Kiwifruit's Most Unwanted

Feb 2023

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 have been 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.

Matrix overview

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	• Pathways that could potentially result in entry • Level of border and post-border interceptions	**1**
Likelihood of Establishment	• 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	**1**
Impact to Production	• Known production impacts offshore • Likely production impacts in New Zealand • Ability to control if established	**10**
Impact to Trade	• 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 3).

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** *(Bactrocera tryoni)*	Lure responsive fruit fly	0.9	0.3	9	1	8.4
2	**Mediterranean fruit fly** *(Ceratitis capitata)*	Lure responsive fruit fly	0.6	0.45	8	2	5.7
3	**Oriental Fruit Fly** *(Bactrocera dorsalis)*	Lure responsive fruit fly	0.6	0.3	7	1	4.5
4	***Ceratocystis fimbriata***	Soil borne fungi	0.4	0.5	1	8	4.4
5	**Brown Marmorated Stink Bug (BMSB)** (*Halyomorpha halys*)	Sap sucking insect	1	0.5	1	6	4
6	**Spotted Lanternfly** *(Lycorma delicatua)*	Sap sucking insect	0.2	0.7	1	5	3.7
7	**Phytophthora** *(Phytophthora dreschleri)*	Fungal-like organism	0.3	0.6	1	5	3.3
8	**Psa non-NZ biovars** *(Pseudomonas syringae actinidiae)*	Bacteria	0.2	0.5	1	6	3.2
9 =	**White Peach Scale** *(Pseudaulacaspis pentagona*)	Scale	0.8	0.5	1	5	2.8
9=	**Yellow Spotted Stink Bug** (*Erthesina fullo)*	Sap sucking insect	0.8	0.4	1	5	2.8
11	**Verticillium wilt** *(Verticillium nonalfalfae)*	Soil borne fungi	0.3	0.6	1	4	2.7
12	**Yellow Peach Moth** (*Conogethes punctiferalis*)	Lepidoptera	0.4	0.5	4	2	2.6
13=	**Summer Canker** (*Pectobacterium carotovorum actinidiae)*	Bacteria	0.2	0.4	1	5	2.2
13=	**Fruit Piercing Moth** *(Eudocima phalonia)*	Lepidoptera	0.7	0.2	2	4	2.2
15=	**South American Fruit Fly** (*Anastrepha fraterculus*)	Non-lure responsive fruit fly	0.2	0.5	8	1	2.1
15 =	**Esca Disease** *(Fomitiporia mediterranea)*	Soil borne fungi	0.3	0.6	1	3	2.1
17	**Pythium** *(Phytopythium helicoides)*	Fungi	0.4	0.4	1	4	2
18	**Yellow-legged Hornet** *(Vespa velutina)*	Winged insect	0.2	0.5	8	1	1.7
19	**Emaravirus actinidae** (*Genus emaravirus*)	Virus	0.2	0.3	1	4	1.4
20	**Xylella** *(Xylella fastidiosa)*	Bacteria	0.5	0.6	0.1	0.1	0.11

Communications

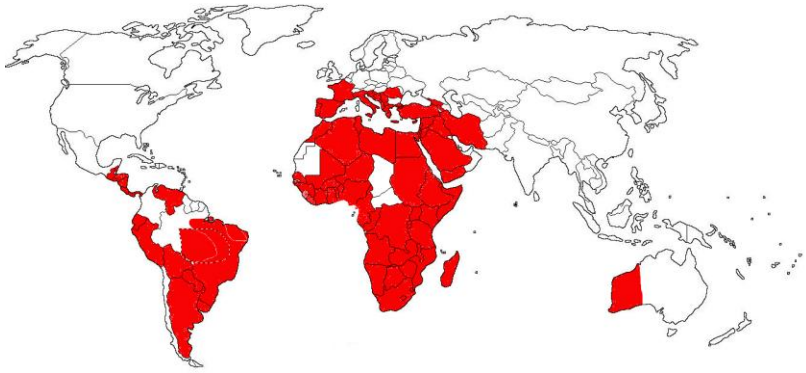
We will reduce the priority ranking list above to eight of "KVHs Most Unwanted" organisms. We will achieve this by combining the fruit fly species under a single heading. Threat specific messaging around the fruit fly, such as high-risk season, market access issues, mitigation measures are applicable across all the fruit fly species, therefore it seems logical to combine the fruit fly species to allow for easier and clearer communication to the industry.

Priority 1:
Queensland Fruit Fly
(Bactrocera tryoni)

Description: Indigenous to Australia, the Queensland Fruit Fly (QFF) (6-8mm) is the major fruit fly pest species in Eastern and Southern Australia. The QFF causes damage to fruit by laying eggs inside the fruit, larvae feeding on the fruit and plant tissue decomposition by microorganisms. Incursions of established populations can result in significant market access implications for kiwifruit exports. QFF has a very limited distribution and is likely to result in access implications across nearly all major markets.

Risk posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Fresh produce, commercial and private (via passengers arriving in New Zealand).	0.9
	Locations	Northern Territory, Queensland, New South Wales and Victoria, New Caledonia, French Polynesia and Pitcairn Islands.	
	Are the likely item associations currently traded or likely to be traded?	Yes, fresh produce. Undeclared passenger fruit a high risk.	
	Any border or post-border detections?	Yes, multiple border detections and post border responses: breeding population in 2015 (eradicated) and the detection of multiple flies in 2019 in Auckland.	
	Is it associated with countries we are trading with?	Yes.	
Likelihood of Establishment	Demonstrated ability to colonise?	QFF has limited invasive ability as highlighted by its limited spread outside of native range.	0.3
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Very likely. Over 200 hosts associated with feeding. Likely to enter as larvae in fruit, hatch and fly to a fruit tree.	
	Suitability to New Zealand climate?	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. Ability to fly short distances when host material available.	
Production Impact	Any known production impacts on international kiwifruit industries?	There have been no impacts reported in Australia on kiwifruit.	1/10
	Likely production impacts?	Low/moderate. Potential production issues as QFF are reported to successful develop (eggs-pupae) in G3	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Yes, cue lure pheromone traps. Phytosanitary cold treatments could be used over long term; needs more development.	
Trade Impact	Degree of market access implications if established?	Initially severe as not present in our major markets of Asia and Europe.	9/10
Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)			**8.4**

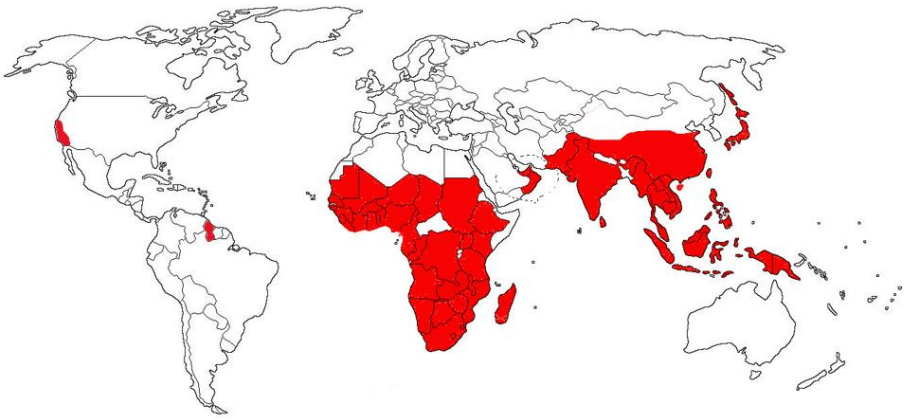
Priority 2:
Mediterranean Fruit Fly
(*Ceratitis capitata)*



Description: Endemic to sub-Saharan Africa, the Medfly has been recorded to infest more than 200 hosts worldwide. It is ranked amongst the most economically important fruit fly species. The first sign of damage is often larvae-infested or 'stung' fruit. The relatively wide global distribution of Medfly is a result of its ability to tolerate temperate climates. Incursions of breeding populations can result in significant market access implications, especially to New Zealand's biggest markets in Asia.

Risk posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Fresh produce: commercial and private (via passengers arriving in New Zealand).	0.6
	Locations	Wide global distribution. Found in Europe, the Middle East, Africa, South America, Hawaii, and Australia (WA).	
	Are the likely item associations currently traded or likely to be traded?	Yes, fresh produce from many countries. Undeclared passenger fruit is a high risk.	
	Any border or post-border detections?	Border detections seldom. A breeding population was discovered in 1996in Auckland and successfully eradicated.	
	Is it associated with countries we are trading with?	Yes.	
Likelihood of Establishment	Demonstrated ability to colonise?	Yes, demonstrated establishment by widespread global distribution.	0.45
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Very likely. Known to feed on over 200 species, can locate hosts year-round	
	Suitable to New Zealand climate?	Yes, ability to adapt to a range of climatic conditions. More cold temperature tolerant than other fruit fly.	
	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?	Very likely. Reported to fly up to 20km but usually 1-2km where host abundant. Spread through the movement of infested fruit (can be controlled).	
Production Impact	Any known production impacts on international kiwifruit industries?	Med Fly individuals found in Italy were reported to have little impact on kiwifruit.	2/10
	Likely production impacts?	Unlikely (low). Oviposition has been reported in damaged fruit, but recovering pupae was very low suggesting kiwifruit may be a poor host.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Pheromone traps. Phytosanitary cold treatments could be used over long term; are cultivar specific and require more research.	
Trade Impact	Degree of market access implications if established?	High. Not found in Asia, our biggest export market.	8/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		**5.7**

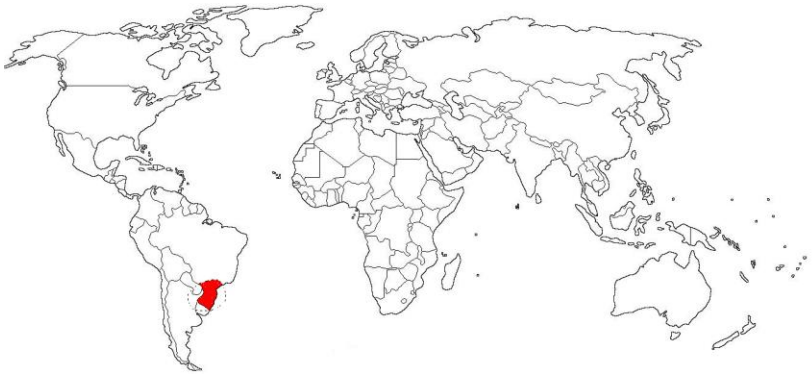
Priority 3:
Oriental Fruit Fly
(*Bactrocera dorsalis*)



Description: Indigenous to parts of tropical Asia, the oriental fruit fly (OFF) (6-8mm) is a destructive pest of fruit. It has established over most of Africa. OFF larvae can feed on over 300 different fruit and vegetables (mostly apple, guava, mango, peach, and pear), 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 posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Fresh produce: commercial and private (via passengers arriving in New Zealand).	0.6
	Locations	Throughout Asia and Africa. United States (California) and found in Hawaii, French Polynesia, Palau, Papua New Guinea, Timor- Leste. South America –Guyana. Recent incursion into Italy	
	Are the likely item associations currently traded or likely to be traded?	Yes.	
	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 of Establishment	Demonstrated ability to colonise?	Yes, demonstrated establishment by widespread established distribution in Hawaii, Asia and Africa.	0.3
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Very likely. OFF has over 300 host species. No shortage of host plants year-round.	
	Suitable to New Zealand climate?	Yes, warmer areas such as Northland, Auckland, Waikato are 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?	Very likely, OFF is a strong flier and is highly mobile. Can spread through the movement of infested fruit (can be controlled).	
Production Impact	Any known production impacts on international kiwifruit industries?	OFF widespread and invasive in China with no reported impacts on kiwifruit.	1/10
	Likely production impacts?	Unlikely, Oviposition found in gold and green kiwifruit, but kiwifruit is not considered a major host.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Yes, pheromone traps. Phytosanitary cold treatments could be used over long term; needs more research.	
Trade Impact	Degree of market access implications if established?	High. Not found in Europe which is one of kiwifruits biggest export markets.	7/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		**4.5**

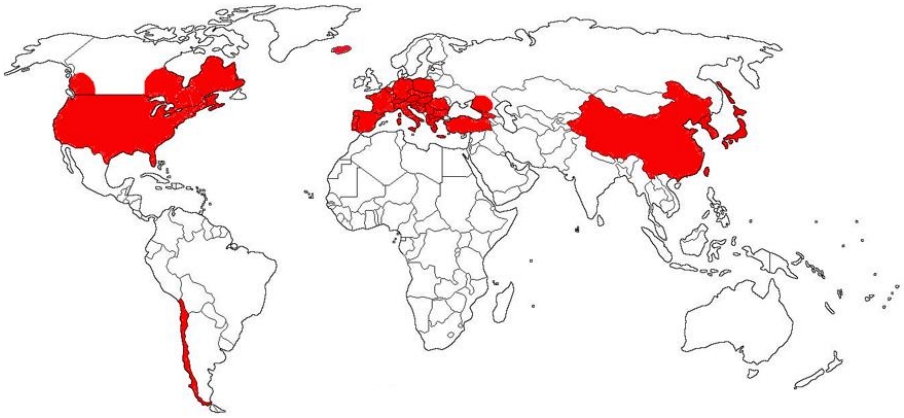
Priority 4:
Ceratocystis wilt
(Ceratocystis fimbriata complex*)*



Description: Ceratocystis wilt is a fungal pathogen (fungi that causes disease in organisms) that has a world-wide distribution. Pathogenicity to kiwifruit has only been reported in Brazil, causing significant damage to kiwifruit orchards. Vine death can occur extremely rapidly following infection, with Hayward on Bruno rootstock appearing to be the most affected cultivar. The disease moves rapidly through root and soil systems. Wilting occurs first, then complete vine collapse occurring as quickly as 3 days.

Risk posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Plant material: legal/illegal importations. Soil on footwear or equipment.	0.4
	Locations	World-wide but kiwifruit strains reported only in Brazil. Strains causing epidemics in South China, Oman & Pakistan, India are genetically similar and are likely pathogenic to kiwifruit.	
	Are the likely item associations currently traded or likely to be traded?	Yes, kiwifruit nursery stock well managed, but other hosts traded which could carry strains but the impact any such strains on *Actinidia* is uncertain.	
	Any border or post-border detections?	No.	
	Is it associated with countries we are trading with?	Yes, other strains/hosts found in many countries.	
Likelihood of Establishment	Demonstrated ability to colonise?	Yes, other strains/hosts widespread. One strain specific to kumara has already established in New Zealand.	0.5
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Dependant on the entry pathway, post-border host suitability unknown.	
	Suitable to New Zealand climate?	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. Can spread between kiwifruit canopies through direct root contact, contaminated tools, scions and possible beetle vectors	
Production Impact	Any known production impacts on international kiwifruit industries?	Yes, severe impacts in Brazil. Hayward, G3 and Bruno are susceptible.	8/10
	Likely production impacts?	Severe impacts potential to destroy Brazil industry. Kiwifruit known to be a highly susceptible host to multiple strains in Brazil.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Many treatments trialled in Brazil, no effective treatments to date.	
Trade Impact	Degree of market access implications if established?	Unknown, expected to be low for fruit.	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		**4.4**

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



Description: The highly mobile Brown Marmorated Stink Bug (BMSB) is a major agricultural pest. Evidence of its rapid invasion reported in Europe and USA in recent years, are indicative of its ability to spread quickly. BMSB causes cosmetic damage to fruit and vegetables resulting in produce that is unfit for sale. The New Zealand climate is a favourable habitat for the BMSB, and it is regularly intercepted at our borders.

Risk posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Hitchhiker species found on inanimate objects. Interceptions have occurred across all pathways.	1
	Locations	China, Korea, Japan, Taiwan, North America, Chile. Currently spreading throughout Europe (29 + countries).	
	Are the likely item associations currently traded or likely to be traded?	Vehicles and machinery considered highest risk. BMSB a Hitchhiker; associated with shipping containers.	
	Any border or post-border detections?	Numerous border and post border interceptions.	
	Is it associated with countries we are trading with?	Yes, as a hitchhiker species many potential pathways exist from each country, primarily inanimates and passengers.	
Likelihood of Establishment	Demonstrated ability to colonise?	Yes, spread rapidly in Europe and the USA (now present in over 44 states and 4 provinces of Canada).	0.5
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Very likely, strong fliers (< 2km) and have a wide host range.	
	Suitable to New Zealand climate?	Yes, considered highly suitable.	
	Can an effective trapping system be implemented to reduce risk of establishment?	Have lures available, but not as effective as Fruit fly lures. Have a National BMSB trapping surveillance system.	
	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	Any known production impacts on international kiwifruit industries?	Research has confirmed BMSB impacts green/gold varieties (average impact of 5-10% and up to 30% on severely impacted orchards in China, Korea, and parts of Europe).	6/10
	Likely production impacts?	Very likely, cosmetic damage (spots under the skin), fruit drop (especially G3), damage leads to fruit unfit for sale.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Chemical treatment. Pheromone traps available but have limited effectiveness. Exclusion netting is an option. Biological control (Samurai wasp) approved for release if BMSB were to establish, but logistics of this are still being explored.	
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)		**4.0**

Priority 6:
Spotted Lanternfly
(Lycorma delicatula)

Description: Native to parts of Asia (China, India, and Vietnam), the spotted lanternfly (SLF) belongs to the planthopper family (neither a fly nor a moth). It has been invaded South Korea and Japan, prior to its detection in the United States in 2014. SLF causes damage by feeing 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 posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Hitchhiker species, inanimate pathway.	0.2
	Locations	Native to parts of Asia, spread to Korea and Japan, Vietnam and is now invasive in the USA.	
	Are the likely item associations currently traded or likely to be traded?	Lays its eggs on smooth vertical surfaces so containers, vehicles and equipment could be considered high risk.	
	Any border or post-border detections?	No live post border detections. A single dead SLF have been found post border.	
	Is it associated with countries we are trading with?	Yes.	
Likelihood of 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. Now spread across a further 11 states.	0.7
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Over 70 hosts reported. Tree of heaven is preferred host and is present in NZ but not widespread.	
	Suitable to New Zealand climate?	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	Any known production impacts on international kiwifruit industries?	Reported as a pest of kiwifruit in China.	5/10
	Likely production impacts?	Yes, main impacts centre around the sooty mould growth on the excretions of the SLF.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	None.	
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)		**3.7**

Priority 7:
Invasive Phytophthora
(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* has caused severe root rot in Korean kiwifruit, especially in poorly drained lowlands with over 80% of plants infected in some orchards.

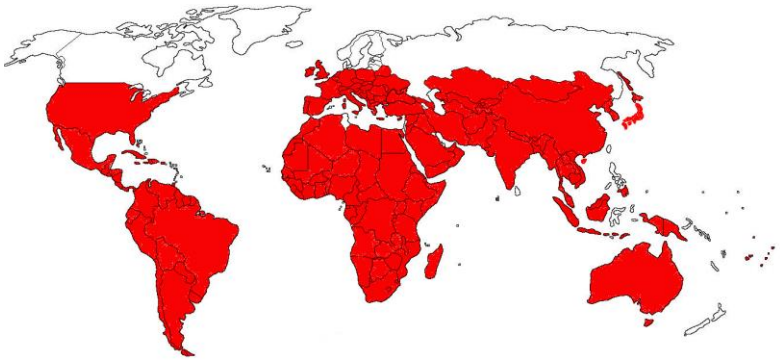
Risk posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Kiwifruit plant material, other host plant material, nursery stock or contaminated equipment, clothing, and footwear.	0.3
	Locations	Reported on kiwifruit in Korea and California. However it does have a wide distribution on a range of hosts	
	Are the likely item associations currently traded or likely to be traded?	Unlikely, NZ does not import kiwifruit plant material from Korea, but it may arrive on other hosts. Kiwifruit is imported from California, but unlikely to enter on this pathway.	
	Any border or post-border detections?	No, previous reports of the species on other hosts within NZ are now attributed to another species.	
	Is it associated with countries we are trading with?	Yes, kiwifruit from California.	
Likelihood for Establishment	Demonstrated ability to colonise?	Phytophthoras have a proven ability to colonise, the *P. drechsleri* strain that impacts kiwifruit is currently located only in Korea and California. Environment will likely play a big role in its colonisation (i.e., waterlogged soils, stressed plants etc).	0.6
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	High likely in nursery stock, but entry pathway dependent.	
	Suitable to New Zealand climate?	Yes, especially kiwifruit orchards with poor drainage.	
	Can an effective trapping system be implemented to reduce risk of establishment?	No.	
	Spread assessment: how likely and to what extent could it spread?	Very likely, may spread through soil and plant material movements. No vector is required. Human vectoring will spread disease long distance.	
Production Impact	Any known production impacts on international kiwifruit industries?	Yes, some orchards in Korea reported the disease to have infected over 80% of plants. This strain appears to be less virulent in California.	5/10
	Likely production impacts?	Severe root rot with extremely high infection rates in some areas, especially poor draining lowlands.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	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**

Priority 8:
Psa non-New Zealand biovars

Description: Different outbreaks of Psa have been caused by related but genetically distinct lineages of *Pseudomonas syringae*, these known non-NZ biovars are: Psa1 (Japan & Italy), Psa2 (Korea), Psa3 (Psa-V, Italy, Chile, NZ, France, Portugal, Japan & Korea), & Psa5 (Japan). It is likely that many more exist in wild kiwifruit populations. Psa1 is of particular concern as it has shown a much higher virulence against Hayward cultivars than the Psa-V biovar currently in New Zealand.

Risk posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Imported kiwifruit plant material, illegal plant material/pollen, nursery stock or contaminated equipment/clothing.	0.2
	Locations	Japan, Korea, China, and Italy all have different biovars than those in New Zealand. Worldwide genetic variation is not yet well understood; any new genetic material is of concern due to the potential of horizontal gene transfer and the impact new biovars may have on new or existing kiwifruit cultivars.	
	Are the likely item associations currently traded or likely to be traded?	Yes, nursery plant material importation is allowed but imports must be permitted, and specific tests exist for these strains. No evidence that Psa is seed transmitted.	
	Any border or post-border detections?	Yes, New Zealand has Psa3 (Psa-V)	
	Is it associated with countries we are trading with?	Yes, however Import Health Standards (IHS) has since tightened post Psa-V incursion, strengthening biosecurity.	
Likelihood of Establishment	Demonstrated ability to colonise?	Yes, thought to have originated in China, now present in nearly every kiwifruit region globally.	0.5
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Highly likely, however very dependent on the pathway.	
	Suitable to New Zealand climate?	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?	Very likely as new strains can be difficult to differentiate from Psa-V. Efficient industry biosecurity practices can limit spread.	
Production Impact	Any known production impacts on international kiwifruit industries?	Yes, most kiwifruit industries around the world are impacted by a Psa strain. Pathogenicity screening is continuous.	6/10
	Likely production impacts?	Psa1 and Psa 2 are likely to be more virulent to Hayward cultivars than Psa3 (Psa-V). Impact other varieties unknown. Psa4 & Psa5 have low virulence.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Limited tools, there are measures in place to reduce the spread and diagnostic testing is already in use.	
Trade Impact	Degree of market access implications if established?	Low to none.	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		**3.2**

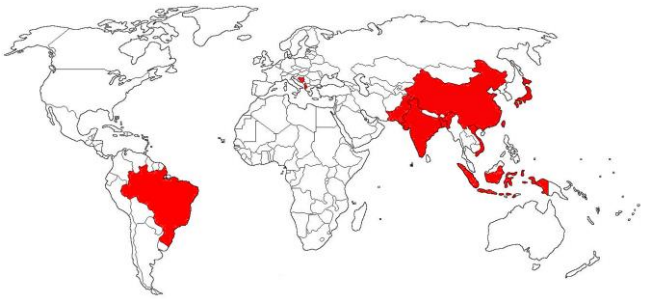
Priority 9:
White Peach Scale
(*Pseudaulacaspis pentagona*)



Description: White Peach Scale (WPS) has caused significant impacts in Italian kiwifruit industry with reports of a 10-20% loss of marketable fruit from the region in 2004. If WPS arrived in New Zealand, it could easily adapt to our environmental conditions and is therefore considered a serious threat to our kiwifruit industry. WPS is regularly intercepted at the New Zealand border and there have been several post-border interceptions in recent years. In response, MPI has reviewed the risk assessment which may reduce its entry risk from pathways such as kiwifruit from Italy.

Risk posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Kiwifruit and kiwifruit plant material. Fresh produce and plant material from other hosts also	0.8
	Locations	Nearly global.	
	Are the likely item associations currently traded or likely to be traded?	Yes, produce and nursery stock (most interceptions on Italian kiwifruit).	
	Any border or post-border detections?	Yes, often found at the border. In 2019, there were post-border finds on Italian kiwifruit. No interceptions on kiwifruit at our borders in 2021/22 season	
	Is it associated with countries we are trading with?	Yes, kiwifruit from Italy is the highest risk.	
Likelihood for Establishment	Demonstrated ability to colonise?	Yes, originated in Asia now spread globally.	0.4
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	High from nursery stock pathway but well managed. Low likelihood from fresh produce pathway.	
	Suitable to New Zealand climate?	Yes.	
	Can an effective trapping system be implemented to reduce risk of establishment?	Yes, a pheromone trap is commercially available for monitoring	
	Spread assessment: how likely and to what extent could it spread?	Moderate, crawlers disperse actively up to 1m but can disperse further by wind, insects & birds. Plant movements can disperse WPS over longer distances.	
Production Impact	Any known production impacts on international kiwifruit industries?	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.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Yes, but limited effectiveness and high cost.	
Trade Impact	Degree of market access implications if established?	Low/ moderate as most countries have it. Cold disinfestation 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)		**2.8**

Priority 10:
Yellow Spotted Stink Bug
(Erthesina fullo)



Description: Highly polyphagous**.** 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 posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Hitchhiker pest- inanimate pathway with concentration on vehicles and machinery.	0.8
	Locations	Asia- China, Japan, Vietnam, India, Pakistan, Bangladesh, Indonesia, Sri Lanka, Taiwan, Vietnam, Myanmar. Europe- Albania. South America- Brazil.	
	Are the likely item associations currently traded or likely to be traded?	Passengers/luggage, containers, general cargo and machinery and vehicles high volume import- China and Japan import high numbers on this pathway.	
	Any border or post-border detections?	Multiple 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?	Yes – has now been detected in Albania and Brazil.	0.4
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	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.	
	Suitable to New Zealand climate?	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	Any known production impacts on international kiwifruit industries?	Reported as a pest on kiwifruit in China.	5/10
	Likely production impacts?	Moderate. Has been reported to cause 10-30% losses on kiwifruit orchards.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	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**

Verticillium wilt
(Verticillium nonalfalfae)

Description: *Verticillium nonalfalfae* is a soil borne pathogen with many strains further affecting a range of host species worldwide, however only Chile has reported the presence of a strain that is virulent against kiwifruit. Chilean kiwifruit growers have suffered large losses from the verticillium wilt, with some orchards losing over 80% of vines. In susceptible kiwifruit cultivars, infection almost always leads to plant death which typically occurs very suddenly.

Risk posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Plant material, Kiwifruit, and other hosts (hops and alfalfa), present in other hosts in NZ but not virulent to kiwifruit.	0.3
	Locations	Virulent kiwifruit strain in Chile, other strains widespread.	
	Are the likely item associations currently traded or likely to be traded?	No, there are no kiwifruit imports from Chile at present.	
	Any border or post-border detections?	No, NZ does have Ceratocystis here that exists in other host species (not virulent towards kiwifruit). The likelihood of this NZ strains evolving into a kiwifruit pathogen is uncertain.	
	Is it associated with countries we are trading with?	No.	
Likelihood for Establishment	Demonstrated ability to colonise?	Yes, other strains of this species are widespread in other host species. Kiwifruit pathogenic strain only reported in Chile at present.	0.6
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Moderate, pathway dependent. Highly likely for plant material.	
	Suitable to New Zealand climate?	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, root contact, air and water. Insect vectors can also spread but are not essential for the pathogen to establish and spread.	
Production Impact	Any known production impacts on international kiwifruit industries?	Yes, severe damage in Chile, 100% plant death in some orchard blocks within a year. Impacts are cultivar dependant and influenced by the environment.	4/10
	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.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Limited tools available; hygiene to prevent spread and cut out infected plants. No treatments proven effective at present.	
Trade Impact	Degree of market access implications if established?	Low, not likely to be introduced from fruit.	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		**2.7**

Yellow Peach Moth
(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	Likely item associations	Fresh produce.	0.4
	Locations	Found throughout Asia and in Australia.	
	Are the likely item associations currently traded or likely to be traded?	Yes, as it is associated with the fresh produce pathway.	
	Any border or post-border detections?	From the late 1990s, YPM has been intercepted on *Capsicum,* cinnamon and *Litchi chinensis*	
	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: how likely is the organism to find suitable host's once post-border?	Highly polyphagous- feeding on fruit and crop plants from over 16 families, some representatives of which are present throughout NZ.	
	Suitable to New Zealand climate?	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	Any known production impacts on international kiwifruit industries?	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/steams and fruit. Excretions have a high sugar content which covers the fruit surface, attracting secondary insect pests and diseases that further damage fruit.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	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**

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

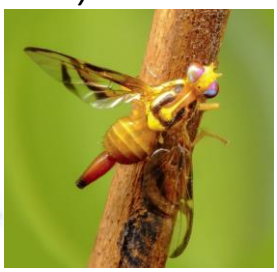
Risk this organism presents to the kiwifruit industry			
Likelihood of Entry	Likely item associations	Kiwifruit plant material, illegal plant material, or pollen. Some subspecies are known to be seed transmitted	0.2
	Locations	Found in Korea and more recently in parts southern and eastern China.	
	Are the likely item associations currently traded or likely to be traded?	Actinidia Nursery stock/plants for planting pathway reopened in 2018 but specific testing for this pathogen is required. Visitors to the region a possible pathway.	
	Any border or post-border detections?	No.	
	Is it associated with countries we are trading with?	Yes .	
Likelihood for Establishment	Demonstrated ability to colonise?	*Pectobacterium carotovorum* as a wide geographic distribution and broad host range. Subspecies are found in Korea, and more recently, has established in parts of China.	0.5
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Likely - similar to Psa but will depend on pathway of entry.	
	Suitable to New Zealand climate?	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	Any known production impacts on international kiwifruit industries?	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.	4/10
	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.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	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)		**2.2**

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	Likely item associations	Fresh produce and can blow over on the wind currents from Australia.	0.7
	Locations	Widespread throughout Asia and Africa. Also present in Hawaii, Australia, and parts of the Pacific.	
	Are the likely item associations currently traded or likely to be traded?	Yes.	
	Any border or post-border detections?	It is an occasional vagrant in NZ	
	Is it associated with countries we are trading with?	Yes.	
Likelihood for Establishment	Demonstrated ability to colonise?	Yes, widespread from its native range. However, despite interceptions in NZ of FPM, none have resulted in an established population.	0.2
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Highly polyphagous- adults are known to feeding on up to 55 different species. Larvae feed mainly on the foliage of certain species.	
	Suitable to New Zealand climate?	Yes. Kiwifruit growing regions may be climatically suitable.	
	Can an effective trapping system be implemented to reduce risk of establishment?	No, pheromones have not been identified for trapping	
	Spread assessment: how likely and to what extent could it spread?	Adults are strong fliers.	
Production Impact	Any known production impacts on international kiwifruit industries?	Yes, kiwifruit is a known host but reports on level of incidence/damage are minimal.	4/10
	Likely production impacts?	Pierce ripe fruit & feed on juices creating damage in fruit. Secondary infection by pathogens can occur.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Cultural methods - 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)		**2.2**

South American Fruit Fly
(*Anastrepha fraterculus*)



Description: SAFF is considered the most economically damaging fruit fly in fruit production areas of Peru, Uruguay, and southern Brazil with complete crop loss possible. It is likely to be a complex of species with different host preferences for different members of the complex. Fruit losses occur because of oviposition wounds causing deformation and inducing fruit decay, and from larval feeding within fruit, which often leads to rots.

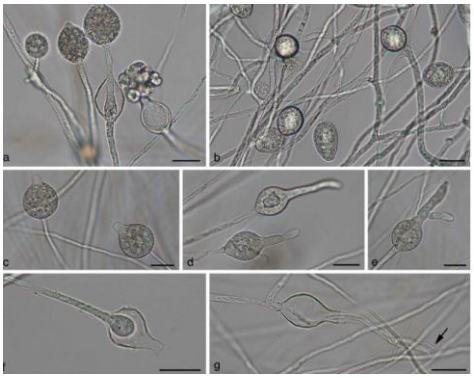
Risk posed on the kiwifruit industry			
Likelihood of Entry	Likely item associations	Fresh produce- both commercially and privately through passengers arriving in NZ.	0.2
	Locations	Parts of Central and North America and most of South America. SAFF is not found in Chile.	
	Are the likely item associations currently traded or likely to be traded?	Yes- fresh produce from many countries, undeclared passenger fruit high risk.	
	Any border or post-border detections?	The first border detection of an *Anastrepha* 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 America. 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.	0.5
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Over 90 reported hosts. However, SAFF is likely to breed in other fruit such as feijoas, stone fruit, some citrus, guavas, and grapes.	
	Suitable to New Zealand climate?	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	Any known production impacts on international kiwifruit industries?	Kiwifruit is not a preferred host. Lab results have suggested that SAFF can complete life cycle on some cultivars, so production impacts are 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.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	Toxic baits or insecticides are used overseas to control SAFF, baits available in NZ. Phytosanitary cold treatments (used longer term) SIT and mating disruption are yet to be developed.	
Trade Impact	Degree of market access implications if established?	Initially severe, not found in Asia and Europe- kiwifruits biggest export markets. No trapping system means proving area/country of freedom hard which means higher market access implications.	8/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		**2.1**

Esca disease
(Fomitiporia mediterranea)

Description: *Fomitiporia mediterranea* is a fungus 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	Likely item associations	Legal importation of grape and kiwifruit vines. Illegal plant material. Soil on footwear/equipment.	0.3
	Locations	Only reported in kiwifruit in Italy since 1995. Significant disease in all European countries producing wine grapes.	
	Are the likely item associations currently traded or likely to be traded?	Kiwifruit nursery stock pathway well managed, could enter on other host material such as grapevine plant material.	
	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: how likely is the organism to find suitable host's once post-border?	Depends on pathway, likely for plant material.	
	Suitable to New Zealand climate?	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	Any known production impacts on international kiwifruit industries?	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.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	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
(Phytopythium 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 widespread but there are reports of *Phytopythium helicoides* causing damage on kiwifruit orchards in China and Japan. *P. 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	Likely item associations	Plant material, nursery stock or soil-contaminated equipment / clothing/ footwear. Wide host range so can enter on other hosts.	0.4
	Locations	Worldwide. China and Japan have a strain that appears to be pathogenic to kiwifruit. Recently found in relation to KVDS in Italy.	
	Are the likely item associations 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.	
	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.	0.4
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Depends on pathway- still unknown. Plant material pathway likely.	
	Suitable to New Zealand climate?	Possibly parts of NZ. It is one of the high temperatures growing Phytopythium species, and is more common in tropical and subtropical regions than in temperate region	
	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	Any known production impacts on international kiwifruit industries?	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.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	None specifically. Hygiene to prevent spread.	
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**

Yellow-legged Hornet
(Vespa velutina)

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

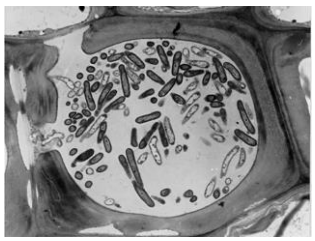
Risk this organism presents to the kiwifruit industry			
Likelihood of Entry	Likely item associations	High hiker pest so on inanimate commodities likely but need a queen to be able to establish a colony. Thought to have arrived in Europe and Korea in importations from China.	0.2
	Locations	Native to South East Asia, including China. Now present in parts of Europe, Japan and South Korea.	
	Are the likely item associations currently traded or likely to be traded?	Yes.	
	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.	0.5
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	High. Opportunistic generalist foragers. Will find a food source year-round.	
	Suitable to New Zealand climate?	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	Any known production impacts on international kiwifruit industries?	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.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	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)		**1.7**

Emaravirus actinidiae
(Genus *emaravirus)*

Description: Recently found in kiwifruit in five provinces of central and western China. Detected in recent surveys. Associated with symptoms including leaf chlorotic ring spots and vein yellowing. Impacts unknown but potential to reduce kiwifruit yield and vine survival with significant economic implications. Found in four species; *Actinidia chinensis, A. deliciosa, A. kolomikta, A.eriantha*. Vectors of Emaraviruses known to have a narrow host range. Other emararaviruses are transmitted by an eriophyid mite vector. The virus is also mechanically sap transmissible to *Nicotiana benthamiana*.

Risk this organism presents to the kiwifruit industry			
Likelihood of Entry	Likely item associations	Kiwifruit plant material and illegal material.	0.2
	Locations	Central & western China.	
	Are the likely item associations currently traded or likely to be traded?	Nursery stock. Illegal materials. The kiwifruit nursery stock pathway well managed.	
	Any border or post-border detections?	No.	
	Is it associated with countries we are trading with?	Yes .	
Likelihood for Establishment	Demonstrated ability to colonise?	New to science, limited information. Current reports only in China on G3, Hayward.	0.3
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Pathway dependent, most likely to occur through exposure to infected plant materials.	
	Suitable to New Zealand climate?	No information to suggest climate suitability. The western and central China regions are generally cooler and wetter than New Zealand (mountainous climate in western China).	
	Can an effective trapping system be implemented to reduce risk of establishment?	No.	
	Spread assessment: how likely and to what extent could it spread?	Mechanically sap transmissible. Can be vectored by Eriophyid mites. May be spread through plant movements and contaminated equipment, little information on spread at current.	
Production Impact	Any known production impacts on international kiwifruit industries?	Yes – impacts in 5 provinces in central and western China, causing significant economic implications.	4/10
	Likely production impacts?	Reduction in Kiwifruit yield and vine survival.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	No current incursion tools. Can detect via high-throughput sequencing (HTS) and conventional Sanger sequencing. Good on orchard hygiene practice to prevent entry and spread.	
Trade Impact	Degree of market access implications if established?	Low/none.	1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		**1.4**

WATCHING BRIEF: Xylella
(*Xylella fastidiosa)*
Kiwifruit not a known host



Description: Xylella infects the plant xylem cells, disrupts the flow of water, and eventually starves the plant of water. Wide host range of over 600 plant species. Not reported in New Zealand and Kiwifruit is not a known host, however, is a major biosecurity concern to New Zealand's agricultural and horticultural sectors. Xylella has been reported in Olives since 2013 and has had devastating impacts. Costs the Californian grape industry US$104 million a year and the Brazilian citrus industry US$120 million a year. Xylella's most well-known diseases; bacterial leaf scorch (elm, oak and maple), Pierce's disease (in grapes) vectored by the Glassy-winged sharpshooter and sycamore leaf scorch (sycamore trees) which can often remain asymptomatic.

Risk this organism presents to the kiwifruit industry			
Likelihood of Entry	Likely item associations	Nursery stock & plant material, illegal imports.	0.5
	Locations	Widespread, found in parts of Africa, Asia, Europe, North & South America.	
	Are the likely item associations currently traded or likely to be traded?	Yes – legal imports are well managed at the border.	
	Any border or post-border detections?	No.	
	Is it associated with countries we are trading with?	Yes.	
f	Demonstrated ability to colonise?	Yes.	0.6
	Exposure assessment: how likely is the organism to find suitable host's once post-border?	Pathway dependant – over 600 known hosts, high likelihood of finding a host.	
	Suitable to New Zealand climate?	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?	Transmitted by xylem sap-feeding insects such as the sharpshooter leafhoppers and spittle bugs. High likelihood of spread, undetected as can remain asymptomatic in plants. We don't have glasswinged sharpshooter in NZ, but we do have Cicadas.	
Production Impact	Any known production impacts on international kiwifruit industries?	No (Kiwifruit not a known host).	0.1/10
	Likely production impacts?	None, as kiwifruit not a known host at current.	
	What tools do we have if an incursion occurs, or a detection occurs in New Zealand?	None specifically. Hygiene to prevent spread.	
Trade Impact	Degree of market access implications if established?	None as Kiwifruit not a host: issued watching brief.	0.1/10
	Risk Score (Entry x Trade Impact) + (Establishment x Production Impact)		**0.1**