

Kiwifruit's Most Unwanted

June 2019



PURPOSE

To develop a list of high priority threats to the kiwifruit industry for readiness and response planning. Also, to offer a brief explanation of the methodology used to prioritise these threats.

BACKGROUND

KVH has 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 reviewed by members of the MPI Risk Analysis team. The matrix has had several iterations and updates since the beginning to reflect changes in the risk profile of pests and pathogens.

OVERVIEW OF MATRIX

In 2014 KVH developed a risk matrix to provide a consistent and objective approach for prioritising biosecurity threats to the kiwifruit industry. This is an update of this matrix to incorporate new information and the changing risk profiles of organisms since that time.

The framework consists of four 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 entryLevel of border and post-border interceptions	1
Likelihood of establishment	<ul style="list-style-type: none">Organism's ability to colonise other countriesSuitability of the New Zealand climateLikelihood of the organism finding a host post-borderAbility to establish effective trapping or surveillance systemAbility to spread and potential extent of spread	1
Impact to Production	<ul style="list-style-type: none">Known production impacts offshoreLikely production impacts in New ZealandAbility to control if established	10
Impact to Trade	<ul style="list-style-type: none">Likely market access implications if the organism were to establish	10
RISK SCORE	(Entry x Trade Impact) + (Establishment x Production Impact)	20

RESULTS

Twenty 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 eleven organisms that are the greatest concern to the kiwifruit industry. This can be further condensed to 8 of KVHs "Most Unwanted".

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

Rank	Name	Type of organism	Entry	Establish	Trade	Production	Total
1	Queensland Fruit Fly (<i>Bactrocera tryoni</i>)	Lure responsive fruit fly	0.9	0.3	9	1	8.4
2	Mediterranean fruit fly (<i>Ceratitis capitata</i>)	Lure responsive fruit fly	0.6	0.35	8	2	5.5
3	Oriental Fruit Fly (<i>Bactrocera dorsalis</i>)	Lure responsive fruit fly	0.7	0.3	7	1	5.2
4	Brazilian Wilt (<i>Ceratocystis fimbriata</i>)	Soil borne fungi	0.4	0.5	1	8	4.9
5	Brown Marmorated Stink Bug (<i>Halyomorpha halys</i>)	Sap sucking insect	1	0.6	1	6	4.6
6	Spotted Lanternfly (<i>Lycorma delicatula</i>)	Sap sucking insect	0.3	0.7	1	6	4.5
7	Psa non-NZ biovars (<i>Pseudomonas syringae actinidiae</i>)	bacteria	0.2	0.7	1	6	4.4
8	South American Fruit Fly (<i>Anastrepha fraterculus</i>)	Non-lure responsive fruit fly	0.3	0.8	9	1	3.5
= 9	White Peach Scale (<i>Pseudaulacaspis pentagona</i>)	Scale	0.8	0.5	1	5	3.3
= 9	Verticillium wilt (<i>Verticillium nonalfalfae</i>)	Soil borne fungi	0.3	0.6	1	5	3.3
= 9	<i>Phytophthora</i> <i>dreschleri</i>	Fungal-like organism	0.3	0.6	1	5	3.3
12	Yellow Spotted Stink Bug (<i>Erthesina fullo</i>)	Sap sucking insect	0.8	0.4	1	5	2.8
13	Summer Canker (<i>Pectobacterium carotovorum actinidiae</i>)	bacteria	0.2	0.5	1	5	2.7
= 14	Yellow Peach Grub (<i>Conogethes punctiferalis</i>)	Moth	0.4	0.5	4	2	2.6
= 14	Fruit Piercing Moth (<i>Eudocima phalonia</i>)	Moth	0.7	0.2	2	4	2.6
= 16	Asian Hornet (<i>Vespa velutina</i>)	Winged insect	0.2	0.7	1	3	2.1
= 16	Esca Disease (<i>Fomitiporia mediterranea</i>)	Soil borne fungi	0.3	0.6	1	3	2.1
18	<i>Phytophthora helicoides</i>	Fungi	0.4	0.4	1	4	2
19	Spotted Wing Drosophila (<i>Drosophila suzukii</i>)	Winged insect	0.2	0.8	3	1	1.4
20	Pelargonium zonate spot virus (PZSV)	Virus	0.2	0.2	1	4	1

Attachment 1: Risk matrices for the top twenty risk organisms

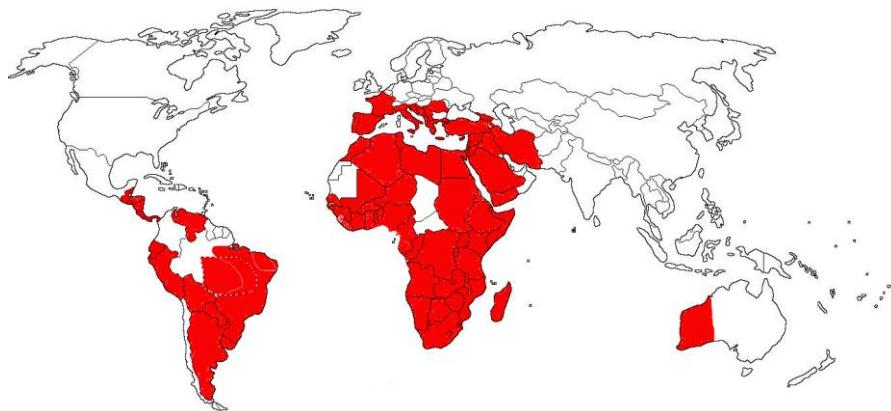
Priority 1: Queensland Fruit Fly (*Bactrocera tryoni*)



Description: Queensland Fruit Fly (QFF) is indigenous only to Australia. It is the major fruit fly pest species in Eastern Australia and can occur in large populations. Damage to fruit results from eggs being laid in fruit, feeding by the larvae, and decomposition of plant tissue by secondary microorganisms. Over 80% of New Zealand horticultural crops are susceptible to QFF. Incursions of breeding populations can result in significant market access implications for kiwifruit exports, especially QFF 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	0.9
	Where does it occur?	Australia, New Caledonia, French Polynesia and Pitcairn Is.	
	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 any border or post-border detections?	Yes, multiple border detections and post border responses including a breeding population in 2015 and the detection of multiple flies in 2019 in Auckland.	
	Is it associated with countries we are trading with?	Yes	
Likelihood for establishment	Demonstrated ability to colonise?	QFF has limited invasive ability as highlighted by its limited spread outside of native range.	0.3
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Very likely. Over 200 hosts associated with feeding. Likely to enter as larvae in fruit, hatch and fly to a fruit tree	
	Is NZ climate considered favourable?	Somewhat. Climatic modelling suggests New Zealand sits in the lower probability range of suitability. Restricted to northern areas.	
	Can an effective trapping system be implemented to reduce risk of establishment?	Yes- already in place for this 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.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	There have been no major impacts reported in Australia on kiwifruit	1/10
	Likely production impacts?	Low / moderate QFF is reported to successfully develop in G3 so potential production issues.	
	Do we have the tools to manage if it arrived in or detected in NZ?	Yes, cuelure pheromone traps.	
Trade Impact	Degree of market access implications if established?	Initially severe as not present in our major markets of Asia and Europe. Although phytosanitary cold treatments are available that could be used over the longer term- however and needs more development.	9/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			8.4

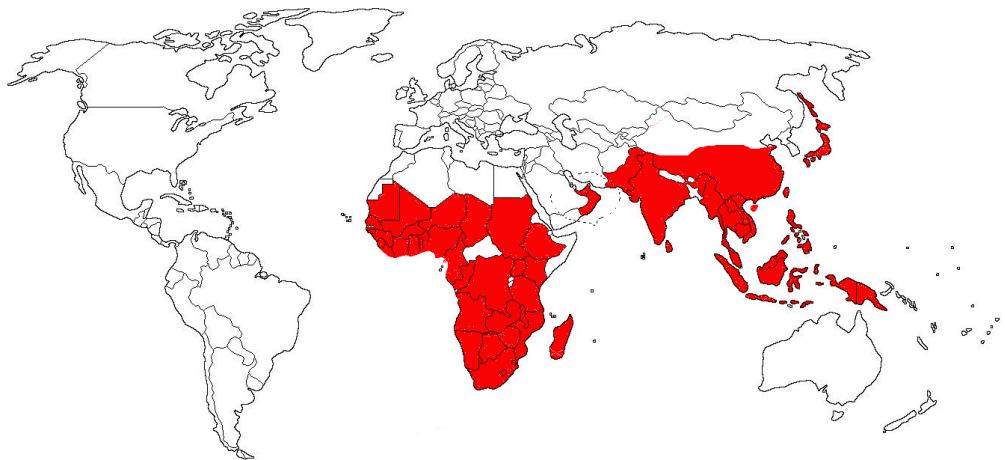
Priority 2:
Mediterranean Fruit Fly
(Ceratitis capitata)



Description: Med Fly has been recorded to infest more than 200 hosts worldwide. The first sign of damage is often larvae-infested or 'stung' fruit. Because of its wide distribution over the world, its ability to tolerate cooler climates better than most other species of tropical fruit flies, and its wide range of hosts, it is ranked amongst the most economically important fruit fly species. Incursions of breeding populations can result in significant market access implications for kiwifruit exports, especially to our biggest markets in Asia.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Fresh produce- both commercially and privately through passengers arriving in NZ.	0.6
	Where does it occur?	Wide spread. Found in Europe, Middle East, Africa, South America, Hawaii and Australia (WA).	
	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 any border or post-border detections?	Not many border detections. However, a breeding population was discovered in 1995 in Auckland.	
	Is it associated with countries we are trading with?	Yes	
Likelihood for establishment	Demonstrated ability to colonise?	Yes- originated in Africa but now widespread.	0.35
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	High. Known to feed on over 200 species so will find a host year-round.	
	Is NZ climate considered favourable?	Yes- ability to adapt to a range of climatic conditions. Hardier than other FF and can withstand cold temperatures better.	
	Can an effective trapping system be implemented to reduce risk of establishment?	Yes- a well-established trapping system is in place.	
	Spread assessment – how likely and to what extent could it spread?	High. Med Fly has been reported to fly up to 20km. Movement through infested fruit which can be controlled.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Med Fly found in Italy and little impact on kiwifruit reported. Med Fly oviposition reported to occur in damaged fruit but recovering pupae was very low suggesting Kiwifruit is a very poor host.	2/10
	Likely production impacts?	Low	
	Do we have the tools to manage if it arrived in or detected in NZ?	Yes, cuelure pheromone traps	
Trade Impact	Degree of market access implications if established?	High. Not found in Asia- our biggest export market. Although phytosanitary cold treatments are available that could be used over the longer term- these are cultivar specific however and need more development.	8/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			5.5

Priority 3:
Oriental Fruit Fly
(Bactrocera dorsalis)



Description: The oriental fruit fly (OFF) is a very destructive pest of fruit in areas where it occurs. It is native to large parts of tropical Asia, has become established over much of Africa. The oriental fruit fly has been recorded on over 300 species of fruit and vegetables, although kiwifruit is not considered a major host. Incursions of breeding populations can result in significant market access implications for kiwifruit exports, more specifically the European market as OFF is already found throughout Asia.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Fresh produce- both commercially and privately through passengers arriving in NZ.	0.7
	Where does it occur?	Throughout Asia and Africa. Also found in Hawaii.	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Yes	
	Do we know of any border or post-border detections?	No post border finds but is detected at the border multiple times a season.	
	Is it associated with countries we are trading with?	Yes	
Likelihood for establishment	Demonstrated ability to colonise?	Yes- native to parts of Asia and now spread throughout Asia and into Africa. Established in Hawaii.	0.3
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	High. OFF has over 300 host species. No shortage of host plants year round.	
	Is NZ climate considered favourable?	Yes- warmer areas such as Northland, Auckland, Waikato ideal. Not favourable in South Island.	
	Can an effective trapping system be implemented to reduce risk of establishment?	Yes- already established.	
	Spread assessment – how likely and to what extent could it spread?	High- OFF is a strong flier and is highly mobile. Movement through infested fruit which can be controlled.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	OFF widespread and invasive in China with no reported impacts on kiwifruit.	1/10
	Likely production impacts?	Low- OFF is capable of oviposition in gold and green but kiwifruit is not considered a major host.	
	Do we have the tools to manage if it arrived in or detected in NZ?	Yes, cuelure pheromone traps	
Trade Impact	Degree of market access implications if established?	High. Not found in Europe which one of kiwifruits biggest export markets. Although phytosanitary cold treatments are available that could be used over the longer term, these are cultivar specific and need more development	7/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		5.2

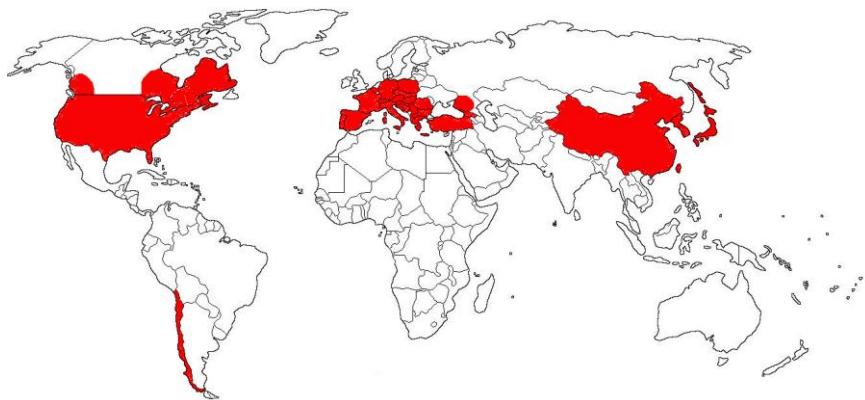
Priority 4:
Brazilian Wilt
(Ceratocystis fimbriata)



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	Plant material- both legal and illegal importations. Soil on footwear or equipment.	0.4
	Where does it occur?	Worldwide but kiwifruit strain reported only in Brazil. Strains causing epidemics in South China, Oman & Pakistan, India and Indonesia are genetically similar and may also likely to be pathogenic to kiwifruit. A strain present in New Zealand is 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 any border or post-border detections?	No.	
	Is it associated with countries we are trading with?	Yes- other strainshosts found in many countries	
Likelihood for establishment	Demonstrated ability to colonise?	Yes -other strainshosts widespread	0.5
	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. <i>C. fimbriata</i> can spread from vine top vine through direct root contact, contaminated tools and scions, as well as by the Ambrosia beetle.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Yes - severe impacts in Brazil with some orchards reporting 50 % vine loss. Hayward and Bruno are susceptible.	9/10
	Likely production impacts?	Severe impacts potential to destroy Brazil industry. 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	
	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	
Trade Impact	Degree of market access implications if established?	Unknown but expected to be low for fruit	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		4.9

Priority 5:
Brown Marmorated Stink Bug
*(*Halymorpha halys*)*



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 and Europe in recent years. BMSB causes cosmetic damage to fruit and vegetables resulting in produce that is unfit for sale. BMSB is regularly intercepted at our borders. 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. Interceptions have occurred across all the pathways	1
	Where does it occur?	China, Korea, Japan, Taiwan, USA, currently spreading throughout Europe (19+ countries).	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Vehicles and machinery considered highest risk. Hitchhiker so associated with containers also.	
	Do we know of any border or post-border detections?	Over 3000 BMSB found at border during 2018/19 season. Numerous post border interceptions.	
	Is it associated with countries we are trading with?	Yes, as a hitchhiker species numerous potential pathway exist from each country.	
Likelihood for establishment	Demonstrated ability to colonise?	Yes, spread rapidly in the USA and now present in over 44 states and 4 provinces of Canada. Rapid invasion occurring across Europe. Specific biological cues to exit diapause and quiescence are required before BMSB can reproduce.	0.65
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Strong fliers (< 2km) and have a wide host range so highly 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	
	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.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Anecdotal reports suggest impacts to both green and gold varieties averaging about 5-10% but up to 30% on severely impacted orchards in China and Korea and parts of Europe. Heavy losses reported from a grower in the USA (confirm)	6/10
	Likely production impacts?	High in some crops causing damage to fruit making it unfit for sale.	
	Do we have the tools to manage if it arrived in or detected in NZ?	Chemical treatments have limited effectiveness and require repeat applications. Pheremone traps available but also limited effectiveness. Exclusion netting an option. Biological control approved for release if BMSB were to arrive.	
Trade Impact	Degree of market access implications if established?	Likely to be low or non-existent as markets consider fresh produce a low risk pathway	1/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			4.6

Priority 6:
Spotted Lanternfly
(Lycorma delicatula)



Description: The spotted lanternfly (SLF), is neither a fly nor a moth but belongs to the planthopper family. The SLF is considered native to China, India, and Vietnam. It has been introduced as a non-native insect to South Korea and Japan, prior to its detection in the United States in 2014. SLF causes damage by feeding on trunks, leaves and stems of plants (not the fruit). Highly susceptible hosts include apples, grapes, stone fruit and forestry species, such as pine but reported impacts on kiwifruit in China and Korea.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Hitchhiker pest- concentration on the inanimate pathway.	0.3
	Where does it occur?	Native to parts of Asia, spread to Korea and Japan and is now invasive in the USA	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Lays its eggs on smooth vertical surfaces so containers, vehicles and equipment could be considered high risk.	
	Do we know of any border or post-border detections?	No recorded post border interceptions	
	Is it associated with countries we are trading with?	Yes	
Likelihood for establishment	Demonstrated ability to colonise?	In Korea, it spread across the whole country in under 2 years. Invasive in US since 2014 and quickly spread throughout the state of Pennsylvania.	0.7
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Over 70 hosts reported. Tree of heaven is preferred host and is present in NZ but not widespread.	
	Is NZ climate considered favourable?	Yes- more suitable in the warmer North Island climate.	
	Can an effective trapping system be implemented to reduce risk of establishment?	No, there are currently no known pheromone aggregation traps for SLF. Currently method is visual monitoring and sticky traps	
	Spread assessment – how likely and to what extent could it spread?	Not a strong flier but thought to easily make its way around through movement of egg masses on vehicles, outdoor furniture etc.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Reported as a pest of kiwifruit in China.	6/10
	Likely production impacts?	Yes, main impacts centre around the sooty mould growth on the excretions of the SLF.	
	Do we have the tools to manage if it arrived in or detected in NZ?	No.	
Trade Impact	Degree of market access implications if established?	Likely to be low or non-existent as markets consider fresh produce a low risk pathway	1/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			4.5

Priority 7: Psa non-New Zealand biovars



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	Imported kiwifruit plant material, Illegal plant material, pollen, nursery stock or contaminated equipment / clothing.	0.2
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- nursery and plant material importation allowed but specific tests for these strains. 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 any border or post-border detections?		Yes - New Zealand has Psa3 (Psa-V) and Psa4 (Psa-LV)	
Is it associated with countries we are trading with?		Yes but IHS tightened post Psa-V incursion providing greater security	
Likelihood for establishment	Demonstrated ability to colonise?	Yes - probably originated in China and now present in nearly every kiwifruit region	0.7
	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.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Yes, most kiwifruit industries around the world are impacted by a Psa strain. Pathogenicity screening is being undertaken	6/10
	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.	
	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.	
Trade Impact	Degree of market access implications if established?	Low / none	1/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			4.4

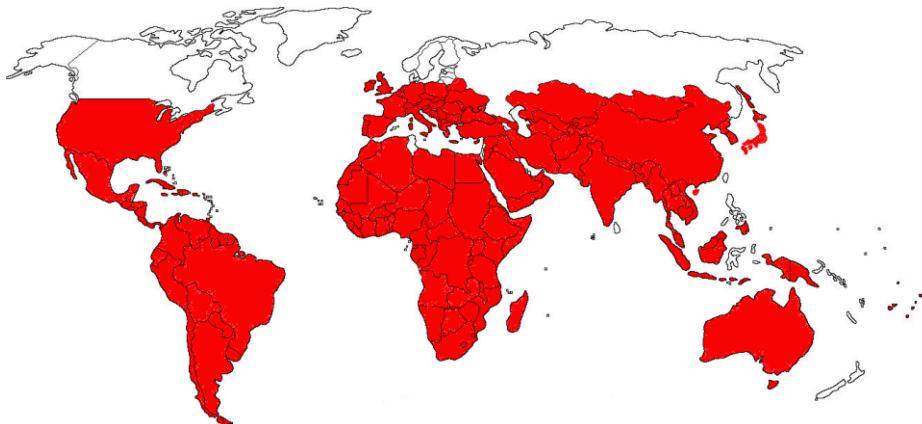
Priority 8:
South American Fruit Fly
(Anastrepha fraterculus)



Description: SAFF is considered the most economically damaging species of fruit fly in fruit production areas of Peru, Uruguay, and southern Brazil with complete crop loss possible. Fruit losses occur as a result of oviposition wounds causing deformation and inducing fruit decay, and from larval feeding within fruit, which often leads to rots. Further economic costs are those associated with control, quarantine compliance, and restriction or loss of markets.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Fresh produce- both commercially and privately through passengers arriving in NZ.	0.3
	Where does it occur?	Parts of Central and North America and most of South America. SAFF is not found in Chile.	
	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 any border or post-border detections?	The first border detection of an <i>Anastrepha</i> sp (only ID'd to genus) in 2019. No post border detections	
	Is it associated with countries we are trading with?	Yes. Fresh produce is brought in from South American. Most recent above detection was on Pawpaw from Uruguay.	
Likelihood for establishment	Demonstrated ability to colonise?	Yes, has spread from native range although restricted to the Americas.	0.8
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Over 90 reported hosts- will likely find a host year-round.	
	Is NZ climate considered favourable?	Yes, kiwifruit growing areas are thought to be climatically suitable. Likely restricted to North Island. 10-35 degrees is estimated temp range for survival.	
	Can an effective trapping system be implemented to reduce risk of establishment?	No pheromone traps available- fruit baiting traps used overseas. The current FF surveillance does not detect SAFF.	
	Spread assessment – how likely and to what extent could it spread?	High- SAFF is a strong flier. Movement through infested fruit which can be controlled.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Kiwifruit is not a preferred host. Lab results have suggested that SAFF can complete life cycle on some cultivars- so production impacts is fairly cultivar specific.	1/10
	Likely production impacts?	Low. Mature fruit may occasionally be targeted for oviposition, but more likely fallen fruit so production impacts are thought to be low.	
	Do we have the tools to manage if it arrived in or detected in NZ?	Toxic baits or insecticides are used mostly overseas to control SAFF- baits available in NZ.	
Trade Impact	Degree of market access implications if established?	Initially severe- Not found in Asia and Europe- kiwifruits biggest export markets. Although phytosanitary cold treatments are available that could be used over the longer term. No trapping system means proving area/country of freedom hard which means higher market access implications.	9/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		3.5

Priority 9:
White Peach Scale
(Pseudaulacaspis pentagona)



Description: White Peach Scale (WPS) has caused significant impact to the kiwifruit industry in 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	0.8
	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 any border or post-border detections?	Yes, WPS is often found at the border during routine inspection. In 2019, there have been post-border finds on Italian kiwifruit.	
	Is it associated with countries we are trading with?	Yes, kiwifruit from Italy is highest risk	
Likelihood for establishment	Demonstrated ability to colonise?	Yes, originated in Asia now spread globally.	0.5
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Low likelihood from fresh produce pathway	
	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	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Yes – impacts are reported from most kiwifruit growing regions globally. 10-20% recorded losses in Italy due to cosmetic quality.	5/10
	Likely production impacts?	Moderate/ high – heavy infestations result in early leaf and fruit drop, increased costs associated with control. In extreme cases, whole vines can die.	
	Do we have the tools to manage if it arrived in or detected in NZ?	Yes, but limited effectiveness and high cost.	
Trade Impact	Degree of market access implications if established?	Low/ moderate as most countries have it. Cold disinfection limited effectiveness as a treatment. WPS scale is present in Italy and no mandatory treatments are required on Italian exports.	1/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			3.3

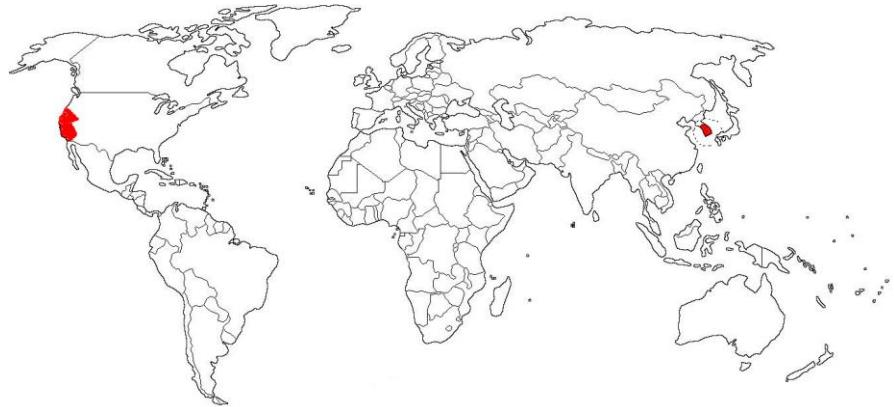
Priority 9:
Verticillium wilt
(Verticillium nonalfalfa)



Description: Chilean kiwifruit growers have suffered large losses from the soil borne pathogen, *Verticillium nonalfalfa*, 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 *Verticillium nonalfalfa* 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). Illegal plant material	0.3
	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 any border or post-border detections?	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	
Likelihood for establishment	Demonstrated ability to colonise?	Other strains of this species are widespread in other host species. Kiwifruit pathogenic strain only reported in Chile.	0.6
	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.	
Production 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. These impacts are cultivar dependant and also the environment may have an influence on production impacts.	5/10
	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.	
	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	
Trade Impact	Degree of market access implications if established?	Low - not likely from fruit	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		3.3

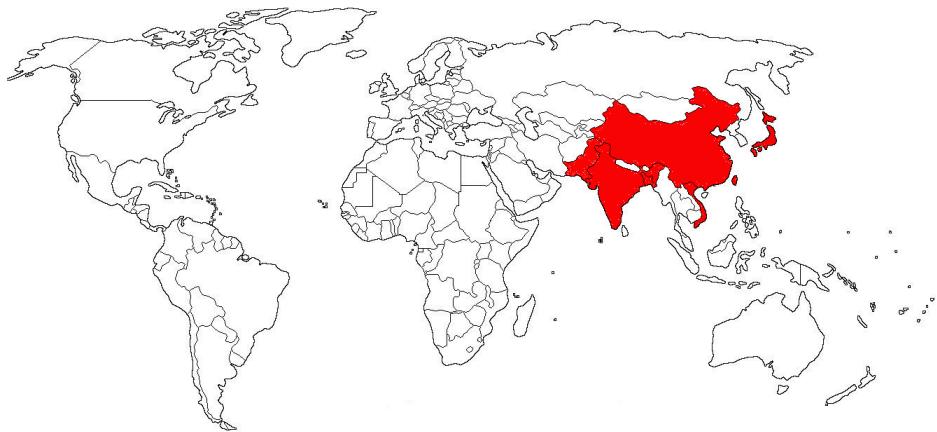
Priority 9: *Phytophthora drechsleri*



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.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Kiwifruit plant material, other host plant material, nursery stock or contaminated equipment / clothing/ footwear.	
	Where does it occur?	Reported on 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 any border or post-border detections?	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	
Likelihood 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. Environment will likely play a big role (i.e. waterlogged soils, stressed plants etc)	
	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. Human vectoring will spread disease long distance.	
Production 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.	
	Likely production impacts?	Severe root rot with extremely high infection rates in some areas, especially poor draining lowlands	
	Do we have the tools to manage if it arrived in or detected in NZ?	No control measures available with proven effectiveness	
Trade Impact	Degree of market access implications if established?	Expected to be low/ negligible	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		3.3

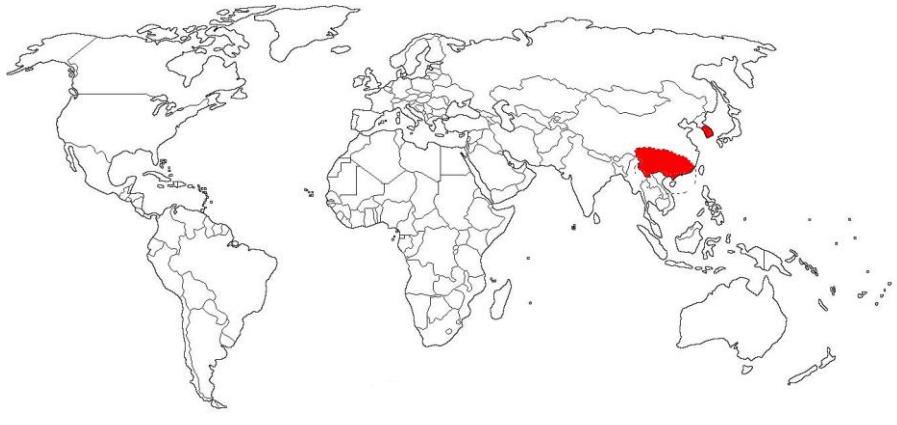
Yellow Spotted Stink Bug (*Erthesina fullo*)



Description: In their natural range in Asia there is limited information recorded about their host range or impacts on plants and trees, though impacts on timber trees and horticultural crops have been noted. YSSB causes cosmetic damage to fruit and vegetables resulting in produce that is unfit for sale. Like BMSB, YSSB is a known hitchhiker pest which can arrive in New Zealand in containers, or amongst general cargo and used machinery and vehicles. This makes it difficult to identify and manage specific entry pathways.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Hitchhiker pest- inanimate pathway with concentration on vehicles and machinery.	0.8
	Where does it occur?	Asia- China, Japan, Vietnam, India, Pakistan, Bangladesh and Taiwan	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Vehicles and machinery high volume import- China and Japan import high numbers on this pathway.	
	Do we know of any border or post-border detections?	Border interceptions on vessels and containers. A number of post border detections on vehicles.	
	Is it associated with countries we are trading with?	Yes	
Likelihood for establishment	Demonstrated ability to colonise?	Has not established outside native range	0.4
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Likely. Strong flier (up to 3km). Limited information on host range but known to feed on up to 50 hosts- mainly forestry species but some significant horticultural species too.	
	Is NZ climate considered favourable?	The recorded distribution is like that of BMSB native range. Therefore, it could be assumed that there is some climatic suitability similar to BMSB.	
	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 – flies short distances and hitchhikes long distances on inanimate objects.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Reported as a pest on kiwifruit in China.	5/10
	Likely production impacts?	Somewhat unknown. Likely low/moderate	
	Do we have the tools to manage if it arrived in or detected in NZ?	Little information on management of YSSB but it is thought management techniques would be similar to those BMSB management techniques. I.e. chemical treatments require repeat applications, exclusion netting could work, biological controls possible (noting BMSB approval it is not approved for YSSB).	
Trade Impact	Degree of market access implications if established?	Likely to be low or non-existent as markets consider fresh produce a low risk pathway	1/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			2.8

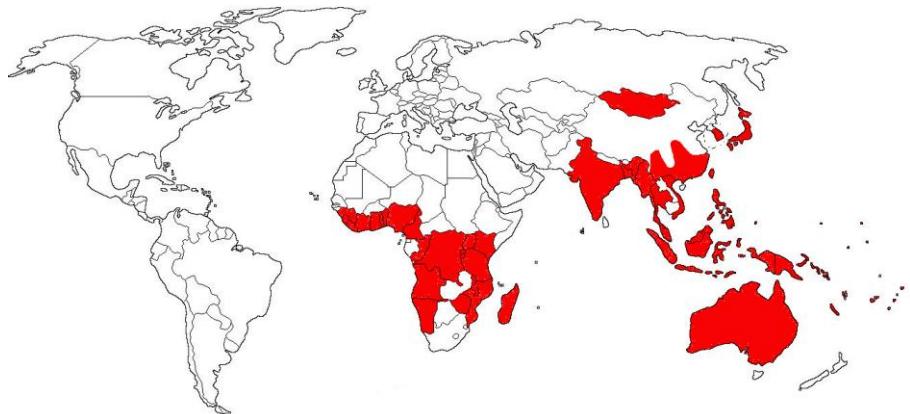
Summer Canker
*(Pectobacterium carotovorum
 actinidiae)*



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, illegal plant material, nursery stock or pollen	0.2
	Where does it occur?	Found in Korea and more recently in parts southern and eastern China.	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Actinidia Nursery stock/plants for planting pathway reopened in 2018 but specific testing for this pathogen occur. Visitors to the region a possible pathway.	
	Do we know of any border or post-border detections?	No	
	Is it associated with countries we are trading with?	Yes	
Likelihood for establishment	Demonstrated ability to colonise?	<i>Pectobacterium carotovorum</i> is widely distributed across a broad host range. This subspecies is found in Korea, and more recently, has established in parts of China.	0.5
	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. Infection will occur in the hotter summer months and 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.	
Production 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. Reports from China state that infection has been around 10% of an orchard.	5/10
	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.	
	Do we have the tools to manage if it arrived in or detected in NZ?	Limited - hygiene to prevent spread & cut out affected material	
Trade Impact	Degree of market access implications if established?	Low / none	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		2.7

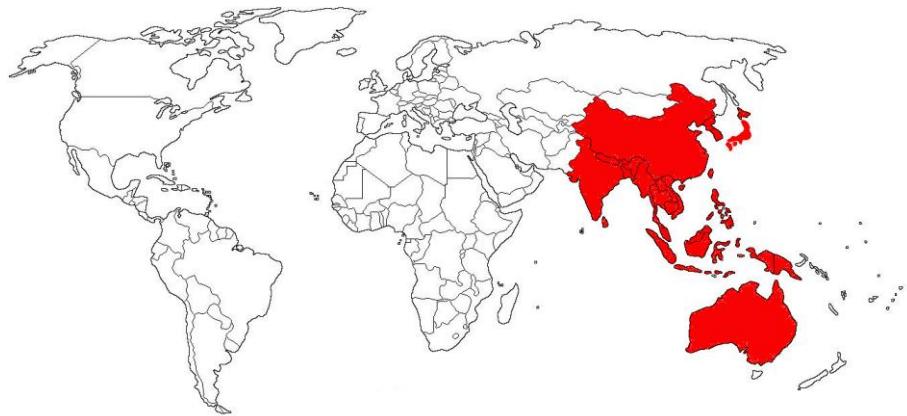
Fruit Piercing Moth (*Eudocima phalonia*)



Description: Fruit piercing moth is native to the Indo-Malaysian region of Asia, with an extensive distribution throughout Africa, Asia and Oceania, including Australia. It is a significant economic pest of ripening fruits and is known to attack over 40 different types of fruit. The Fruit Piercing moth is nocturnal and moths feed on fruiting crops at night then subsequently return to surrounding bush. As well as causing damage through holes and discolouration of skin, feeding damage can also result in secondary fungal or bacterial infections.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Fresh produce, can blow over on the wind currents from Australia.	0.7
	Where does it occur?	Widespread throughout Asia and Africa. Also present in Hawaii, Australia, and parts of the Pacific.	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Yes	
	Do we know of any border or post-border detections?	It is an occasional vagrant in NZ - blown from Australia on prevailing westerlies.	
	Is it associated with countries we are trading with?	Yes	
Likelihood for establishment	Demonstrated ability to colonise?	Yes, wide spread from its native range. However, despite interceptions in NZ of FPM thought to have blown across the Tasman, none have resulted in an established population.	0.2
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Highly polyphagous- adults are known to feeding on up to 55 different species. Larvae feed mainly on the foliage of species within the families of Menispermaceae and Fabaceae.	
	Is NZ climate considered favourable?	Yes. Kiwifruit growing regions may be climatically suitable.	
	Can an effective trapping system be implemented to reduce risk of establishment?	No semiochemicals have been identified for this pest so traps baited with an attractant is not an option.	
	Spread assessment – how likely and to what extent could it spread?	Adults are strong fliers.	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Yes, kiwifruit is a known host but reports on level of incidence/damage are minimal. In Queensland (AU), 30-40% crop damage has been reported in bad years.	4/10
	Likely production impacts?	Pierce ripe fruit & feed on juices creating damage in fruit. It is thought secondary infection by pathogens	
	Do we have the tools to manage if it arrived in or detected in NZ?	Cultural methods seem to be primary management tool- such as early picking, bagging, orchard layout, removal of fallen fruit, host trees of caterpillar. Chemical control not easily achieved as this needs to occur when fruit is ripe (i.e. around harvest)	
Trade Impact	Degree of market access implications if established?	As it is the adult stage that is damaging (larvae feeds on foliage) so fruit itself is low risk and market access implications thought to be minimal.	2/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			2.6

Yellow Peach Grub (*Conogethes punctiferalis*)



Description: The yellow peach moth belongs to a complex of species native to India, Southeast Asia, and Australia. Larvae are highly polyphagous and feed on fruits in a wide variety of families. Intense feeding on fruits can render them unfit for commercial sale leading to economic losses. Boring by larvae can cause extensive damage and frass accumulation, but may also predispose fruits to secondary pathogens, adding to crop loss.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Fresh produce	0.4
	Where does it occur?	Found throughout Asia and in Australia	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Yes, as it is associated with the fresh produce pathway	
	Do we know of any border or post-border detections?	No	
	Is it associated with countries we are trading with?	Yes, China and Australia mainly.	
Likelihood for establishment	Demonstrated ability to colonise?	It has established itself in Australia. Interceptions reported in other countries, but it has not established in these countries.	0.5
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Highly polyphagous- feeding on fruit and crop plants from over 16 families which are throughout NZ	
	Is NZ climate considered favourable?	Parts of New Zealand may have climatic suitable- particularly the warmer, wetter northern regions.	
	Can an effective trapping system be implemented to reduce risk of establishment?	Pheromones are used by females to attract males, so a pheromone based trapping system could be implemented but at this stage there is no system in place.	
	Spread assessment – how likely and to what extent could it spread?	Moderate- Eggs, larvae and pupae are spread through infested fruit movement. Lifecycle can be completed on discarded waste. Adults are active fliers and can fly long distances.	
Impact	Are there known production impacts on kiwifruit industries internationally?	This has been reported as a pest on kiwifruit in China.	2/10
	Likely production impacts?	Eggs are laid on surface and larvae feed on leaves/stems and fruit. Excretions have a high sugar content which covers the fruit surface, attracting secondary insect pests and diseases that further damage fruit	
	Do we have the tools to manage if it arrived in or detected in NZ?	Nothing specific but cultural methods will likely play an important role in management.	
Trade Impact	Degree of market access implications if established?	Moderate Fruit is considered a high-risk pathway for larvae. It is still relatively confined globally so it could have market access implications.	4/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			2.6

Asian Hornet (*Vespa velutina*)



Description: The Asian hornet is an invasive predatory pest that originates from Asia. There are a dozen known sub-species of the Asian hornet. While typically all hornets are predators of insect species, the Asian hornet has been a significant problem for beekeepers due to its aggressive and effective predation of the European honeybees and wild bee populations. Asian hornets have a direct impact on honeybee colonies by killing honeybees and honey bee brood to feed their own brood larvae.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	High hiker pest so on inanimate commodities likely but need a queen to be able to establish a colony. Thought to have arrived in Europe and Korea in importations from China.	0.2
	Where does it occur?	Native to South East Asia, including China. Now present in parts of Europe, Japan and South Korea.	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Yes	
	Do we know of any border or post-border detections?	No	
	Is it associated with countries we are trading with?	Yes	
Likelihood for establishment	Demonstrated ability to colonise?	Yes. Rapidly established and spread outside its native range.	0.7
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	High. Opportunistic generalist foragers. Will find a food source year-round.	
	Is NZ climate considered favourable?	Tropical/subtropical species so parts of New Zealand will offer climatic suitability for this species. It's been reported that at temperatures lower than 10 degrees hive activity ceases but can overwinter	
	Can an effective trapping system be implemented to reduce risk of establishment?	No	
	Spread assessment – how likely and to what extent could it spread?	Reported to spread 20km annually through natural spread. Could potentially hitchhike longer distances. A single nest has the potential to disperse many mated queens over a large area.	
Impact	Are there known production impacts on kiwifruit industries internationally?	Spain recorded indirect impacts through disrupted pollination. Bees have been reported to represent 1/3 of their diet and there have been reports of up to 80% hive loss. An accurate assessment of pollination disruption has yet to be undertaken	3/10
	Likely production impacts?	Possible impacts on pollination which will result in less fruit	
	Do we have the tools to manage if it arrived in or detected in NZ?	Trapping and nest destruction are main control methods	
Impact- Trade	Degree of market access implications if established?	Little to none as fruit is not considered a host	1/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			2.1

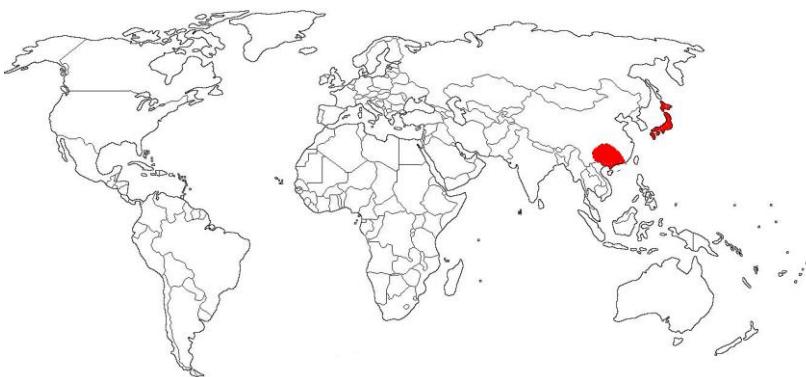
Esca disease (*Fomitiporia mediterranea*)



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	Legal importation of grape and kiwifruit vines. Illegal plant material. Soil on footwear/equipment	0.3
	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, could enter on other host material such as grapevine plant material	
	Do we know of any border or post-border detections?	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	
Likelihood for establishment	Demonstrated ability to colonise?	Spread through multiple kiwifruit regions in Italy, and many wine grape countries- has not spread in kiwifruit out of Italy since first discovered in 1995.	0.6
	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. Human assisted movement such as contaminated equipment may also spread the pathogen long distance.	
Production 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.	3/10
	Likely production impacts?	Reduced productivity and longevity of vines	
	Do we have the tools to manage if it arrived in or detected in NZ?	Preventative measures most effective, limited control options	
Trade Impact	Degree of market access implications if established?	Likely to be low / negligible	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		2.1

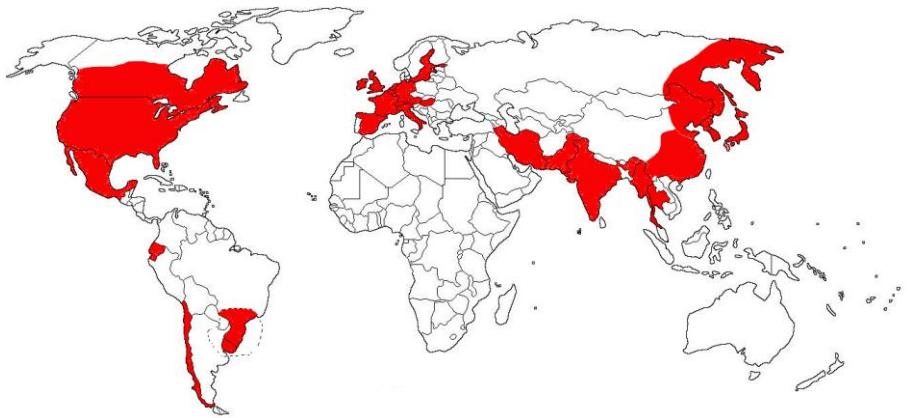
Pythium/Phytophytium helicoides



Description: The common features of this genus are Phytophthora-like ovoid to globose sporangia, and Pythium-like zoospore discharge, which differentiates this genus from the closely related genera *Pythium* and *Phytophthora*. This pathogen is wide spread but there are reports of *Phytophytium helicoides* causing damage on kiwifruit orchards in China and Japan. *Phytophytium helicoides* causes necrosis of leaf margins and leaf curl followed by decline and then vine death.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Plant material, nursery stock or contaminated equipment / clothing/ footwear. Wide host range so can enter on other hosts.	0.4
	Where does it occur?	Worldwide. China and Japan has a strain that appears to be pathogenic to kiwifruit	
	Are the items that it is likely to be associated with currently traded or likely to be traded?	Yes. The kiwifruit nursery stock pathway well managed and specifically tests for this pathogen. Can enter on other hosts.	
	Do we know of any border or post-border detections?	No	
	Is it associated with countries we are trading with?	Yes	
Likelihood for establishment	Demonstrated ability to colonise?	Yes- found on almost every continent	0.4
	Exposure assessment - once post-border how likely is the organism to find suitable hosts?	Depends on pathway- slightly unknown. Plant material pathway 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?	Short distance dispersal through zoospores in water. Long distance through human assisted movement	
Production Impact	Are there known production impacts on kiwifruit industries internationally?	Reported root rot of kiwifruit in Japan and China. Incidence of infection in China was up to 38% in some orchards. Gold and green both affected.	4/10
	Likely production impacts?	Yes, infecting plants show necrosis of leaf margins and leaf curl followed by decline and then vine death. Arguta thought to be somewhat resistant	
	Do we have the tools to manage if it arrived in or detected in NZ?	Not currently	
Trade Impact	Degree of market access implications if established?	Expected to be low	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		2

Spotted Wing Drosophila (*Drosophila suzukii*)



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. There are no reported impacts to kiwifruit from SWD despite being endemic and invasive across kiwifruit regions globally.

Risk this organism presents to the kiwifruit industry			
Likelihood of entry	Items likely to be associated with	Fresh produce	0.2
	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 any border or post-border detections?	Two border detections. One in 2012 and more recently in 2019.	
	Is it associated with countries we are trading with?	Yes, multiple trade pathways	
Likelihood for establishment	Demonstrated ability to colonise?	Yes- rapid expansion in North America and Europe, new incursion in South America	0.8
	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 infected fruit.	
Production 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	1/10
	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).	
	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	
Trade Impact	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. Although not a host, could be reported as one in some areas so some markets may restrict access.	3/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			1.4

Pelargonium zonate spot virus
Genus Anulavirus



Description: Pelargonium zonate spot virus (PZSV) is one of two viruses known to induce severe symptoms in kiwifruit—Cherry leaf roll virus (CLRV) 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. Illegal plant material.	0.2
	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. Illegal material.	
	Do we know of any border or post-border detections?	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	
Likelihood for establishment	Demonstrated ability to colonise?	Limited, only reported in kiwifruit in Southern Italy	0.2
	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.	
Production 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.	4/10
	Likely production impacts?	Decrease in plant vigour & productivity	
	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.	
Trade Impact	Degree of market access implications if established?	Low/ none	1/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			1