sources in nectar and pear tissues, such as glucose and fructose, were used by both the antagonist and the pathogen. Sucrose, which is found in all organs, was only used by E. amylovora. Therefore, in terms of the effects of nutrient use and availability on plant host tissues, EPS62e has the potential to outcompete E. amylovora."

Is the formulation known as Serenade available and registered for use in New Zealand?

Is the formulation known as Serenade available and registered for use in Australia?

Apple and Pear Australia Limited fails to see how this scientific paper can lead to the statement that '***specific nutrients or carbon sources may not be available for growth to occur in waste material'***.

Ability of the pest to move from the pathway to a suitable host

A recent laboratory experiment has shown that Mediterranean fruit fly can act as a vector of *E. amylovora* from infested apple fruit **(Ordax *et al.* 2010b).**

New scientific reference for review

This new science adds a new vector to the list and given that Mediterranean Fruit Fly is an established pest with Western Australia makes the spread of the disease within that state more likely.

This study showed transmission could occur under favourable artificial conditions, which do not replicate conditions that would occur with imported apple fruit. In the pathway considered in this review of policy, bacteria are within the adverse environment of the calyx, in low numbers and in an attenuated state. The experiment of **Ordax *et al.* (2010b)** is more closely aligned to the vector transfer of *E. amylovora* from oozing cankers on plant material, a method of dispersal that is already well known in the epidemiology of the fire blight (van der Zwet and Keil 1979).

New scientific reference for review

Apple and Pear Australia Limited rejects the assessment of Biosecurity Australia that the information shown through this study

c) 'do not replicate conditions that would occur with imported apple fruit', or the

d) 'bacteria are within the adverse environment of the calyx, in low numbers and in an attenuated state'.

Apple and Pear Australia Limited would accept that "*the experiment of Ordax et al. (2010b) is more closely aligned to the vector transfer of E. amylovora from oozing cankers on plant material, a method of dispersal that is already well known in the epidemiology of the fire blight (van der Zwet and Keil 1979)'* is a reasonable assessment from the scientific paper.

A recent study has reaffirmed that the flesh of fresh apple fruit does not lead to the multiplication of *E. amylovora* to produce symptoms or bacterial ooze **(Ordax *et al.* 2010b).**

New scientific reference for review

Apple and Pear Australia Limited finds this assessment as confusing given that the following extracts from the scientific research paper (part A):-

> ***"In conclusion, it has been shown that asymptomatic fruits can be naturally contaminated after a fire blight episode, at least in a certain percentage. In fact, our results of the analysis of symptomless azaroles show that latent infections in fruits can occur, as reported in other host fruits for E. amylovora [Schroth et al., 1974; van der Zwet et al., 1990]."***

Apple and Pear Australia Limited finds this assessment as confusing given that the following extracts from the scientific research paper (part B) :-

"The bacterium was able to retain their culturability in cuts and small peeled areas on disinfected mature apples at similar inoculums levels during the first 5 days (around 10^7 cfu/ml) regardless the area of the fruit in where the cuts or the peelings were performed."

And

"Moreover, epiphytic and endophytic E. amylovora populations were recovered in similar levels in transmitted fruits with cut damages or small peeled areas, so both kinds of lesions were shown as susceptible to be contaminated by this insect."

Apple and Pear Australia Limited has considered this paper in more detail in another section of this submission.

Ability of the pest to initiate infection of a suitable host.

There is no accepted threshold number of bacteria required to initiate an infection, and this may vary with environmental and host factors. One cell of *E. amylovora* can potentially infect pomaceous flowers through the hypanthium. However, the minimum infective dose generally depends on environmental conditions, pathogen aggressiveness, and host susceptibility. The likelihood of infection increases with inoculum load and high levels of fresh inoculum (>10^4 cfu) are required for high rates of infection (Cabrefiga and Montesinos 2005; **Pusey and Smith 2008**).

New scientific reference for review

The scientific paper did indicate that *'in our field experiment the inoculums level of 10^2 CFU per flower hypanthium'* can cause a disease incidence.

In contrast, stigmas of crab-apple trees supported bacterial growth in 4- to 10-day-old flowers, depending on temperature and pollination. However, disease incidence was relatively high only when hypanthia were inoculated at ages between 0 to 4 days (Pusey 2004). Later it was shown infection rates steadily decreased over a 10 day period from flower opening **(Pusey and Smith 2008).**

New scientific reference for review

In reviewing this scientific paper it is worth understanding the nature of the research application used in relation to the crab-apple trees:-

"Controlled-environment experiments with detached flowers have enhanced our understanding of variables affecting bacteria colonization on the stigma (12, 20, 21) and bacterial infection through the hypanthium (3, 20). This approach may have less value for investigating disease in relation to flower age, since over time

the physiology of detached flowers is expected to increasingly diverge from that of blossoms in the field. Nevertheless, detached flowers appear to go through the same late development and senescence stages as those observed in the field (21; P. L. Pusey, unpublished).”

Probability of establishment

Availability of suitable hosts, alternative hosts in the PRA area.

Detailed information on exact flowering times for pome fruit production areas is not available. Flowering patterns vary with latitude and altitude. However, it has been shown for the Goulburn Valley that the flowering period for apple and pear coincides with suitable infection periods for *E. amylovora* **(Gouk 2008).**

New scientific reference for review

Details on exact flowering times of pome fruit production areas is available and Apple and Pear Australia Limited would be willing to make them available.

The work by S C Gouk highlights the vulnerability of one of the major apple and pear growing regions within Australia to Fire Blight.

Suitability of the environment

Erwinia amylovora is native to North America and was initially recorded from England in 1958 (van der Zwet and Kiel 1979). Since then is has established across continental Europe and to Mediterranean countries in Europe, Middle East and North Africa (CABI 2002; Bonn and van der Zwet 2000). Many of these countries, particularly the Mediterranean countries, have climates broadly similar to temperate regions of Australia **(Peel *et al.* 2007).**

New scientific reference for review

This scientific reference further highlights the position consistently taken by Apple and Pear Australia Limited that Australia has the appropriate climatic conditions for Fire Blight to establish and spread.

A recent study has confirmed that the Goulburn Valley in Victoria, the main pome fruit region of Australia, has suitable climatic conditions for inoculum production and infection in spring that coincide with the main blossom period and results in many potential high risk infection events **(Gouk 2008).** This study used the two most important predictive models for blossom infection that have been used effectively in North America and New Zealand to predict infective events and manage blossom infection (Steiner 1990; van der Zwet *et al.* 1994; Biggs *et al.* 2008; Manktelov and Tate 2001).

New scientific reference for review

The work by S C Gouk highlights the vulnerability of one of the major apple and pear growing regions within Australia to Fire Blight.

Reproductive strategy and the potential for adaption

The stigmas of blossoms are the most receptive sites for initiation of new infections, where bacteria can multiply rapidly. Bacterial populations often reach 10^6 to 10^7 cfu per healthy flower (Thomson 1986; **Johnson *et al.* 2009**).

New scientific reference for review

Apple and Pear Australia Limited would accept this as a reasonable assessment from the scientific paper.

Cultural practices and control measures

Naturally occurring bacterial antagonists (for example, *Pantoea agglomerans* [synonym: *Erwinia herbicola*] and *Pseudomonas fluorescens*) have proven to be effective against blossom infection (Johnson and Stockwell 2000; **Cabrefiga *et al*. 2007)** although results can be variable in some locations **(Sundan *et al.* 2009)**.

New scientific reference for review

The scientific paper titled 'Mechanisms of antagonism of *Pseudomonas fluorescens* EPS62e against *Erwinia amylovora*, the casual agent of fire blight" (Cabrefiga et al. 2007) was a report on the work undertaken on pears.
Apple and Pear Australia Limited seeks confirmation from Biosecurity Australia that the information in this scientific paper can be extrapolated to apples.

Sundan et al (2009) indicates the following:-

> ***"When examined individually, the biological control materials were not consistently effective in reducing blossom infection."***
>
> ***And***
>
> ***"The antibiotic streptomycin is currently the most effective compound available to growers for limiting populations of the fire blight bacterium on flowers."***
>
> ***And***
>
> ***"The success of bacterial biological control agents in the western United States has been erratic."***
>
> ***And***

“Our results indicate that biological control efforts with bacterial antagonists were largely ineffective in reducing the incidence of blossom blight in field trials with inoculated trees in Michigan, New York, and Virginia. The requirements for bacterial antagonists to be successful in biological control of blossom blight include the colonization of a large proportion of flower stigmata with growth to a large population size.”

And

“Of the three bacterial antagonists examined in this study, Pseudomonas fluorescens A506 exhibited the least potential biological control activity and colonized the lowest percentage of flowers (mean colonization of 61% in 13 experiments, Table 6).”

And

“These new observations indicate that there is still much to learn concerning the biology and ecology of Pseudomonas fluorescens A506 and Pantoea agglomerans C9-1. Likewise, it is also critical that a knowledge base is gained of E. amylovora virulence factors that enhance colonization of stigmata (19, 37), as well as the physical partitioning of the pathogen in this habitat.”

And

Our results indicate that the biological control Serenade (active ingredient: lipopeptides produced by B. subtilis QST713) was slightly more efficacious in blossom blight control than the bacterial antagonists and more consistent from year to year and between locations.”

And

“In summary, the bacterial antagonists Pseudomonas fluorescens A506 and Pantoea agglomerans C9-1 and E325, and the biological control agent Serenade were insufficiently effective in controlling blossom blight when applied as the sole control agent in trials conducted in Michigan, New York, and Virginia.”

And

“However, materials with high variability in control performance are not good options for growers.”

Probability of spread

Suitability of the natural/or managed environment.

Many of these countries, particularly the Mediterranean countries, have climates broadly similar to temperate regions of Australia **(Peel *et al.* 2007).**

New scientific reference for review

This scientific reference further highlights the position consistently taken by Apple and Pear Australia Limited that Australia has the appropriate climatic conditions for Fire Blight to establish and spread.

More recently, fire blight has continued to spread in the Mediterranean region and has now been recorded from Syria and Morocco **(Ammouneh *et al.* 2007**; **Fatmi and Bougsiba 2008**).

New scientific reference for review

Apple and Pear Australia Limited argues that these outbreaks show that the movement of Fire Blight around the world continues unabated at cannot be contained even with the large amount of past current and new science that has/is being undertaken.

Most years, environmental conditions in many Australian apple and pear growing areas (notably the Goulburn Valley) are favourable for infection and spread of *E. amylovora* (Penrose *et al.* 1988; Wimalajeewa and Atley 1990; Fahy *et al.* 1991; **Gouk 2008**).

New scientific reference for review

The work by S C Gouk highlights the vulnerability of one of the major apple and pear growing regions within Australia to Fire Blight.

Recent research has identified the effectiveness of kasugamycin as a product that controls blossom infestation and subsequent shoot infection in apple and pears **(McGhee and Sundin 2011: Adaskaveg *et al.* 2011).** However, this product is not currently a registered chemical in Australia.

New scientific reference for review

Apple and Pear Australia Limited would accept that this research is of interested but as indicated the product is not currently registered in Australia and therefore has currently no value even were there and outbreak of Fire Blight in Australia.

Biosecurity Australia does not indicate whether this chemical is registered for use in New Zealand and/or whether it is being used in New Zealand.

The researchers highlight that

"Taken together, all of these results indicate that Kasumin represents a viable alternative antibiotic, in particular for use for fire blight management in orchards harboring SmR strains of E. amylovora."

Apple and Pear Australia Limited seeks clarification from Biosecurity Australia as to whether the New Zealand strains of Erwinia amylovora are SmR strains.

Potential for movement with commodities, conveyances or vectors

A recent review has stated *E. amylovora* can survive for many years in the xylem tissue and symptoms do not express until the xylem is damaged and the bacteria invade the parenchyma tissue **(Billing 2011).** These are factors that could assist in the spread of *E. amylovora* in planting material.

New scientific reference for review

Apple and Pear Australia Limited would accept this as a reasonable assessment from the paper prepared by Billing (2011).

Potential natural enemies

It has been reported that one reason why Australian orchards have remained free of fire blight is in part due to natural antagonists **(Sosnowski *et al.* 2009).**

New scientific reference for review

The following extract from the technical paper may assist in understanding the context of the above statement:-

"Biological control has been commonly employed to control endemic plant pathogens, but due to its variable nature has not been considered for eradication of exotic pathogens. However, there may be potential for its use as part of an integrated approach, especially for containing an outbreak. Bacteriophage may provide a promising strategy in the control of fire blight. Bacteriophages isolated from E. amylovora have shown a high degree of lytic activity against E. amylovora in the laboratory, but there have been no studies to determine the effectiveness of the phage as a control agent in the orchard environment. To date, E. amylovora lytic phage has been investigated only in areas where fire blight is endemic in the USA (Schnabel et al., 1999) and Canada (Svircev et al., 2002).
Australian orchards have remained free of fire blight and this may be due in part to the presence of some natural defence mechanisms in those orchards in the form of a natural antagonist of E. amylovora such as an aggressive bacteriophage."

Apple and Pear Australia Limited believes the later part of this extract is not supported by any scientific evidence and therefore has no relevance to the current Import Risk Analysis.

There is evidence for a unique microflora consisting of closely related saprophytic *Erwinia* species in Australian orchards, which requires further investigation **(Sosnowski *et al.* 2009)**

New scientific reference for review

As this statement is not supported by any scientific data Apple and Pear Australia Limited would seek clarification as to whether Biosecurity Australia has undertaken the investigation as considered important by the researcher?

Consequences

Significant at the national level

More recently a study has estimated the consequences of *E. amylovora* in Australia could in the range of $33 to $95 million per year depending on the model used to estimate consequences and confidence assigned to those estimates **(Cooke *et al.* 2009).**

New scientific reference for review

Apple and Pear Australia Limited questions where Biosecurity Australia has utilised this information in assessing the impact at the national, regional and local domestic situation.
This would seem to be a highly important figure in determining the consequence on the industry.

Further, the major pome fruit producing region in Australia is reported to have a very suitable climate based on fire blight predictive models **(Gouk 2008).**

New scientific reference for review

The work by S C Gouk highlights the vulnerability of one of the major apple and pear growing regions within Australia to Fire Blight.

Significant at the regional level

Eradication of *E. amylovora* has also been tried in other countries without success and highlight the difficulty and expense involved **(Sosnoski *et al.* 2009).** However, in Norway eradication events continue as the program has severely reduced the prevalence of the disease in combination with unfavourable seasonal conditions **(Sosnoski *et al.* 2009).**

New scientific reference for review

The following is an extract from the technical paper that puts this statement in context:-

> ***"Fire blight was not detected in Norway between 1993 and 2000 (Sletten & Melboe, 2004). It is not clear if the recent detection of fire blight within the restriction zone in 2000 is due to the re-emergence of the original inoculum or a more recent introduction. Although no evidence was provided, it was believed that the limited spread from this incursion was due to the illegal movement of contaminated Cotoneaster plants and beehives between private gardens. The strict eradication campaign has now been re-established in Norway to prevent the spread of fire blight into the important fruit growing areas and nurseries (Sletten & Melboe, 2004)."***

APPLE LEAF CURLING MIDGE
Dasineura mali

This species is native to northern Europe, and has been introduced to both North America and New Zealand **(Gagné 2007).**

New scientific reference for review

This is general information on the pest but does not have any bearing on the aspects relating to the export of apples from New Zealand.

When fully grown, larvae are 1.5–2.5 mm long **(LaGasa 2007).**

New scientific reference for review

This is general information on the pest but does not have any bearing on the aspects relating to the export of apples from New Zealand.

Pupation takes place in a white silken cocoon 2–2.5 mm in length **(LaGasa 2007)**

New scientific reference for review

This is general information on the pest but does not have any bearing on the aspects relating to the export of apples from New Zealand.

The adult female deposits eggs in the leaf folds or along the margins of immature apple leaves **(LaGasa 2007).**

New scientific reference for review

This is general information on the pest but does not have any bearing on the aspects relating to the export of apples from New Zealand.

Probability of Entry

Ability of the pest to survive existing pest management

Control of *D. mali* in New Zealand involves a range of biological control agents such as the egg parasitoid *Platygaster demades* (Hymenoptera: Platygasteridae) and predatory mites such as *Anystis* spp. (Acarina: Anystidae) **(Shaw and Wallis 2008).**

New scientific reference for review

This research was undertaken in a block of apples at the HortResearch orchard in Nelson and not in a commercial orchard. In addition most of the trees had either five applications of IFP insecticides or eleven applications of carbaryl.
More importantly the researchers report that

> **"*The relatively small size of the trial plots, the mobility of some of the natural enemies monitored and the inability of carbaryl to exclude them totally from the treated plots makes interpretation of the results difficult".***

The mirid bug *Sejanus albisignata* (Hemiptera: Anthocoridae) is also noted as a predator of *D. mali* eggs **(Shaw and Wallis 2008).**

New scientific reference for review

The mirid bug *Sejanus albisignata is* known not to exist in Australia. The findings of this research raises the question of whether the predator mired bug could be transported to Australia with infested apples or trash. Biosecurity Australia has failed to assess the implications and consequences of the mirid bug being transported to Australia by apples and then in itself becoming a 'pest' within the Australian environment and having its own dire consequences?

Similar parasitism results were found in the North Palmerston district, which is between Wellington and Hawke's Bay. In that study, the parasitism rates were 55, 41, 68 and 73 per cent of the first, second, third and fourth (overwintering) generations respectively **(He and Wang 2007).**

New scientific reference for review

This research was done in an organic orchard at Massey University, Palmerston North in New Zealand and not on a commercial orchard. There is no understanding of the level of the Apple Leaf Curling Midge population and while the research highlights that parasitism does occur it is not a process that results in the elimination of the insect within the orchard.
The researchers also highlight that

"information on the seasonal cycle of P. demades under natural conditions is still lacking, making it difficult to understand its population dynamics and the co-evolution of the host-parasitoid system".

And

"Sandanayaka & Charles (2006b) suggest that ALCM may become a contaminant of export fruit if mature larvae fall into the calyx of the fruit and pupate there. All unparasitised ALCM in the first three generations emerged normally during the season.
Therefore, it is thought that the main cause of fruit contamination could be ALCM parasitised by aestivated P. demades and fourth generation ALCM (Fig. 1) attaching to the fruits."

Based on these statements the research

c) **lacks clarity on how the host-parasitoid system works in natural conditions, and**
d) **gives an indication that apple fruit will be contaminated, but**
e) **gives no confirmation as to what might be in contaminated fruit.**

The parasite *Platygaster demades* was introduced into New Zealand in 1925 to assist in the control of pear leaf-curling midge.

The findings of this research raise a number of questions: whether the parasite *Platygaster demades is* known to exist in Australia and whether the parasite could be transported to Australia with infested apples or trash.

Again, Biosecurity Australia has failed to assess the implications and consequences of the Platygaster demades parasite being transported to Australia by apples and then in itself becoming a pest within the Australian environment and having its own dire consequences?

Association of the pest with the commodity pathway

If a pupa did not move when prodded it was considered to be dead. Expressed as a proportion of occupied cocoons, 75 per cent contained dead pupae **(Rogers 2008)**

New scientific reference for review

The actual statement made by Dr David Rogers in his letter to Karen Sparrow, Manager Plant Imports, Biosecurity New Zealand dated 16th August 2008, was

"In our study the figure of 60% of all cocoons, included both occupied and unoccupied cocoons. The context of the study was to determine actual quarantine risk, ie viable occupied cocoons.

Therefore we expressed the number of dead ALCM as a proportion of all cocoons (both occupied and unoccupied) that could be found during inspection. If the number of dead ALCM was expressed as a percentage of occupied cocoons only, the mean mortality was 75%".

Apple and Pear Australia Limited see no relevance to the statement that *"if a pupa did not move when prodded it was considered to be dead"* given that there is no reference to that statement in the correspondence from Dr Rogers.
If you consider the reverse to the statement the number of live ALCM as expressed as a percentage of occupied cocoons only the mean live ALCM is 25%. This would be considered a significantly high quantity of live cocoons.

The 2008 response by Dr Rogers was in relation to a question raised about the original paper titled "Apple leafcurling midge cocoons on apple: pupal occupancy and mortality". The interesting aspect is that Biosecurity Australia report in their bibliography to the "draft report for the non-regulated analysis of existing policy for apples from New Zealand" that the 2006 paper is an 'unpublished paper provided by Ministry of Agriculture and Forestry, New Zealand.

Apple and Pear Australia Limited would question how an unpublished paper has any relevance to the Import Risk Analysis process.

Probability of distribution

Completion of development

In that study, the parasitism rates were 55, 41, 68 and 73 per cent of the first, second, third and fourth (overwintering) generations respectively **(He and Wang 2007).**

New scientific reference for review

Refer to the information above.

Ability of the pest to move from the pathway to a suitable host

Adult male *D. mali* have been recorded to fly distances of at least 50 metres **(Cross and Hall 2009)**, though longer distance flight may also be possible **(Cross 2010**). While specific studies on the flight potential of females have not been conducted, similar flight distances would be expected.

New scientific reference for review

This is general information on the movement of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.

All that one can take from this science is that 50 metres is at least the distance that an adult male can travel. It could be much further but it has not been researched.

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Suckling *et al.* (2007) further reported that the maximum colonisation distance for females was 30m.

New scientific reference for review

This is general information on the movement of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.
All that one can take from this science is that 30 metres is at least the distance that an adult male can travel. The researcher/s conclusion that 30 metres is a maximum distance for female movement is in conflict with the reference by Cross and Hall, 2009 and Cross, 2010.

It is worth noting that this distance is in relation to the research about colonisation of a block from the edge of a block and not necessarily about the distance travelled in flight. There may be other factors within the orchard that may affect/restrict the movement in a normal flight pattern.

Ability of the pest to initiate infestation of a suitable host

Adult female midges held at 4°C with moisture available survive 4–5 days, and rarely 6 days. Further, most male and female midges held at 18–20°C in a low airflow environment survived less than one day **(Cross 2010).** A shorter life span of 1–2 days has also been reported **(Suckling *et al.* 2007).**

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

New scientific reference for review

In relation to the reference "a shorter life span of 1-2 days has been reported (Suckling et al, 2007) Apple and Pear Australia Limited believe that there is no relevance to this given that

c) the quote comes from the 'Materials and Methods' part of the document and not within the 'results', and
d) the information is referenced as W.R.M.S., unpublished data.

Probability of establishment

Suitability of the environment

It is possible that the relatively dry environmental conditions in many regions of Australia where apple and crab-apple trees are grown would be unsuitable for *D. mali* to survive long enough to establish a persistent population. This, along with potential absence of suitable conditions to enter or break diapauses, would appear to be the case in countries such as Greece, Turkey and Spain that produce apples, but have no records of *D. mali* **(CABI CPC 2008).**

This is general information on the environmental conditions under which the pest might/might not survive but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand. The comment above is based on supposition and not on any science.

APAL does not believe that the CABI Crop Protection Compendium 2008 document is in itself a true scientific paper. The original scientific source for the research reported within CABI and used by Biosecurity Australia needs to be referenced. If this is not possible the document has little relevance to this risk assessment process.

Reproduction strategy and the potential for adaptation

Females are reported to commence "calling" for mates two hours after emerging from pupation **(Suckling *et al.* 2007).**

New scientific reference for review

This reference actually gives strong support to the fact that live fertile females start mating and egg development in a very short period of time and if such insects were to arrive in Australia could result in very quick population development.

The pheromone has subsequently been utilised to develop a trap for male *D. mali* **(Cross and Hall 2009).**

New scientific reference for review

This is general information on the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand. While pheromones may be a way of managing the insect they do not eliminate the pest. In other examples of pheromone use Australian growers are aware that pheromones are far less effective when there are high populations of the insect. Chemicals are required to lower the pressure before obtaining effective management from the pheromones.

Cultural practices and control measures

Generalist predators such as *Anystis sp*. and *Sejanus albisignata* also provide some control of *D. mali* in New Zealand **(Shaw and Wallis 2008).** While *Sejanus* species are not recorded from Australia, there are two species of

Anystis in Australia, *A. wallacei* and *A. baccarum* (AICN 2005). These species, or other generalist predators, may result in some mortality in any *D. mali* populations. However, it is not considered that they would prevent *D. mali* from establishing a founding population

New scientific reference for review

Biosecurity Australia has not advised stakeholders whether the two species *A. wallacei* and *A. baccarum* found in Australia are the same Anystis species as those found in New Zealand.
If there are different species of Anystis in New Zealand they should be identified. Moreover, Biosecurity Australia should conduct a risk assessment on those Anystis species to determine the level of risk that they are transported to Australia with apples and then in themselves become a 'pest'.

More importantly, however, Biosecurity Australia itself has highlighted that

> ***"These species, or other generalist predators, may result in some mortality in any D. mali populations. However, it is not considered that they would prevent D. mali from establishing a founding population".***

European earwig (*Forficula auricularia*) has also been established as a predator of *D. mali* larvae and will bite through leaves to access its prey (**He *et al.* 2008).**

New scientific reference for review

This scientific work is a combination of laboratory and field work.
In previous work of He and Wang (2007) they report that there are four generations occurring in Palmerston North

> ***"overwintered generation, late September–late October; first generation, late November–early January; second generation, mid January–early March; and third generation, early March–early April".***

The research was again done in an organic orchard at Massey University. Given that insecticides are not used in the organic orchard it is highly likely that both the Apple Leaf Curling Midge and the European Earwig were in higher numbers.
Given that the orchard was an organic orchard the use of the insecticide carbaryl would not have been used. The work of Shaw and Wallis (2008) highlights that carbaryl is used in IFP orchards and that *"no earwigs were recorded in the carbaryl treatment".*
Australian apple growers are well aware of the biological control capacity of Earwigs but find that their numbers within orchards are never high enough. More importantly Earwigs are a pest in cherry orchards so

growers producing both apples and cherries are in conflict over the value of the Earwig as a predator.

What the research does not cover is how widely spread European Earwigs are within New Zealand orchards. Biosecurity Australia gives no indication of that within the "Draft report for the non-regulated analysis of existing policy for apples from New Zealand".

The research being addressed by the above reference appears to have been undertaken in a short period in January 2008 as part of the second generation. There is no reference to whether this pattern is replicated in other parts of the year and in other generations.
More importantly the researchers highlighted that

> ***"Further investigation into this potential biological control agent for ALCM is warranted. For example, programmes like laboratory mass-rearing and field augmentation, conservation and trapping can be developed to biologically control ALCM populations using European earwigs".***

Apple and Pear Australia limited would argue that while the science is of some interest it is not in practise within New Zealand and has no scientific evidence that it is successfully in reducing the populations of Apple Leaf Curing Midge.

Probability of spread

Suitability of the natural/or managed environment

From Europe, *D. mali* is reported as present in Finland, Norway and Sweden in the north and Bulgaria, Italy, and Macedonia in the South **(CABI CPC 2008).**

> ***General information with no new science.***

This is general information on the potential distribution of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.

APAL does not believe that the CABI Crop Protection Compendium 2008 document is in itself a true scientific paper. The original scientific source for the research reported within CABI and used by Biosecurity Australia needs to be referenced. If this is not possible the document has little relevance to this risk assessment process.

The distribution of *D. mali* appears to have reached an equilibrium with the pest spanning the northern latitudes from 38°N to 65°N **(CABI CPC 2008; Cross 2010)**

> ***General information with no new science.***

This is general information on the potential distribution of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.
Any extrapolation to possible Australian conditions will only be based on models which use broad parameters and fail to take into account specific environmental and topographical aspects of the unique growing regions of Australia.
It is well known that in an apple growing region the climatic and environmental conditions vary from one subregion to another subregion and this results in different maturity times and harvest times.
One model does not fit all circumstances unless you put in the very specific localised information.

Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science

Presence of natural barriers

Adult *D. mali* is capable of independent flight. Adult males have been trapped with pheromone lures at distances up to 50m **(Cross and Hall 2009)** though longer distances were not tested.

New scientific reference for review

This is general information on the movement of the pest but does not have any scientific bearing on the aspects relating to the export of apples from New Zealand.
All that one can take from this science is that 50 metres is at least the distance that an adult male can travel. It could be much further but it has not been researched.

EUROPEAN CANKER
Neonectria ditissima

Under field conditions, temperatures of 11–16°C with a measure of leaf wetness provide the best predictors of disease prevalence **(Beresford and Kim 2011).**

New scientific reference for review

While the research supports the temperature range of 11 – 16 ^{o}C offer the best predictor of disease prevalence it is not definitive in saying that the disease will only occur in this temperature range. Conditions as temperatures either side of the range have not been tested.

Probability of entry
Association of the pest with the crop

However, annual rainfall alone is considered a poor predictor of disease prevalence **(Latorre 2010; Swinburne 2010a)** and duration of leaf wetness in combination with suitable temperature provide a more reliable predictor of European canker **(Swinburne 2010a).** Recent work predicts disease prevalence under field conditions is best predicted by temperatures of 11^{o} C–16 ^{o} C and a measure of leaf wetness (number of rainfall days per month) **(Beresford and Kim 2011).**

> ***Lattore 2010 and Swinburne 2010 are Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science***
>
> ***New scientific reference for review***

While the research supports the temperature range of 11 – 16 ^{o}C offer the best predictor of disease prevalence it is not definitive in saying that the disease will only occur in this temperature range. Conditions as temperatures either side of the range have not been tested.
Similarly, the leaf wetness days are only a guide and are not definitive in saying that the disease will only occur at 30% of days/month.

Later work predicts the current distribution of European canker in New Zealand based on temperature and leaf wetness **(Beresford and Kim 2011).**

> ***New scientific reference for review***

This work only predicts the distribution using averages and means of weather data. There is nothing within the model that deals with either variable climate (climate change) or extreme environmental events that might trigger an outbreak outside of the normal conditions.

Association of the pest with the commodity pathway

The typical rainfall and temperature patterns of major New Zealand apple export areas would suggest latent infection is very unlikely to occur as conditions during fruiting are not favourable for conidia production and subsequent fruit infection **(Beresford and Kim 2011).**

In scientific and statistical terms what does 'very unlikely' mean?
This term is not quantified within the documentation.

> ***New scientific reference for review***

In the south east of England, under artificial conditions with high inoculum and humidity, fruit infection has been recorded to occur most readily up to four weeks after flowering and infection can continue to occur on fruit one week before harvest under suitable conditions **(Xu and Robinson 2010).**

New scientific reference for review

The research highlights that given the right level of inoculum and climatic conditions fruit infection can occur

c) up to four weeks after flowering, and

d) can continue to occur on fruit one week from harvest.

This would highlight the need for specific measures for orchards known to have an outbreak of European canker.

In addition, low temperatures that would justify frost management are not conducive to European canker **(Beresford and Kim 2011**) if *N. ditissima* was recorded from the region in the future.

New scientific reference for review

This is an assumption that endeavours to link low temperatures with frost management and infection without any sound scientific data.

Recent research has supported the suitability of the Auckland region for European canker disease based on a worldwide comparison of climate suitability **(Beresford and Kim 2011).**

New scientific reference for review

Given that this is the assessment of the scientists Biosecurity Australia must undertake specific measures for fruit that might be exported from this region

Ability of the pest to survive existing pest management

A recent study on fruit rots in New Zealand sampled over 12,000 apples from the Hawke's Bay area, that included treatments to promote rot development (wounding, cold storage), and found no European canker rots **(Scheper *et al.* 2007).**

New scientific reference for review

Apple and Pear Australia Limited find this an most confusing reference given that the work undertaken by Scheper et al was specific to storage rots after postharvest apple washing and gives no consideration and/or reference to European Canker. While 12,000 fruit might have been used they were used across various treatments including controls.
More importantly the researchers indicate that in undertaking the statistical analysis

> ***"there was no replication of main plots. Therefore it is not possible to test the main effect of the postharvest treatment"***

Ability of the pest to survive packing, transport and storage conditions

It is likely that latently infected fruits that can develop rots during this time **(Berrie *et al.* 2007)** will be removed during this inspection.

> ***New scientific reference for review***

Apple and pear Australia Limited would question the context of this particular reference particularly when the scientific paper says the following:-

> ***"However, as Bramley apples can be stored for almost twelve months losses due to nectria rot are potentially much higher, particularly in those stored in low level oxygen, high carbon dioxide regimes (3.5º C, 1% oxygen, 5% carbon dioxide)(Prinja, 1989). N. galligena infects developing apples in the orchard between blossom and harvest. Some infections develop into eye rots in the orchard, but many remain latent and subsequently develop in cold store, usually after 3 months. Nectria rots in store occur as eye rots, stalk end rots or cheek rots. Those at the stalk end are often difficult to detect during grading, but develop into visible rots during marketing….."***

Apple and Pear Australia limited would contend that one possible scenario is that:-

e) there is infection in the orchard between blossom and harvest, and
f) the fruit comes straight from the orchard and is packed without cold storage, and
g) there is stalk end rots that are not picked up during grading, and
h) the fruit is immediately exported to Australia.

The end result is that the rot is detected during 'marketing' in Australia. This seems a very logical and feasible pathway for *Nectria galligena*.

Probability of distribution

Ability of the pest to initiate infection of a suitable host

However, under field conditions, temperatures in the range of 11 ºC –16 ºC are a better predictor of disease prevalence **(Swinburne 2010a; Beresford and Kim 2011).**

> ***Swinburne 2010a reference is Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science***

> ***New scientific reference for review***

While the research supports the temperature range of 11 – 16 ^{o}C offer the best predictor of disease prevalence it is not definitive in saying that the disease will only occur in this temperature range. Conditions as temperatures either side of the range have not been tested.

In summer, low rainfall and high temperatures are unfavourable for disease development **(Beresford and Kim 2008; Beresford and Kim 2011).**

New scientific reference for review

While this statement may have some validity the researchers have not appeared to consider the climatic variability and extreme weather events that might present both rainfall and temperatures in summer that are favourable for disease development.

Probability of establishment

Suitability of the environment

Recent climate models have confirmed Tasmania as marginal for European canker **(Beresford and Kim 2011).** This work predicts with some accuracy the suitability of the climate for European canker around the world. Although this work does not cover other areas of Australia, an earlier version of this work presented information that predicts other apple growing regions of Australia would also be marginally suitable for European canker **(Beresford and Kim 2008).**

New scientific reference for review

The scientific work has only used a past example of the outbreak of European canker in Spreyton in Tasmania as a base from which the researchers have made this prediction. The use of other data from Tasmania the researchers have used Global Summary information from Mt Wellington and the Grove research centre. Industry would question the relevance of that average/mean information from at least one of those weather stations.
Similarly they have used data from Australian weather sites that lack relevance to the actual growing areas within those regions.
For instance growers in Orange have highlighted in a recent Cherry Industry Climate Change project that the information from the Orange Airport weather station has no relevance to the specific growing regions that are many kilometres from the Orange Airport.
The researchers have not taken into account the specific aspects of regional variance in their modelling.

Another climate model predicted a greater range of locations that would be suitable for European canker in Australia **(Baker and Mewett 2009).** However, this study noted that conditions in Australia are typically less conducive (warmer and drier) than regions of the world where European canker is highly prevalent. The model also predicts regions of New Zealand are very suitable for European canker where the disease is rarely present or absent. This work may be considered a more conservative model in predicting European canker establishment.

New scientific reference for review

The report by Baker and Mewett indicates the following main findings of their work:-

:

"***Using the Beresford and Kim (2007) infection requirements and location-specific weather data, there are Australian commercial apple-growing regions and Australian port cities meeting the infection requirements for European canker."***

And

"Assuming that a combination of more than 6 hours rainfall and more than 8 hours of temperatures between 10–16^{o}C on the same day can cause European canker infection or spread (Grove 1990; Lolas and Latorre 1996; Latorre et al. 2002), it can be shown that New Zealand and Australian locations experience conditions in all seasons that meet these requirements."

And

"This report uses Lenswood (Adelaide Hills region) as representative of the cooler apple-growing regions of Australia. Based on the predictive model developed by Latorre et al. (2002), warnings of European canker infection could occur in the temperate commercial apple-growing regions of Lenswood during autumn."

The report concludes that:-

"A comparison of a limited number of Australian and New Zealand locations shows that climatic conditions in Australia can be very similar to those of regions already infected by European canker in New Zealand. It is therefore reasonable to assume that European canker could establish and spread to host plants in commercial apple-growing regions and metropolitan areas such as Sydney and Melbourne in Australia should European canker enter the country."

Reproductive strategy and the potential for adaption

Ascospores have only been recorded from the most suitable climatic regions in New Zealand (Brook and Bailey 1965**)** that are considered more suitable for European canker than regions in Australia **(Beresford and Kim 2011).**

New scientific reference for review

The research highlights that ascospores can exist within most suitable climatic regions within New Zealand. As a result the possibility of outbreak of the disease in New Zealand orchards in those most suitable climatic regions is real.

Probability of spread

Suitability of the natural/or managed environment

The lack of spread may have been because of the absence of airborne ascospores which are better suited to long-distance dispersal than conidia (Ransom 1997), combined with marginal climatic conditions **(Beresford and Kim 2011).** The use of chemicals to control apple scab may also have limited disease spread **(Latorre 2010; Swinburne 2010a).**

New scientific reference for review

This reference is an expert judgement that is not supported by any scientific data and while the response by both Latorre and Swinburne are expert judgements it does highlight that other aspects other than climatic conditions may have limited the disease spread in Tasmania.

The Latorre 2010; Swinburne 2010a *references are Expert Replies/comment from the Scientific Experts to Questions Posed by the Panel. World Trade Organization WT/DS367/11 and not new science*

Consequences

Plant life or health – Significant at the district level

In Australia, recent climate models have confirmed Tasmania as marginal for European canker **(Beresford and Kim 2011).** This work predicts with some accuracy the suitability of the climate for European canker around the world. Although this work does not cover other areas of Australia, an earlier version of this work presented information that predicts that most other apple growing regions of Australia would be marginally suitable for European canker **(Beresford and Kim 2008).** These apple growing areas include the major production area of the Goulburn Valley in Victoria. The marginal climatic suitability of Australia will limit any potential impact *N. ditissima* may have on host plants.

New scientific reference for review

The scientific work has only used a past example of the outbreak of European canker in Spreyton in Tasmania as a base from which the researchers have made this prediction. The use of other data from Tasmania the researchers have used Global Summary information from Mt Wellington and the Grove research centre. Industry would question the relevance of that average/mean information from at least one of those weather stations.

Similarly they have used data from Australian weather sites that lack relevance to the actual growing areas within those regions.

For instance growers in Orange have highlighted in a recent Cherry Industry Climate Change project that the information from the Orange Airport weather station has no relevance to the specific growing regions that are many kilometres from the Orange Airport.

The researchers have not taken into account the specific aspects of regional variance in their modelling.

APPENDIX C EXTRACT FROM THE TECHNICAL SUBMISSION BY APPLE AND PEAR AUSTRALIA IN JUNE 2004 IN RELATION TO INTEGRATED FRUIT PRODUCTION.

INTEGRATED FRUIT PRODUCTION

9. INTEGRATED FRUIT PRODUCTION

9.1 IFP WITHIN NEW ZEALAND

The IRA and the New Zealand apple industry place a great emphasis on the widespread adoption of Integrated Fruit Production **("IFP")** in New Zealand apple orchards and that only those growers implementing IFP would be registered to export to Australia.

Integrated Fruit Production aims to produce fruit in the most environmentally friendly manner and includes as a centrepiece Integrated Pest Management **("IPM")** principles for control of pests, diseases and weeds. In general, IPM aims to reduce the use of broad spectrum insecticides by employing a variety of strategies which may include:

1. Specific insecticides with low toxicity to other life forms, particularly vertebrates, e.g. insect growth regulators **("IGR").**
2. Population reduction using specific insect sex pheromones for mating disruption.
3. Reduction in the number of sprays used by optimised spray timing based on population monitoring systems and detailed knowledge of the insect's population dynamics. These systems may include trapping of insects in sex pheromone or other traps, direct population estimates on foliage, monitoring of damage levels in developing fruit or day degree accumulation to monitor development of insect life cycle stages.
4. The use of 'economic thresholds'. These are pest levels below which spraying is not cost-effective, i.e. the cost of applying the spray exceeds the cost of the damage prevented.
5. The use of biological control agents such as predators and parasites.

Of these, methods 1, 3, 4 and 5 are widely practised in New Zealand (Shaw *et al*., 1997). The IFP programme is largely based around the use of an IGR chemical, tebufenozide, for control of the key leafroller pests and Codling Moth (Walker *et al.*, 1997, 1998). Predatory mites are instrumental in control of European Red Mite and Twospotted Mite (Wearing, 1996), and spray thresholds based on various population monitoring systems are implemented for most other pests (Walker *et al.*, 1997, 1998).

IFP has several important implications for quarantine. Compared with the traditional use of broad spectrum pesticides, orchards in which IFP is practised are likely to:

- Have higher and more variable population levels of key pests
- Include a higher diversity of pests

9.2 HIGHER KEY PEST POPULATIONS

There are several reasons why higher pest populations would occur in IFP orchards:

- For biological control to be effective there must always be a host population to support the specific predator or parasite population.
- The economic threshold philosophy virtually ensures there are low (subthreshold) populations of the pest in the orchard.
- Systems based on mating disruption are less effective for reducing pest population levels than broad spectrum sprays and usually result in higher levels of pest damage to apple crops.
- Similarly, specific chemicals such as IGRs may be less effective than broad spectrum chemicals such as organophosphates. However, tebufenozide is a particularly efficacious IGR.

9.3 HIGHER DIVERSITY OF PESTS

The use of pest control strategies targeted specifically to particular key pests, often leads to the emergence of new pests that were formerly suppressed, often unknowingly, by broad spectrum chemicals. These insects were usually recognised only as occasional or minor pests when broad spectrum sprays were in wide use. When these pests are released from broad spectrum control and become significant under IFP programmes, new control strategies need to be developed specifically for them. Such strategies must be compatible with the IFP strategies for all other pests. The result is that IFP becomes increasingly complex and fragile, often with a range of measures that result in suboptimal control of one or more of the pests because of the constraints on the system. Such systems require intensive maintenance and are prone to collapse if one of the key control measures fails due to a perturbation such as the development of resistance to a key chemical in one of the main pests. Often, there are few, if any, alternatives available.

The current pest complex on New Zealand apples features a number of pests that have risen to greater prominence under IFP (Shaw *et al.* 1997, Walker *et al*., 1997, 1998). The most notable of these is Apple Leaf Curling Midge, *Dasineura mali*, which is now one of the main apple pests in New Zealand (Smith and Chapman, 1997.) A similar phenomenon has occurred in organic blocks in New York State (Agnello *et al.* 2000), where *Dasineura mali* developed ‘serious infestations’.

However, the New Zealand apple industry is aware of the quarantine risks associated with the implementation of IFP. IFP has been introduced to minimise environmental damage in orchards and surrounding areas, and to meet the demands of consumers worldwide for produce grown in an environmentally acceptable manner. The IFP programme attempts to balance the need to meet strict quarantine regulations on its export fruit with environmental responsibility. To avoid the potential quarantine issues arising from IFP, quite conservative spray thresholds are used to minimise the likelihood of quarantine breaches (Walker *et al*., 1997, 1998).

The foregoing considerations of the potential quarantine significance of IFP in New Zealand apples have been taken into account in evaluating the risks of entry for each pest in this review. This was done wherever possible by using published results of IFP monitoring studies as the base data for this analysis.

9.4 IFP MANUAL

While the IFP Manual has been referenced throughout the RDIRA the industry has not been able to formally access the document to adequately consider the document and the importance of the document in the RDIRA.

A request for access to the IFP Manual has been made to BA (letter to Bill Roberts, 31st May 2004). In a response from Dr Brian Stynes (16th June 2004) BA indicated that *"the IFP manual is the property of the New Zealand Pipfruit Ltd (PNZ).Biosecurity Australia has been informed by New Zealand Ministry of Agriculture and Fisheries that PNZ do not wish to release the document in its entirety. They have suggested that the most effective way to handle enquiries would be to direct them to Paul Browne, General Manager of PNZ".*

Based on personal communications, industry is aware that the IFP Manual covers the following pests/diseases:

- Leafroller
- Codling Moth
- Mealybug
- Scale
- Apple Leaf Curling Midge
- Pear Leaf Curling Midge
- Woolly Apple Aphid
- European Red Mite
- Two Spotted Mite
- Froggatt's Apple Leaf Hopper
- Noctuid Moths
- Fuller's Rose Weevil
- Pear Sawfly (Pear Slug or Cherry Slug)
- Lemon Tree Borer
- Pear Leaf Blister Mite
- Black Spot
- Powdery Mildew
- Phytophthora
- Fire Blight

- Summer Rots
- European Canker

In addition the manual has a section which covers insect control for USA market access. As part of the section industry understands that there is a ‘zero tolerance for leaf roller in USDA inspection procedures’ which requires a high level of leaf roller control within blocks of fruit that will be submitted for inspection.

In addition we understand that including the utilization of the IFP program New Zealand growers are required to use additional treatments for apples submitted for USDA inspection.

Industry also understands that for many pests / diseases there is a requirement to destroy plants that are host sources for pest and diseases either within or outside the orchard.

With regards Fire Blight the IFP Manual requires the removal of alternative hosts and infected plant material from the orchard and in the vicinity of the orchard. Removal of alternative hosts should be within 100 metres of an orchard block.

Unfortunately without access to the complete document industry has been denied the opportunity to offer a full and comprehensive review and report on a document that is considered an integral part of RDIRA.

APPENDIX D: NZ Pipfruit – IFP MANUAL (2001) Extract of relevant information

Contents

A. PEST MANAGEMENT

CONTENTS

PEST MANAGEMENT
Good integrated plant protection gives priority to natural, cultural, biological and biotechnical methods of pest disease and weed control. It is about using the most selective, least toxic, least persistent product only when justified.

1. MINIMUM NZ PIPFRUIT IFP REQUIREMENTS

1.1 Education

Agrichemical Code of Practice - Anyone applying agrichemicals to export blocks must hold a current GROWSAFE Standard Certificate (one day course minimum).

NZ Pipfruit IFP Grower Discussion Groups - All first and second year NZ Pipfruit IFP growers participating in the NZ Pipfruit IFP Programme must register with an approved IFP Discussion Group Facilitator. These groups are the primary source of training on the NZ Pipfruit IFP programme requirements and will be used as a tool for communication and feedback. All growers are strongly encouraged to continue belonging to an IFP discussion group beyond the first 2 years as this is an excellent source of ongoing improvement

1.2 Record Keeping

NZ Pipfruit IFP pest and disease monitoring
Where pest and disease monitoring records are used to justify the use of agrichemicals, growers must ensure these records are:

a accurately and fully completed.
b made available to the exporter or their agent for auditing to verify that the use of the agrichemical can be justified.

1.3 Agrichemical Use

a Agrichemicals may only be used where justified.
b Applications of agrichemicals may be justified by one or more of the following methods:
- Monitoring records
- Early warning or forecast systems
- Phenology based recommendations detailed in the NZ Pipfruit IFP
  Manual

c Where the use of agrichemicals is justified, the product used must be
- as selective as possible;
- the least persistent;
- the lowest toxicity to humans, livestock, fauna, flora and the environment;

while still providing effective pest or disease control.

Approved agrichemicals
Growers must only use registered formulations of agrichemicals listed in the exporter PCR book for the control of fungi, bacteria, insects and mites.

Withholding periods and application timing
Growers must adhere to the withholding periods as stated by the exporter.

Experimental and non-approved agrichemicals

Growers must not use an experimental or a non approved agrichemical on pipfruit to be submitted to the exporter without obtaining written permission from the exporter.

Inadvertent application or drift

a Growers must follow practices that minimise spray drift so as to protect:

- the public
- neighbouring orchards
- adjacent varieties or blocks that have earlier harvest dates

b Growers who apply an agrichemical to pipfruit in error, or believe their fruit may have an unacceptable residue due to drift, must inform the exporter immediately.

1.4 Sprayer Calibration

Sprayers used to apply agrichemicals should be well maintained and regularly calibrated to ensure the correct amount of chemical is being applied to all parts of the target.

- Calibration of sprayers
  - a Calibration is compulsory for all agrichemical sprayers (excluding herbicide sprayers) used in blocks of fruit intended for export.
  - b Sprayer calibration must be completed at least once every two years. It is strongly recommended that sprayers are calibrated annually (or more frequently).
  - c Calibration and maintenance procedures must be fully documented.

2. RECOMMENDED PRACTICES

2.1 Resistance Management

Product usage should not exceed the manual guidelines. Please refer to resistance management guidelines for insecticides (Section A: Fact Sheet 2) and fungicides (Section B: Fact Sheet 2).

2.2 Thresholds

NZ Pipfruit IFP growers are encouraged to follow the monitoring threshold recommendations found in the NZ Pipfruit IFP manual. The recommendations are designed to suit most growers under a range of seasons and conditions.

However, monitoring data may need interpretation under certain circumstances. Seek advice from your NZ Pipfruit IFP Facilitator or consultant if you are unsure how to interpret the monitoring data.

2.3 USA Market

Growers intending to supply the USA market are strongly encouraged to follow the USA recommendations as outlined in Fact Sheet 15.

2.4 Non Chemical Management Methods

Non chemical pest management should be used where available and effective e.g. Integrated Mite Control (IMC). No more than 5 dithiocarbamate fungicides should be applied per season as they are disruptive to predatory mites.

2.5 Education and Safety

Growers should attend at least one seminar, workshop or field day per year that specifically addresses pest management techniques in IFP orchards.
Ongoing participation in an NZ Pipfruit IFP discussion group is highly recommended.

2.6 Chemical soil sterilisation

Chemical soil sterilisation is not an environmentally sustainable practice, and should only be practiced when absolutely justifiable.

FACT SHEETS

FACT SHEET 1: INTEGRATED PEST MANAGEMENT

Integrated pest management (IPM) is a system that integrates all suitable methods of pest control to keep pest populations below the levels that cause economic injury; IPM gives priority to biological control and uses pesticides only when pest populations exceed predetermined levels, called economic thresholds or action thresholds. Natural enemies (parasites and predators) attack many orchard pests and are used as a first line of defence in IPM. However, there are many other methods of control compatible with natural enemies, such as plant resistance (e.g. rootstocks resistant to woolly apple aphid), cultural control (e.g. planting shelter tree species which do not harbour pests), and insect pheromones (e.g. for mating disruption). These methods are preferred for IPM, and chemicals are reserved for those times when they are essential. This not only assists natural enemies to provide their full benefits, but also extends the useful life of the pesticides by delaying or preventing the development of resistance.

When spraying does become necessary, IPM also promotes improved integration of chemicals with the use of natural enemies. There are two main ways of achieving this:

1. Use of selective insecticides that reduce pest numbers, but have little effect on natural enemies (e.g. insect growth regulators).

2. Use of broad-spectrum chemicals (e.g. organophosphates) in a selective manner. For example, this can involve spraying at times when the chemical will have least effect on natural enemies (e.g. optimum miticide treatment dates), or spraying a restricted area that requires treatment (e.g. spot-treating affected trees or parts of trees) and allowing natural enemies to survive elsewhere.

A fundamental change from conventional pest control is that IPM requires knowledge of pest levels and risks within particular orchard blocks. Whereas in the past, insurance spraying was used to minimise pest risk, monitoring is essential for decision making and to minimise pest risk in IPM. This manual includes recommended treatments, sampling methods and action thresholds based on the best information currently available. They are designed conservatively to meet the requirements of pest control in the vast majority of cases, but require the grower to be vigilant and monitor the orchard carefully. Extreme pest situations can occur (e.g. a neighbouring neglected block of apples severely damaged by codling moth) which may generate extraordinary risk. As growers develop experience with this new system of pest control, they may be able to confidently make further savings in insecticide use or streamline their sampling procedures, but they should be aware that pest populations and problems can vary from season to season.

In addition to using action thresholds, IPM makes considerable use of information on the timing of pest generations (phenology) to minimise spraying. Generations of many pests are particularly well synchronised in the spring; the timing of a pesticide against a susceptible stage at that time can reduce substantially the need for spraying during the summer, and allow natural enemies to contribute more to control. Pre-bloom is the optimum time for control of several pests in this way, and there are benefits of improved spray coverage at that time. These techniques assist in reducing the need for broad-spectrum pesticides in the summer period, when many natural enemies are most active and susceptible to chemical treatment.

With reduced, targeted use of narrow spectrum pesticides, it is critical that when pesticides are used they achieve maximum effect. Accurate and complete coverage of the target is crucial.

Growers should ensure that sprayers are well maintained, regularly calibrated, and set up to ensure even and complete coverage of the target. Higher water rates are most effective for the control of many pests.

Water sensitive paper is an effective tool to monitor coverage.

Tree row volume techniques are strongly recommended.

Refer to Section G for further detail.

FACT SHEET 5: LEAFROLLER MONITORING AND CONTROL

It is strongly recommended that an application of either Match® or Mimic® be applied to coincide with the first peak in leafroller egg laying activity. This is .petal fall to the first week in November in most districts, or by 12 December in Canterbury and Otago. It is assumed that good leafroller control of this first larval generation is achieved through this initial application, except in the south where the generation is more extended.

Due to the nil tolerance of leafroller for fruit destined for the USA Market, it is highly recommended that a Match®, Avaunt® or Mimic® be applied in early December in northern districts or a Mimic® in mid January in Canterbury and Otago. These applications of Mimic® are also highly recommended in pear blocks where fruit are more vulnerable to attack by this first larval generation. In northern districts, leafroller control can be checked in conjunction with blackspot and powdery mildew samples and observations during fruit thinning. If a leafroller larva is found on any shoots examined, or two leafroller damaged fruit are found out of the 1000 examined, then a spray of Mimic® or Match® or Avaunt® (observe withholding periods for the latter two products) should be applied. Diazinon will not provide adequate leafroller control at this time. Chlorpyrifos cannot be used for post-bloom control of leafroller or codling moth on apple crops (refer to Fact Sheet 15).

From 15 December (or from the date of the first highly recommended spray in Canterbury and Otago), applications of Mimic® are applied when more than 30 moths (10 moths for USA market) have been caught in a single trap since this date. Even if the threshold is exceeded in the week or two following insecticide treatment, Mimic® should be applied no closer than 21 days apart for leafroller control.
In most districts, leafroller activity is highest during the harvest period. For this reason it is strongly recommended that a Mimic® be applied before the withholding period (14 days), to cover the crop over this period. This may not be required in Otago in most seasons.

Resistance management . In Nelson (Mariri) lightbrown apple moth (*Epiphyas postvittana*) is resistant to azinphos methyl. In Hawkes Bay (Twyford) and Otago (Dunbarton), greenheaded leafrollers (*Planotortrix octo*) are resistant to organophosphates and have the potential to become cross-resistant to Mimic®. In these areas, an insecticide programme based on these insecticides alone will not provide stable control of leafrollers and will continue to select for resistance. Growers in these areas should either use a product where the potential for crossresistance is low (e.g. Match® during early season) or use mating disruption.

LEAFROLLER - North Island, Nelson, Marlborough
Summary of control and thresholds

Petal-fall to early November
Match®, Avaunt®, or Mimic® highly recommended based on leafroller phenology.
Use Match® in areas affected by OP resistance.

Late November or early December
IF ONE leafroller larva found on shoots or TWO leafroller damaged apples found during blackspot/powdery mildew monitoring or fruit thinning, OR fruit destined for USA Market and pear blocks
THEN Match®, Mimic® or Avaunt® (no Avaunt® or Match® after December 12th)
Use Match® in areas affected by OP resistance.
Observe Match® WHP on apples and pears

15 December to two weeks prior to harvest
IF a cumulative total of 30 lightbrown apple moth (10 moths for USA crops) caught since 15 December. or last leafroller/codling moth spray
THEN Mimic® or Success® NOTE that Mimic® now has a 28 day withholding period.

Two weeks prior to harvest
Success® highly recommended based on leafroller risk and phenology

NOTE: Insecticides should not be applied closer than 21 days apart for leafroller control. Use at least two different classes of insecticides for leafroller control during the season and do not exceed the suggested maximum number of applications for any one product. Match® is the preferred option for control of OP resistant leafrollers on apples prior to December 12th and pears prior to November 20th.

LEAFROLLER . Canterbury, Otago
Summary of control and thresholds

By December 12th
Match®, Avaunt® or Mimic® highly recommended based on leafroller phenology. Use Match® in areas affected by OP resistance.
(observe Match® **and Avaunt®** WHP.s on apples and pears)

From first spray to two weeks prior to harvest
IF a cumulative total of 30 lightbrown apple moth and/or green-headed leafroller caught since 15 December or last leafroller/codling moth spray
THEN Mimic® or Success® **NOTE Mimic now has a 28 day withholding period.**

Two weeks prior to harvest
Success® highly recommended in Canterbury based on leafroller risk and phenology
Success® recommended in some seasons in Otago depending on phenology and cultivar harvest date

NOTE: Insecticides should not be applied closer than 21 days apart for leafroller control. Use at least two different classes of insecticides for leafroller control during the season and do not exceed the suggested maximum number of applications for any one product. Match® is the preferred option for control of OP resistant leafrollers on apples prior to December 12th and pears prior to November 20th.

FACT SHEET 6: CODLING MOTH MONITORING AND CONTROL

There is one highly recommended spray for codling moth control in early summer. This should be a Match®, Avaunt® or Mimic® applied between 'petal-fall' and November 1st in northern districts (this can be delayed by 7-10 days if carbaryl has been applied for fruit thinning).
In Canterbury and Otago this can be delayed until late November or early December (Mimic®). Growers should maintain contact with advisors for the optimum timing in southern districts.

After this highly recommended spray, codling moth control in all districts is then based on pheromone trap catches.

Either Match®**, Avaunt®** (observe WHP.s) or Mimic®, should be applied if any of the following thresholds are exceeded:

1. Five or more moths in any single trap in any one calendar week. OR
2. An average of two or more moths over all the traps in the orchard. OR
3. An accumulation of ten moths in any single trap since the last codling moth or leafroller insecticide.

If traps show codling moth pressure within the orchard is high (e.g. adjacent unsprayed apples) then the interval between Match®**,** Avaunt® or Mimic® sprays should not exceed 14-21 days.

Carbaryl used for thinning is also highly toxic to codling moth.

Where high populations of codling moth occur (consistent periods where most traps average more than 10 moths) within or close to the orchard, the spray threshold is likely to be exceeded regularly and could result in 2-3 weekly spraying. Removal of the outside sources of codling moth is preferred if possible.

Codling moth mating disruption
This method of control is recommended if codling moth thresholds are regularly exceeded (requiring 5 or more applications per season). It is not recommended where there is a high population in the orchard or high immigration of codling moth from nearby neglected apple trees or walnuts. Codling moth mating disruption is best used against low populations and will probably be all that is required for control provided large blocks (>3ha). It is most effective on flat sites and with uniform dense canopy. However, under mating disruption, pheromone-based thresholds will not be valid unless high dose (10x) caps are used. High dose traps operated in the very tops of trees can be used in conjunction with the above thresholds to guide spray applications. Contact your consultant regarding monitoring and timing of insecticide use if mating disruption is used.

Summary of control and thresholds

Petal-fall to early November (North Island, Nelson, Marlborough)
Late November or Early December (Canterbury, Otago)
Either Match®**,** Avaunt® (observe WHP.s) or Mimic® is highly recommended based

on codling moth phenology.

Avaunt®, and Match® cannot be applied to apples after December 12th.

Match**®** cannot be applied to pears after November 20th.

Rest of season
IF codling moth pheromone traps catch;

1. 5 or more moths in any single trap in any one calendar week. OR
2. An average of 2 or more moths over all the traps in the orchard. OR
3. An accumulation of 10 moths in any single trap since the last codling moth or leafroller insecticide.

THEN Either Match® (observe WHP) or Mimic**®.**

NOTE: Insecticides should not be applied closer than 14-21 days apart for codling moth control. Use at least two different classes of insecticides for codling moth control during the season and do not exceed the suggested maximum number of applications for any one product.

FACT SHEET 9: APPLE LEAFCURLING MIDGE MONITORING AND CONTROL

Apple leafcurling midge is an important pest affecting normal tree growth and development, especially in young trees and grafts. Infestations during flowering can affect normal fruit development (bumpy fruit) and infest fruit at harvest. However there is increasing evidence that the use of broad-spectrum insecticides, e.g. diazinon, may be ultimately less effective than biological control of midge populations in mature trees. Diazinon limits the activity of the apple leafcurling midge parasite, *Platygaster demades* which is now common in most orchards. In the absence of broad-spectrum insecticides *P. demades* increases quite quickly and can provide a useful level of midge control. It is therefore recommended that for midge control in mature trees that you avoid use of all broad-spectrum insecticides (organophosphates and carbamates). The suggested monitoring and control programme below is intended for young developing trees and recently grafted trees with vigorous shoot growth.

Monitoring method. It is useful to choose one block to monitor on a regular basis to determine when to monitor all blocks and determine insecticide use (We suggest Royal Gala or Braeburn). Apple leafcurling midge (ALCM) activity is determined by the proportion of actively growing shoots infested by ALCM eggs. These are small red clusters of eggs laid on the developing leaf. You may need a hand lens to see these eggs at first, but are quite obvious when you know what you are looking for.

Summer inspections - Inspect two actively growing shoots on each of 20 randomly selected trees (total of 40 shoots). Start monitoring your chosen block before the optimum time in your district. In most districts sampling should start in mid November. When you notice ALCM egg numbers increasing, then sample the rest of your orchard to determine treatment. You may wish to repeat this sample in early to mid-January.

To protect growth on young establishing trees, growers may want to increase the frequency of sampling and treatment.

The number of fruit infested with ALCM pupae at harvest (1000 fruit per sampling area) should be recorded on the harvest assessment sheet.

Thresholds and Actions.
Late November to early December. From the 40 shoot sample done in each sampling area: IF more than 20 shoots (50%) infested with ALCM eggs, THEN treat with foliar application of diazinon.
January. From the 40 shoot sample done in each sampling area: IF more than 20 shoots (50%) infested with ALCM eggs, THEN treat with foliar application of diazinon.

APPLE LEAFCURLING MIDGE. All districts

Summary of control and thresholds
Biological control (mature trees)
Successful biological control of apple leafcurling midge by *Platygaster demades* is most likely achieved when broad-spectrum OP insecticides are avoided. Continue to monitor midge eggs at the suggested post-bloom times (below) and treat only if there

is potential for a serious outbreak.

Insecticidal control for vigorous trees (young, or newly grafted trees)
Late-November to early-December

After determining optimum sampling time, assess 40 actively growing shoots; IF more than 50% of new shoots infested with eggs, THEN foliar application of diazinon.

January
After determining optimum sampling time, assess 40 actively growing shoots; IF more than 50% of new shoots infested with eggs, THEN foliar application of diazinon.

FACT SHEET 15: INSECT CONTROL FOR USA MARKET ACCESS

A high level of insect control is required in crops intended for the USA market. There are more than 50 species of insects that will result in USDA inspectors rejecting export consignments. Over two thirds of these insects are associated with the crop in the orchard so there is no substitute for effective pest control. It is highly recommended that you observe the following procedures if your crop is intended for the USA market.

Chlorpyrifos
Restrictions on the application of organophosphate insecticides now limit the use of chlorpyrifos on apples up to and including bloom period for all markets. This is critical for the USA fresh fruit market and affects all crops, which might be used for juice. Post-bloom use of chlorpyrifos can no longer be justified as alternative products are now available for each of the major pests.

Pirimor
Pirimor must not be used on crops for the USA or EU markets after flowering.

Pirimor may be used post-bloom where there is no effective alternative product however fruit that receives post bloom applications of Pirimor® must be withdrawn from USA and EU supply. Withholding periods must be observed. Alternatively, diazinon can be used for WAA aphid control on USA crops

Leafroller control
There is a zero tolerance for leafroller in USDA inspection procedures. This requires a high level of leafroller control within blocks of fruit that will be submitted for inspection. The recommended pheromone trap threshold for the USA market is:

A cumulative total of 10 moths per trap since the last insecticide application.
Pheromone traps should be used following procedures given in Fact Sheet 4, Pest Monitoring. Ensure that traps are checked weekly, then cleared and the moth catches recorded. Poorly maintained traps are likely to result in inadequate leafroller control and failure in inspection procedures.

Insecticide application and water rates
Unlike diseases, most insect pests are cryptic or hidden. They burrow into the fruit (codling moth), live in leaf rolls in terminal shoots (e.g leafrollers and leafcurling midge) or prefer cuts, scars and burr knots (woolly apple aphids and mealybugs). Unlike diseases, good insect control should be achieved with relatively few applications when sprayers are correctly calibrated.
High volume application (2000-2500L/ha for 4.5 metre high trees) is the minimum recommended water rate for control of mealybug, scale and woolly apple aphid. Good control of leafroller and codling moth may be achieved at lower water rates but there is an increasing likelihood of poor leafroller and codling moth control at water rates below 1000L/ha. When using lower water rates be sure that the correct insecticide rate per hectare is observed. For example the correct product rate for Mimic® is 286g/ha in 4.5m high trees, lower product rates in mature trees increase the risk of insect damage.

Control of mealybug, scale insects and woolly apple aphid

The USA Environmental Protection Agency has reduced the allowable use of some broad-spectrum organophosphate insecticides (e.g. azinphos methyl) and banned the post-bloom use of chlorpyrifos. Specific pre-bloom treatments are therefore important for control of mealybug and scale. Good control of these pests is highly dependent on elimination of resident populations that establish in blocks during the previous autumn. This is best done with pre-bloom treatments when thorough coverage can be more readily achieved. In Hawkes Bay, mealybug populations should now be considered as generally resistant to chlorpyrifos so the emphasis must be on pre-bloom Applaud® treatments for effective mealybug control. Calypso® used in November/December can provide effective control of mealybug and scale insects and suppression of woolly apple aphid.

Post bloom insect control in USA crops

Mealybug - Calypso®
Scale insects - Calypso® or diazinon (observe withholding periods) oil (be aware of potential incompatibility with fungicides) azinphos-methyl (observe withholding period)
Woolly apple aphid - diazinon or Calypso® (observe withholding periods)

Managing USA pesticide residue tolerances

Do not use products that are not permitted on fruit destined for the USA market.

Apples
Restricted - Chlorpyrifos and Pirimor® pre-bloom use only.
Restricted - Match® and Avaunt® maximum two applications, no later than December 12th.

Pears
Not permitted - Pirimor®
Restricted - Match®, to 1 application no later than November 20th.

Reducing the risk of USDA inspection failure

In addition to close adherence to the IFP programme recommendations growers should choose one of two options for crops submitted for USDA inspection. These options are necessary for reducing the risk of quarantine actionable pests.

EITHER:
An approved apple washer treatment prior to packing OR Controlled atmosphere storage; minimum requirement of 6 weeks for mealybug control, or 10 weeks for leafroller control.

FACT SHEET 16: MONITORING TEMPLATES

Codling Moth and Leafroller Monitoring Template Instructions

(See Fact Sheets 4, 5 & 6 in the NZ Pipfruit IFP Manual for more detail.)

1. Put codling moth traps out one week before first highly recommended insecticide application.
2. Put leafroller traps out 2-3 weeks before 15 December.
3. Read traps on the same day each week.
4. Remove moths after counting and recording.
5. Change sticky bases every three weeks or sooner if dusty
6. Change pheromone caps every six weeks and dispose in rubbish
7. Record when bases and/or caps changed
8. Enter the dates of any sprays that control leafroller or codling moth regardless of their primary target (e.g. Match®, Alsystin®, Mimic®, Avaunt® or Success®).
9. In the cumulative (grey) columns, add the current week's trap catch to the cumulative total for the same trap last week. If a spray has been applied in the last week, then enter (into the grey column) the current week's trap catch only.
10. If more than half the leafroller traps within a block exceed the threshold, then treat the entire block.
11. If two species of leafroller are being trapped, then record the number of each species caught in the single weekly box, but have a single cumulative total.
12. Record the letter of the threshold that has been exceeded in the .threshold. column.

The pheromone trap thresholds are:

Codling moth
A. 5 or more moths in a single trap in one week OR
B. an average weekly catch in all traps of 2 or more moths OR
C. an accumulation of 10 or more moths caught in a single trap since last spray

Leafroller
D. An accumulation of 30 or more moths in a trap since last spray or 15 Dec
E. The threshold for USA destined fruit from December 15th is an accumulation of 10 moths.

Pest Monitoring Template Instructions.

(See Fact Sheets 8, 9, 10, 11, & 14 in the NZ Pipfruit IFP Manual for more detail)

Apple leaf-curling midge (ALCM)
WHERE AND WHEN TO LOOK: Monitor a Gala block on a regular basis from mid November, and when egg-laying peak occurs, then monitor other cultivar blocks. MONITORING METHOD: Examine the growing tips of 2 shoots on each of 20 trees (40 shoots), for the presence of orange-red clusters of EGGS THRESHOLD: More than 20 egg-infested shoots

KEY POINTS – PESTS

2.2 Codling moth

- Codling moth (*Cydia pomonella*) lays its eggs close to, or on, the fruit and is a key pest of apples and pears. Larvae typically enter the fruit on the ripe side or through the calyx. Control must be achieved before the larva enters the fruit.

- Codling moth has one generation per year in the south (Central Otago, Canterbury and Nelson) and usually two to three generations in the North Island.

- Natural enemies do not provide sufficient control and spraying is essential where codling moth populations are above the action threshold.

- Destruction of plants that are sources of codling moth outside or within the orchard (e.g. infested trees of apple, pear or walnut) is very valuable for control.

- Mating disruption is a valuable control method that can be used alone or to supplement the use of insecticides and delay the development of any insecticide resistance. If used, thresholds based on pheromone traps are not applicable.

2.5 Apple leafcurling midge

- Apple leafcurling midge (ALCM, *Dasineura mali*) larvae can damage the leaves, flowers and fruitlets of apple trees. Control of ALCM may be required on young trees to stop tree development being retarded and on mature trees to prevent fruit contamination by pupal cocoons.

- ALCM has three generations per year in Nelson, Canterbury and Central Otago, five in Hawkes Bay and 6-7 in Waikato and Auckland.

- The number of generations per year, and consequently the seasonal abundance of ALCM, may be greater when weather conditions are wetter than normal.

- Natural enemies do not provide sufficient control and spraying may be required depending on the level of egg infestation of actively growing shoots in an orchard.

B. DISEASE MANAGEMENT

CONTENTS

B. DISEASE MANAGEMENT

Good Integrated Plant Protection gives priority to natural, cultural, biological and biotechnical methods of pest disease and weed control. It is about using the most selective, least toxic, least persistent product only when justified.

1. MINIMUM NZ PIPFRUIT IFP REQUIREMENTS

1.1 Education

- **Agrichemical Code of Practice -** Anyone applying agrichemicals to export blocks must hold a current GROWSAFE Introductory Certificate (one day course minimum).

- **NZ Pipfruit IFP Grower Discussion Groups -** All first and second year NZ Pipfruit IFP growers participating in the NZ Pipfruit IFP Programme must register with an approved IFP Discussion Group Facilitator. These groups are the primary source of training on the NZ Pipfruit IFP programme requirements and will be used as a tool for communication and feedback. All growers are strongly encouraged to continue belonging to an IFP discussion group beyond the first 2 years as this is an excellent source of ongoing improvement.

1.2 Record Keeping

- NZ Pipfruit IFP pest and disease monitoring
  Where pest and disease monitoring records are used to justify the use of agrichemicals, growers must ensure these records are:
  a accurately and fully completed.
  b made available to the exporter or it's agent for auditing to verify that the use of the agrichemical can be justified.

1.3 Agrichemical Use

a. Agrichemicals may only be used where justified.

b Applications of agrichemicals may be justified by one or more of the following methods:
- Monitoring records
- Early warning or forecast systems
- Phenology based recommendations detailed in the NZ Pipfruit IFP Manual

c. Where the use of agrichemicals is justified, the product used must be
- as selective as possible;
- the least persistent;
- the lowest toxicity to human, livestock, fauna, flora and the environment; while still providing effective pest or disease control.

Approved agrichemicals
Growers must only use registered formulations of agrichemicals listed in the exporter PCR book for the control of fungi, bacteria, insects and mites.

Withholding periods and application timing
Growers must adhere to the withholding periods as stated by the exporter.

Growers must not use an experimental or a non approved agrichemical on pipfruit to be submitted to the exporter without obtaining written permission from the exporter.

Inadvertent application or drift

a Growers must follow practices that minimise spray drift so as to protect:
  - the public
  - neighbouring orchards
  - adjacent varieties or blocks that have earlier harvest dates

b Growers who apply an agrichemical to pipfruit in error, or believe their fruit may have an unacceptable residue due to drift, must inform the exporter immediately.

1.4 Sprayer Calibration

Sprayers used to apply agrichemicals should be well maintained and regularly calibrated to ensure the correct amount of chemical is being applied to all parts of the target.

- Calibration of sprayers:
  - a Calibration is compulsory for all agrichemical sprayers (excluding herbicide sprayers) used in blocks of fruit intended for export.
  - b Sprayer calibration must be completed at least once every two years.
    It is strongly recommended that sprayers are calibrated annually (or more frequently).
  - c Calibration and maintenance procedures must be fully documented.

2. RECOMMENDED PRACTICES

2.1 Resistance Management

Product usage should not exceed the manual guidelines i.e.:

- 4 DMI fungicides per season
- 6 Dodine per season (no more than 4 consecutively)]
- 2 Streptomycin per season
- 4 Pyrimidamides per season
- 3 Strobilurins

2.2 Thresholds

NZ Pipfruit IFP growers are encouraged to follow the monitoring threshold recommendations found in the NZ Pipfruit IFP Manual. They are reasonably conservative recommendations designed to suit most growers under a range of seasons and conditions. However, monitoring data may need interpretation under certain circumstances. Seek advice from your NZ Pipfruit IFP Facilitator if you are unsure how to interpret your monitoring data.

2.3 USA Market

Growers intending to supply the USA market are strongly encouraged to follow the USA recommendations as outlined in this manual.

2.4 Non Chemical Methods

Non chemical pest and disease management should be used where available and effective.

2.5 Education and Safety

Growers should attend at least one seminar, workshop or field day per year that specifically addresses disease management techniques in IFP orchards.
Ongoing participation in an NZ Pipfruit IFP discussion group is highly recommended.

2.6 Chemical soil sterilisation

Chemical soil sterilisation is not an environmentally sustainable practice, and should only be practiced when absolutely justifiable.

FACT SHEET 1:` DISEASE MANAGEMENT CONCEPTS

Infection and disease increase requires a **susceptible host** (e.g. young apple leaves), the presence of pathogen **inoculum** (e.g. black spot ascospores) and an **environment** favourable for infection and/or disease development (e.g. a black spot Mill's Period). Disease management practices influence the first two of these three factors to prevent or slow disease development.

Under NZ Pipfruit IFP all disease management actions must be justified. The following check-list forms the basis for making and recording disease management decisions.

Table B1: Disease Management decision check-list

Factor Question Notes

Host:

- Is the host susceptible to infection?
- Consider all possible sites of infection
- Consider alternative hosts

Pathogen:

- Is sufficient inoculum present to constitute a disease risk?
- Know the pathogen and the disease cycle thoroughly
- Monitor levels of the pathogen if possible

Environment:

- Is the weather suitable for infection?
- Consider both monitored and forecast weather.

Management Issues Requiring Action

- Is there risk of new infection?
- Is there a risk of crop loss or damage arising from current events?
- Is there an opportunity now to reduce or avoid future disease?
- Susceptible host + suitable weather + presence of inoculum
- Could disease reach economically damaging levels in the future?
- For example, by removing diseased material

Disease management and agrichemical use

Disease control under NZ Pipfruit IFP is expected to be equal to, or better than, that achieved under current conventional practice. Disease management practices under conventional production are generally well founded and NZ Pipfruit IFP is not expected to result in major changes to these practices. The disease monitoring and prediction tools used in NZ Pipfruit IFP aim to enable growers to justify disease management actions and to use as few applications as possible of chemicals that are as safe as possible to humans and the environment.

Disease monitoring and risk predictions under NZ Pipfruit IFP aim to provide growers with information on when and what disease control actions are required at different stages of the season. In general terms NZ Pipfruit IFP seeks to make greatest use of fungicides in the spring period of greatest disease risk, then to minimise fungicide use over the period leading up to harvest. High risks of black spot and powdery mildew in the spring mean that a full cover protectant fungicide programme can be justified over a period that typically spans between 30 and 90 days, with most emphasis around bloom.

FACT SHEET 7: FIRE BLIGHT *(Erwinia amylovora)*

(a) Disease management principles

- Successful management of fire blight bacteria requires a combination of disease risk assessment, well-timed chemical sprays, and removal of inoculum sources.

- Mature apple trees are generally much less susceptible to fire blight than pears and for both crops, most infections occur in the blossom period.

- In many cases streptomycin applications will not be required. Any streptomycin use has to be justified on the basis of the following check list and infection risk assessments:
  - What is the previous disease history? What is the risk of infection? Is the crop susceptible to fire blight?
  - Are inoculum sources present within the orchard or in the vicinity of the orchard?
  - What non-chemical, alternative control measures (e.g. pruning out infected tissues) are available?
  - What is the risk of crop loss or tree damage if a spray is not applied?

(b) Cultural controls

i) Plant Material

Use resistant or low susceptibility rootstocks, interstems, and/or scions. Select rootstock and scion combinations which are not both highly susceptible to fire blight.
Where possible, obtain nursery stock from areas free of fire blight.
Ensure blocks neighbouring young plantings have no infection sources.

ii) Alternative hosts

Remove alternative hosts of fire blight and infected plant material from the orchard and in the vicinity of the orchard. A list of fire blight host material is shown in Table B2.

Table B2: Hosts to fire blight disease

Species	Common Name	Species	Common Name
Amelanchier spp	Sugar Plum	*Kerria* spp	Japanese rose
	Serviceberry	*Malus* spp*	Apple
	Sarviceberry	*Mespilus* spp*	Medlar
	Juneberry	*Photinia* spp	
	Shadbush, Shad	*Physocarpus* spp	Ninebark
Aronia spp	Chokeberry	*Potentilla* spp	Fivefinger
Chaenomeles spp	Flowering quince		Cinquefoil
Cotoneaster spp*		*Prunus* spp	Stonefruit
Crataegomespilus	Cliffrose		Ornamentals
Crataegus spp*	Hawthorn	*Pyracantha* spp*	Firethorn
Cydonia spp*	Quince	*Pyrus* spp*	European Pear

Dichotomanthes spp			Asian pear (nashi)
Eriobotrya spp*	Loquat	*Sorbaria* spp	False spiaea
Exochorda spp	Pearlbush	*Sorbus* spp	Mountain ash
Holodiscus spp	Creambush	*Spiraea* spp	Bridal wreath
	Rockspiraea	*Stransvaesia* spp	

*Recorded as hosts in New Zealand

iii) Pruning out fire blight

- Cut infected shoots at least 45-60 cm below visible symptoms. Where possible, burn or bury infected plant materials immediately.
  Disinfect pruning tools in a mixture of one part household bleach (sodium hypochlorite) with 10 parts water, or 5% lysol between each cut. These disinfectants are corrosive, so avoid skin and eye contact. Clean and oil pruning tools after use. Failure to disinfect the pruning tools between each cut will probably do more to spread fire blight than prevent it.

- Inspect the orchard frequently over the growing season, especially from blossom to mid-summer.

- For young plantings, it may be necessary to replace infected trees as the disease sometimes may have already spread to healthy shoots despite removal of infected shoots.

iv) Irrigation, soil acidity and fertilisers

- Avoid overhead irrigation.
- Maintain soil acidity at pH 5.5-6.5.
- Avoid fertiliser programmes which cause lush growth on trees. Young succulent shoots are particularly susceptible to fire blight.

v) Infection risk assessment

- In established orchards, blossom infection poses the greatest risk of crop reduction due to fire blight.

  The following criteria must be met for blossom infection:
  - Open flowers must be present with stigmas and petals intact;
  - Accumulation of at least 110 degree hours > 18.3 ^{o}C after first bloom;
  - Occurrence of dew or = 0.25mm rain on the day of infection, or = 3 mm rain the previous day;
  - Occurrence of an average daily temperature of = 15.6 ^{o}C.
  - The first early symptoms of blossom blight are expected with the accumulation of an additional 57 degree-days above 12.7 ^{o}C. This may be 3-30 days after the occurrence of the infection event depending on the temperature.
- These criteria can be monitored manually using a rain gauge and a maximum and minimum thermometer. Keep daily records of

maximum/minimum temperatures and rainfall, and correlate these as degree-days above a threshold with fire blight incidence in your orchard. Alternatively, more detailed weather data are available from automatic, electronic weather stations such as those used by the Orchard 2000TM system. Weather data is used to identify fire blight infection periods and possible infection events.

(c) Chemical controls

- Use one or more copper applications in the winter programme from leaf fall as necessary. Remove infected shoots and cankers in the winter.

- On russet pears and non-fruiting trees, consider in-season use of copper sprays alternating with streptomycin sprays or instead of streptomycin.

- Apply streptomycin sprays only when weather data indicate high risk of infection. **Calendar sprays of streptomycin during blossom are not acceptable.**

- The optimum spray timing to apply streptomycin 24-48h before an infection event, and no later than 24 h after of an infection event.

(d) Seasonal fire blight management programme

- Identify and remove alternative hosts from within 100 meters of the orchard block. If hosts cannot be removed, consider applying dormant and blossom copper sprays to them to reduce inoculum potential.

- Prune out fire blight wood cankers from trees while dormant.

- Begin infection risk monitoring from the pink (or white in pears) blossom stage and only use antibiotic or copper sprays if infection risks warrant.

- Monitor for signs of infected blooms-shoots and prune these out and burn them (see earlier notes on pruning.)

FACT SHEET 9: EUROPEAN CANKER *(Nectria galligena)*

- European canker of apple and pear is caused by the fungus *Nectria galligena.*
- Causes damage in regions where mean annual rainfall exceeds 1,000 mm.
- Severe in the northern North Island and sometimes causes significant damage in Nelson.
- Not normally problematic in the drier regions of Hawke’s Bay, Wairarapa, Canterbury and Central Otago.
- Affects trees of all ages and there are no resistant varieties.
- Has a wide host range and can infect crab apple pollenizers and several shelter species.
- Can cause rotting of fruit in storage, but this is seldom a problem in New Zealand.
- New apple blocks can become diseased as a result of infected nursery stock.

a: Disease cycle

N. galligena can infect branches and limbs of any age through wounds, including:

- leaf scars, where leaves have been shed during summer or autumn
- cracks in the bark, caused by tree growth
- damage from rubbing or abrasion
- pruning cuts
- wounds made for other management operations, such as Trichodowel insertion.

Trees can become infected at any time of year and there are two types of spores, which provide inoculum:

1. ***Conidia***, which are dispersed by water, are produced in creamy white pustules during spring and summer.
2. ***Ascospores***, which are both water and wind dispersed, are produced in red perithecia during autumn and winter.

b: Disease management principles

There are four equally important components to canker management:

1. ***Pruning wound protection:*** Pruning wounds must be dressed with fungicidal pruning paint in all canker-prone regions. Wound healing can take days to weeks to occur and pruning cuts should be dressed the same day that they are made.
   Application of copper fungicide can slow wound healing. (See below for wound dressing products.)

2. ***Leaf fall fungicide sprays:*** Three copper sprays during leaf fall have been the basis for canker control in New Zealand since the 1970s. In wet northern regions copper sprays are often applied monthly throughout winter. The original copper recommendation was based on the use of Bordeaux mixture. Copper oxychloride has also been shown to be effective. Newer copper fungicides have not been formally tested.

3. ***Canker removal:*** The tree produces callous tissue above and below the canker as a defense response, but unless treated, the fungus eventually grows beyond this and can kill the branch. Cankers must be removed from trees to reduce inoculum in the orchard and to prevention spread of infection. Cankers can be removed by either cutting or scraping with a knife or removed with a chainsaw, followed by application of fungicidal wound dressing. Pieces of wood cut from cankers must be removed from the orchard.

4. ***Spring and summer fungicide sprays:*** Fungicides applied for black spot, powdery mildew and fruit rots also prevent canker infection during the growing season. The effectiveness for canker control of various fungicide products that are registered for IFP apples is currently being determined. (See under chemical controls.)

c: Chemical controls

Evaluation of fungicides that are more environmentally sustainable than copper is in progress. The efficacy fungicides used against black spot (*Venturia inaequalis)* for canker control is also being investigated.

- The most effective fungicide against *N. galligena* is carbendazim (e.g. Bavistin). Carbendazim can be used as a foliar spray or in a wound dressing, although current New Zealand wound dressings do not include carbendazim.
- Carbendazim resistance has not been reported in *N. galligena.*
- Any increase in the use of MBC sprays in the orchard could lead to MBC resistance in *Botrytis cinerea* (dry eye rot) and in other fungi that cause apple fruit rots.
- *Venturia inaequalis* (apple black spot) is already resistant to MBCs in New Zealand.

Newer fungicides used for black spot control are currently being evaluated for their efficacy against canker. Older protectant fungicides, including captan and ziram have some activity against canker, but may not be as effective as newer fungicides.

Wound dressing fungicides registered for use in apples in New Zealand.

Product	**Supplier**	**Active ingredient**	**Chemical group**
Bacseal Super	Bayer NZ Ltd	tebuconazole	triazole
Garrison	Chemcolour Industries	cyproconazole + 1iodocarb	triazole + carbamate

Scomrid	Fruitfed Supplies/ Elliott Chemicals	azaconazole + imazalil	imidazole + DMItriazole triazole
Nectec paste	Bayer NZ Ltd/Elliot Chemicals	azaconazole + imazalil	Imidazole + DMI-triazole

1iodocarb = broad-spectrum wood preservative.

FACT SHEET 14: MONITORING TEMPLATES

Powdery Mildew Monitoring Template Instructions.

(See Fact Sheets 5 & 11 in the NZ Pipfruit IFP Manual for more detail)

1. Undertake this sample between petal-fall and mid-November.

2. Sample 10 trees at random throughout the block

3. Choose 1 shoot per tree and count the total number of leaves on that shoot (This is used to calculate the average number of leaves per shoot and should be representative of the shoots examined below).

4. Examine leaves on 5 shoots per tree for Powdery Mildew lesions. A hint is to get the light behind the leaves and look for yellowing on the leaves and leaf distortion.

5. Record the number of leaves with Powdery Mildew on each shoot (don't worry about the number of lesions per leaf).

6. Sum down all the columns.

7. Divide the leaves per shoot total by 10 to get average leaves per shoot. (A)

8. Add the five cells of .powdery mildew totals. together to get the total leaves with powdery mildew from 50 shoots examined (B)

9. Multiply B by 2, then divide by A (you may want to use a calculator)

10. Determine what risk category the block is in.

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