

Kiwifruit's most unwanted



Jan 2016

Purpose

Develop a list of high priority threats to the kiwifruit industry for readiness and response planning and explain the methodology used to prioritise these threats.

Background

In August 2014, KVH developed a risk matrix to prioritise potential threats to the kiwifruit industry for the purpose of readiness and response planning.

The matrix framework, data populating the matrix and resulting priority list was independently peer review by Plant and Food Research and members of the MPI Risk Analysis team. The matrix is continually updated to reflect changes in the risk profile of pests and pathogens.

Overview of the matrix

The risk matrix has been developed to provide a consistent and objective approach for prioritising industry threats. Generic response plans will be completed for each of the main organism categories (arthropod, bacteria, fungi and virus), with more specific planning included for the top priority organisms. The framework consists of three categories, each with a set of criteria that is used to allocate a score (Table 1). The allocation of scores for each category is still somewhat subjective and can be influenced by biosecurity measures in pre-border, border and post-border interventions and therefore is continually reviewed and updated.

Table 1: Description of the risk matrix framework

Category	Score considers:	Maximum Score
Likelihood of entry	<ul style="list-style-type: none"> Pathways that could potentially result in entry Level of border and post-border interceptions 	Five
Potential for establishment	<ul style="list-style-type: none"> Organism's ability to colonise other countries Suitability of the New Zealand climate Likelihood of the organism finding a host post-border Ability to establish effective trapping or surveillance system Ability to spread and potential extent of spread 	Five
Impact	<ul style="list-style-type: none"> Likely production impacts Likely market access implications if the organism were to establish Ability to control if established 	Ten
RISK SCORE	Entry x Establishment x Impact	

Results

Eleven organisms considered the greatest potential threats to the New Zealand kiwifruit industry were selected and applied to the risk matrix with results shown below (Table 2).

Risk scores indicate that there are eight organisms that are the greatest concern to the kiwifruit industry. These eight organisms do not change when different scoring scenarios are used.

Table 2. Priority ranking of kiwifruit industry threats based on scores produced by the risk matrix.

Rank	Name	Type of organism	Risk Score
1	Fruit Fly (Mediterranean, Oriental, and Queensland)	arthropod	80
2	Brown marmorated stink bug (<i>Halyomorpha halys</i>)	arthropod	75
3	White Peach Scale (<i>Pseudaulacaspis pentagona</i>)	arthropod	60
4	<i>Ceratocystis fimbriata</i>	fungi	42
5	Psa non-NZ biovars	bacteria	40
6	Spotted wing drosophila (<i>Drosophila suzukii</i>)	arthropod	30
7	Verticillium wilt	fungi	28
8	<i>Invasive phytophthoras</i>	oomycete	18
9	Summer canker (<i>Pectobacterium carotovorum actinidiae</i>)	bacteria	18
10	Esca disease (<i>Fomitiporia mediterranea</i>)	fungi	18
11	Pelargonium zonate spot virus	virus	16

Attachment 1: Risk matrices for the top five risk organisms

Fruit Flies (Mediterranean, Oriental and Queensland)

Rank: 1

Description: Three species of fruit fly have been identified as the most serious threat to the kiwifruit industry. These are the Oriental fruit fly (Ofly), Mediterranean fruit fly (Med fly) and the Queensland fruit fly (Qfly). Each of these species has a well demonstrated ability to cause serious production impacts to a wide range of horticultural species when established. Incursions of breeding populations can result in significant market access implications for kiwifruit exports, especially Qfly as this has a very limited distribution and is likely to result in access implications across nearly all major markets.



Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Fresh produce	5
	Where does it occur?	Distribution shown in map above	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Yes, fresh produce from many countries, undeclared passenger fruit high risk	
	Do we know of previous post-border interceptions?	Yes, 9 since 1989 (incl. a QFF breeding population in 2015)	
	Is it associated with countries we are trading with?	Yes	
Potential for establishment	Demonstrated ability to colonise?	Yes, but variable depending on species. Qfly limited invasive ability	2
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Very likely. Likely to enter as larvae in fruit, hatch and fly to a fruit tree	
	Is NZ climate considered favourable?	Yes. Qfly restricted to northern areas	
	Can an effective trapping system be implemented to reduce risk of establishment?	Yes already in place for these species	
	Spread assessment – how likely and to what extent could it spread?	Movement through infested fruit which can be controlled. Fly short distances when host material available. Spread can be controlled	
Impact	Are there known production impacts on kiwifruit industries internationally?	Yes. OFF widespread and invasive in China with no reported impacts on kiwifruit. Medfly widespread in Italy with limited impacts on kiwifruit	8
	Likely production impacts?	Low / moderate Wide host range but limited reported impacts on kiwifruit despite exposure in China and Italy.	
	Degree of market access implications if established?	Initially severe, although phytosanitary cold treatments are available that could be used over the longer term.	
	Do we have the tools to manage if it arrived in or detected in NZ?	Yes	
Risk Score (entry x establishment x impact)			80

Brown Marmorated Stink Bug (*Halymorpha halys*)

Rank: 2

Description: The Brown Marmorated Stink Bug (BMSB) is a major agricultural pest that is highly mobile and capable of spreading rapidly as evidenced by its rapid invasion of USA in recent years. BMSB causes cosmetic damage to fruit and vegetables resulting in produce that is unfit for sale. NZ's climate is considered favourable.



Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Hitchhiker species found on inanimate objects. Border interceptions have occurred on air & sea freighted containers, vessel holds, passenger luggage, mail and a shipment of clothing	5
	Where does it occur?	China, Korea, Japan, Taiwan, USA, starting expansion in Europe	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Yes, shipping containers and cars highest risk items	
	Do we know of previous post-border interceptions?	Yes, 5 post-border interceptions over the summer of 2014/2015 and numerous border interceptions.	
	Is it associated with countries we are trading with?	Yes, as a hitchhiker species numerous potential pathways exist from each country.	
Potential for establishment	Demonstrated ability to colonise?	Yes, spreading rapidly in the USA and now present in over 35 states. Also spreading in Europe.	5
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Highly likely. Strong fliers (< 2km) and have a wide host range so likely to find a host.	
	Is NZ climate considered favourable?	yes, considered highly suitable	
	Can an effective trapping system be implemented to reduce risk of establishment?	No effective lures available making this a significant problem- current R&D project with USA.	
	Spread assessment – how likely and to what extent could it spread?	Highly likely – flies short distances and hitchhikes long distances on inanimate objects. Difficult to contain.	
Impact	Are there known production impacts on kiwifruit industries internationally?	No reported impacts, <i>A. deliciosa</i> is a reported host but unknown what state of fruit ripeness it will eat. Only recently invaded kiwifruit production areas (Italy, California), impacts may occur when populations reach sufficient numbers. Kiwifruit regions with endemic populations (China) may be in equilibrium with native predators.	3
	Likely production impacts?	Unknown. High in some crops causing damage to fruit making it unfit for sale.	
	Degree of market access implications if established?	Likely to be low or non-existent as markets consider fresh produce a low risk pathway	
	Do we have the tools to manage if it arrived in or detected in NZ?	Chemical treatments have limited effectiveness and require repeat applications. Pheromone traps available but also limited effectiveness.	
Risk Score (entry x establishment x impact)			75

White Peach Scale (*Pseudaulacaspis pentagona*)

Rank: 3

Description: White Peach Scale (WPS) has caused significant impact to the kiwifruit industry in Latina, Italy with a reported 10-20% loss of marketable fruit from the region in 2004. WPS could easily adapt to New Zealand conditions and is therefore considered a serious threat to our kiwifruit industry. WPS is regularly intercepted at the border and there have been several post-border interceptions in recent years resulting in MPI reviewing the risk assessment for this organism which should result in a reduced risk of entry from pathways such as kiwifruit from Italy.



Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Kiwifruit & other fresh produce imports	4
	Where does it occur?	Almost global distribution including Australia	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Produce and nursery stock, most interceptions are on Italian kiwifruit	
	Do we know of previous post-border interceptions?	Yes, multiple. In 2014 there were 2 post-border finds on Italian kiwifruit	
	Is it associated with countries we are trading with?	Yes kiwifruit from Italy highest risk (5 consignments had live WPS 2011-2013)	
Potential for establishment	Demonstrated ability to colonise?	Yes, originated in Asia now almost spread globally	3
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Depends on pathway. Low likelihood from fresh produce pathway but higher if brought in on plant material	
	Is NZ climate considered favourable?	Yes	
	Can an effective trapping system be implemented to reduce risk of establishment?	No	
	Spread assessment – how likely and to what extent could it spread?	Moderate – crawlers disperse up to 1m but can disperse further by wind, insects & birds. Plant movements can disperse WPS over longer distances	
Impact	Are there known production impacts on kiwifruit industries internationally?	Yes - significant impact in Italy, 10-20% fruit loss in Latina, 2004	5
	Likely production impacts?	Moderate/ high - results in early leaf and fruit drop, increased costs associated with control	
	Degree of market access implications if established?	Low/ moderate as most countries have it. Cold disinfestation limited effectiveness as a treatment	
	Do we have the tools to manage if it arrived in or detected in NZ?	Yes, but limited effectiveness and high cost	
Risk Score (entry x establishment x impact)			60

Ceratocystis fimbriata

Rank: 4

Description: *Ceratocystis fimbriata* is a fungal pathogen that is causing significant damage to kiwifruit orchards in Brazil, with some growers reporting 50% vine loss over the past 5 years. Vine death can occur extremely rapidly following infection, with Hayward on Bruno rootstock appearing to be the most affected cultivar.



Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Kiwifruit known to be a highly susceptible host to multiple strains in Brazil. <i>C. fimbriata</i> from any population in South America could be an aggressive pathogen on kiwifruit. Strains causing epidemics in South China (Eucalyptus, taro, loquat, pomegranate) Oman & Pakistan (mango), India (pomegranate) and Indonesia (Acacia) are genetically similar and may also likely to be pathogenic to kiwifruit. <i>C. fimbriata</i> can spread from live vine to neighbouring vine through direct root contact, contaminated tools and scions, as well as by the Ambrosia beetle	3
	Where does it occur?	Worldwide but kiwifruit strain reported in Brazil. Strains in South China, Oman, Pakistan, India, and Indonesia may be pathogenic to kiwifruit. A strain is known to be present in New Zealand but thought to be host specific for Kumara and proven to be non-pathogenic to kiwifruit	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Not kiwifruit, other hosts traded which could carry strains but the impact any such strains on <i>Actinidia</i> is uncertain	
	Do we know of previous post-border interceptions?	No.	
	Is it associated with countries we are trading with?	Yes- other strains/hosts found in many countries	
Potential for establishment	Demonstrated ability to colonise?	Yes -other strains/hosts widespread	2
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Depends on entry pathway, unknown	
	Is NZ climate considered favourable?	Yes	
	Can an effective trapping system be implemented to reduce risk of establishment?	No	
	Spread assessment – how likely and to what extent could it spread?	Plant material movements most likely method of spread. May spread in other hosts before transferring to kiwifruit. Ambrosia beetles and other insects may vector the pathogen but are not the sole mechanism of spread.	

Impact	Are there known production impacts on kiwifruit industries internationally?	Yes - severe impacts in Brazil with some orchards reporting 50 % vine loss	7
	Likely production impacts?	Severe impacts, potentially destroy Brazil industry	
	Degree of market access implications if established?	Unknown but expected to be low for fruit	
	Do we have the tools to manage if it arrived in or detected in NZ?	Many treatments trialled in Brazil, none found to be effective so far	
Risk Score (entry x establishment x impact)			42

Psa - non New Zealand biovars

Rank: 5

Description: Different outbreaks of Psa have been caused by at least four related, but genetically distinct lineages of *Pseudomonas syringae* and it is likely that many more exist in wild kiwifruit populations. The Japanese strain is of particular concern as it has shown a much higher virulence against Hayward cultivars than the Psa-V strain currently in NZ. New genetic material of any strain is a concern due to the potential of horizontal gene transfer and the impact new strains may have on new or existing kiwifruit cultivars.

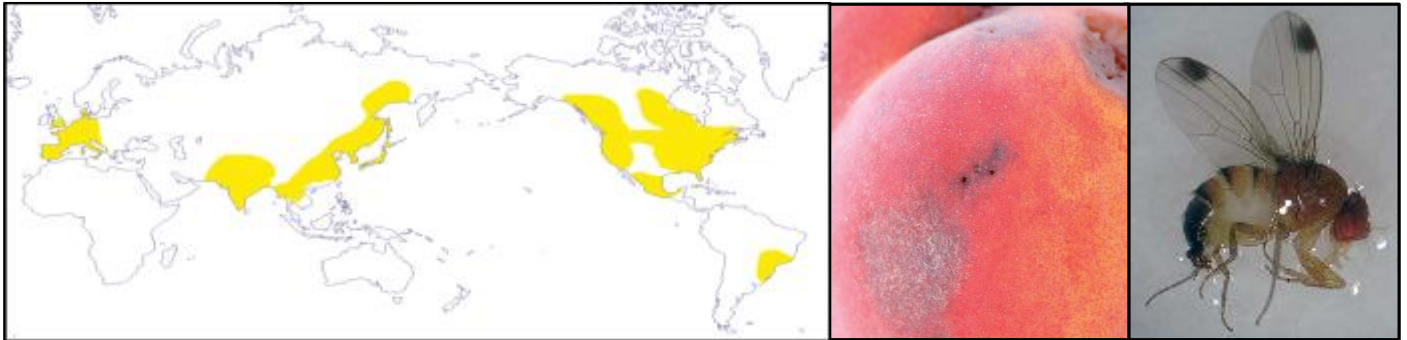


Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Kiwifruit plant material, pollen, nursery stock or contaminated equipment / clothing	1
	Where does it occur?	Japan, Korea, China, Italy all have biovars different to NZ. Worldwide genetic variation not well understood and any new genetic material is of concern.	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Yes, although nursery & pollen IHS currently cancelled. No evidence that fruit is a pathway, seed is allowed but there is no evidence that Psa is seed transmitted and imports must be permitted, assessed for emerging risks and processed through post-entry-quarantine.	
	Do we know of previous post-border interceptions?	Yes - New Zealand has Psa3 (Psa-V) and Psa4 (Psa-LV)	
	Is it associated with countries we are trading with?	Yes but IHS tightening post Psa-V incursion provides greater security	
Potential for establishment	Demonstrated ability to colonise?	Yes - probably originated in China and now present in nearly every kiwifruit region	5
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Strongly dependent on pathway, potentially high	
	Is NZ climate considered favourable?	Yes	
	Can an effective trapping system be implemented to reduce risk of establishment?	No	
	Spread assessment – how likely and to what extent could it spread?	Industry biosecurity practices can limit spread, new strains difficult to distinguish from Psa-V	
Impact	Are there known production impacts on kiwifruit industries internationally?	Yes, most kiwifruit industries around the world are impacted by a Psa strain.	8
	Likely production impacts?	Psa1 and Psa 2 are likely to be more virulent to Hayward cultivars than Psa3 (Psa-V). Impact on Psa3 tolerant cultivars (G3) is unknown.	
	Degree of market access implications if established?	Low / none	
	Do we have the tools to manage if it arrived in or detected in NZ?	Limited - measures in place to reduce spread. Diagnostic tests already in use.	
Risk Score (entry x establishment x impact)			40

Spotted Wing Drosophila (*Drosophila suzukii*)

Rank: 6

Description: Spotted-wing drosophila (SWD) lay eggs in ripening fruit making it soft and unmarketable. The SWD is a serious threat to fruit crops in every country it has established in, resulting in major economic costs due to control, crop destruction and market access implications.



Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Fresh produce	2
	Where does it occur?	Japan, China, SE Asia, Americas, Europe	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Yes - fresh produce from these countries possible entry pathway	
	Do we know of previous post-border interceptions?	No	
	Is it associated with countries we are trading with?	Yes, multiple trade pathways	
Potential for establishment	Demonstrated ability to colonise?	Yes- rapid expansion in North America and Europe, new incursion in South America	5
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Likely, mobile in local areas and spreads in infested fruit	
	Is NZ climate considered favourable?	Yes, 10 to 25°C optimum	
	Can an effective trapping system be implemented to reduce risk of establishment?	No, some traps are available but limited effectiveness for low populations, no pheromone traps available	
	Spread assessment – how likely and to what extent could it spread?	High – invasions internationally have spread rapidly both through short distance flight and movement of infested fruit.	
Impact	Are there known production impacts on kiwifruit industries internationally?	Green and gold not known hosts. Arguta is a known host but impacts expected to be low	3
	Likely production impacts?	Known to damage ripening fruit making unsuitable for markets. Wide range of host species so impacts on kiwifruit possible, but unlikely given lack of reported impacts in kiwifruit production regions where SWD is endemic (China) and invasive (Italy)	
	Degree of market access implications if established?	Moderate – most markets have the pest and some still trade in host material, Australia would likely impose access restrictions	
	Do we have the tools to manage if it arrived in or detected in NZ?	No pheromone traps available, sprays can be used for eradication in combination with destroying ripening fruit	
Risk Score (entry x establishment x impact)			30

Verticillium wilt – (Verticillium albo atrum)

Rank 7

Description: Chilean kiwifruit growers have suffered large losses from the soil borne pathogen, *Verticillium albo-atrum*, with some orchards losing over 80% of vines. In susceptible kiwifruit cultivars, infection always leads to plant death and this typically occurs very suddenly. There appear to be many strains of *V. albo-atrum* affecting a range of host species worldwide, however only Chile has reported the presence of a strain that is virulent against kiwifruit.



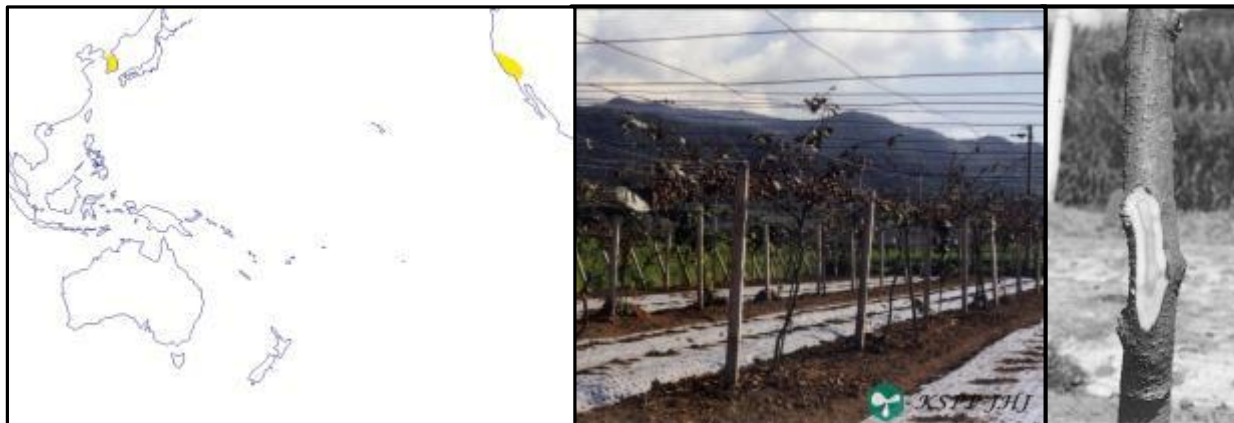
Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Kiwifruit and other hosts like hops and alfalfa (present in other hosts in NZ but not virulent to kiwifruit)	2
	Where does it occur?	Kiwifruit strain in Chile, other strains widespread	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	No, there are no kiwifruit imports from Chile	
	Do we know of previous post-border interceptions?	No. A strain does exist in NZ in other host species that is not virulent towards kiwifruit. The likelihood of this NZ strain evolving into a kiwifruit pathogen is uncertain.	
	Is it associated with countries we are trading with?	No	
Potential for establishment	Demonstrated ability to colonise?	Other strains of this species are widespread in other host species. Kiwifruit pathogenic strain only reported in Chile.	2
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Moderate - depends on pathway. Highly likely for plant material.	
	Is NZ climate considered favourable?	Yes	
	Can an effective trapping system be implemented to reduce risk of establishment?	No	
	Spread assessment – how likely and to what extent could it spread?	Spread through plant material movements, contaminated tools, through root contact, air and water. Insect vectors can also spread but are not essential for the pathogen to establish and spread.	
Impact	Are there known production impacts on kiwifruit industries internationally?	Yes - Severe damage in Chile, 100% plant death in some orchard blocks within a year.	7
	Likely production impacts?	Wilting of entire plant leading to serious injury and inevitably plant death. In susceptible cultivars such as Hort16A, the entire block can be killed within a year.	
	Degree of market access implications if established?	Low - not likely from fruit	
	Do we have the tools to manage if it arrived in or detected in NZ?	Limited tools available- hygiene to prevent spread and cut out infected plants. No treatments proven effective	
Risk Score (entry x establishment x impact)			28

Invasive Phytophthoras

Rank 8

Description: Phytophthora species have been responsible for devastating epidemics in a range of species around the world. Phytophthora species are often not host specific and can cause disease on a wide range of organisms, making assessment of impacts and potential pathways extremely difficult. New Zealand has several species of Phytophthora impacting kiwifruit already; impacts from other non-New Zealand species are likely should they enter our borders. *Phytophthora drechsleri* caused severe root rot in Korean kiwifruit, especially in poorly drained lowlands with over 80% of plants infected in some orchards.

Phytophthora ramorum is another species of concern, while impacts have not been reported on kiwifruit, this species has host range of over 100 diverse species of plants causing severe impacts in many species.



Risk this organism presents to the kiwifruit industry (<i>P. drechsleri</i>)			
Likelihood of entry	Items likely to be associated with	Kiwifruit plant material, pollen, nursery stock or contaminated equipment / clothing	1
	Where does it occur?	Reported in kiwifruit in Korea and California.	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	No kiwifruit plant material imported from Korea, may come in on other hosts. Kiwifruit imported from California but unlikely to enter on this pathway.	
	Do we know of previous post-border interceptions?	No. Earlier reports of the species on other hosts within New Zealand are now attributed to another sp.	
	Is it associated with countries we are trading with?	Yes, kiwifruit from California. Other species could enter via other pathways	
Potential for establishment	Demonstrated ability to colonise?	Phytophthora in general have a proven ability to colonise, this particular strain impacting kiwifruit is so far confined to Korea and California.	3
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Depends on pathway of entry, nursery stock would be highly likely.	
	Is NZ climate considered favourable?	Yes, many areas of poor draining kiwifruit orchards where the species would thrive	
	Can an effective trapping system be implemented to reduce risk of establishment?	No	
	Spread assessment – how likely and to what extent could it spread?	May spread through soil and through plant movements. No vector is required.	
Impact	Are there known production impacts on kiwifruit industries internationally?	Yes. The disease is relatively severe in Korea in the poorly drained lowlands with over 80% of plants infected in some orchards. Strain appears to be less virulent in California.	6
	Likely production impacts?	Severe root rot with extremely high infection rates in some areas, especially poor draining lowlands	

	Degree of market access implications if established?	Expected to be low/ negligible	
	Do we have the tools to manage if it arrived in or detected in NZ?	No control measures available with proven effectiveness	
	Risk Score (entry x establishment x impact)		18

Summer Canker
(*Pectobacterium carotovorum actinidiae*)
Rank 9

Description: A bacterial canker currently attacking gold kiwifruit in Korea has the potential to cause significant economic impact during the hot summer months and for orchards under plastic cover.

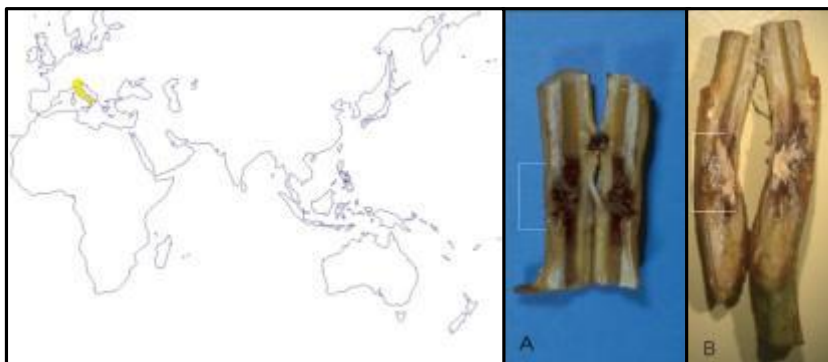


Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Kiwifruit plant material, nursery stock or pollen	1
	Where does it occur?	Only reported in the Jeju province of Korea	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	No kiwifruit plant material currently permitted to enter from Korea, visitors to the region a possible pathway.	
	Do we know of previous post-border interceptions?	No	
	Is it associated with countries we are trading with?	Yes	
Potential for establishment	Demonstrated ability to colonise?	<i>Pectobacterium carotovorum</i> is widely distributed across a broad host range. This subspecies is confined to Korea.	3
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Likely - similar to Psa but will depend on pathway of entry.	
	Is NZ climate considered favourable?	Prefers warmer temperatures than Psa. Orchards under plastic cover provide the most suitable habitat	
	Can an effective trapping system be implemented to reduce risk of establishment?	No	
	Spread assessment – how likely and to what extent could it spread?	Likely to spread in similar manner to Psa-V but distribution limited to warmer areas of New Zealand.	
Impact	Are there known production impacts on kiwifruit industries internationally?	Yes - Korea. A 2009 survey of Jeju orchards found 40% were infected with summer canker. Severe infection results in plant death	6
	Likely production impacts?	Symptoms similar to Psa-V, can result in plant death even in summer. Causes infection in different locations and times of year to Psa.	
	Degree of market access implications if established?	Low / none	
	Do we have the tools to manage if it arrived in or detected in NZ?	Limited - hygiene to prevent spread & cut out affected material	
Risk Score (entry x establishment x impact)			18

Esca disease – (*Fomitiporia mediterranea*)

Rank 10

Description: *Fomitiporia mediterranea* is a fungi associated with a vine rot disease referred to in Europe as “Esca disease”. This is a disease that has been present for many years in all European wine grape production countries and has shown a dramatic increase in incidence in the past decade. In 1995 the disease was first reported in kiwifruit in Italy and by 2000 the number of infected orchards in the Emilia Romagna region had risen significantly.



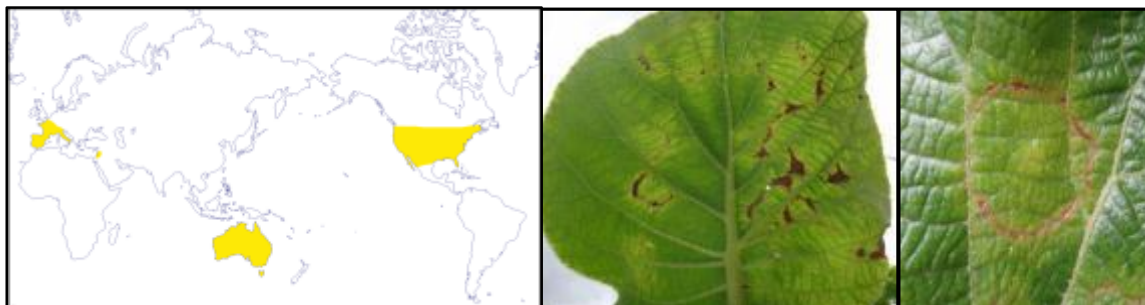
Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Grape and kiwifruit vines	2
	Where does it occur?	Only reported in kiwifruit in Italy since 1995. Significant disease in all European countries producing wine grapes.	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Kiwifruit nursery stock pathway well managed (currently closed), could enter on other host material such as grapevine plant material	
	Do we know of previous post-border interceptions?	No	
	Is it associated with countries we are trading with?	Italy. Visitors to orchards in Italy need to take appropriate hygiene measures. Fruit not considered a viable pathway	
Potential for establishment	Demonstrated ability to colonise?	Spread through multiple kiwifruit regions in Italy, and many wine grape countries.	3
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Depends on pathway, likely for plant material	
	Is NZ climate considered favourable?	Yes	
	Can an effective trapping system be implemented to reduce risk of establishment?	No	
	Spread assessment – how likely and to what extent could it spread?	Likely to spread through fungal spores. Contaminated equipment may also spread the pathogen.	
Impact	Are there known production impacts on kiwifruit industries internationally?	Yes – in Italy the disease can cause leaves to spot, wilt and drop. Fruit on diseased vines are stunted and do not reach full maturity. Vines decay internally reducing productivity and longevity.	3
	Likely production impacts?	Reduced productivity and longevity of vines	
	Degree of market access implications if established?	Likely to be low / negligible	
	Do we have the tools to manage if it arrived in or detected in NZ?	Preventative measures most effective, limited control options	
Risk Score (entry x establishment x impact)			18

Pelargonium zonate spot virus

Genus *Anulavirus*

Rank 11

Description: Pelargonium zonate spot virus (PZSV) is one of two viruses known to induce severe symptoms in kiwifruit—Cherry leaf roll virus (CLR) being the other. This virus is widely distributed in many species but has only been reported in kiwifruit in Italy. PZSV is reported as a severe disease in tomatoes and is seed transmissible; however symptomless expression has not been reported reducing the likelihood of infected fruit being exported.



Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Kiwifruit, pelargoniums, chrysanthemums and tomatoes	2
	Where does it occur?	Italy in kiwifruit, widespread in other hosts including presence in Italy, Spain, France, California, Israel and Australia in tomatoes.	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Nursery stock and fresh produce pathways.	
	Do we know of previous post-border interceptions?	No	
	Is it associated with countries we are trading with?	Yes –imports of Italian kiwifruit, and imports of other host material such as tomatoes from Australia	
Potential for establishment	Demonstrated ability to colonise?	Limited, only reported in kiwifruit in Southern Italy	2
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Depends on pathway, infected plants material host exposure likely	
	Is NZ climate considered favourable?	Yes	
	Can an effective trapping system be implemented to reduce risk of establishment?	No	
	Spread assessment – how likely and to what extent could it spread?	Spread through seed, pollen, plant movements and contaminated equipment. May be spread through asymptomatic material.	
Impact	Are there known production impacts on kiwifruit industries internationally?	Yes - Impacts in Southern Italy on Hort16A. Infected plants decline in vigour and production year after year. Impacts on other cultivars unknown.	4
	Likely production impacts?	Decrease in plant vigour & productivity	
	Degree of market access implications if established?	Low/ none	
	Do we have the tools to manage if it arrived in or detected in NZ?	High schemes for plant material and good hygiene prevent entry and spread. No viable control options for infected plants.	
Risk Score (entry x establishment x impact)			16