Proposed new Pathway Management Plan

Case Study: The soil-borne pathogen *Ceratocystis fimbriata*

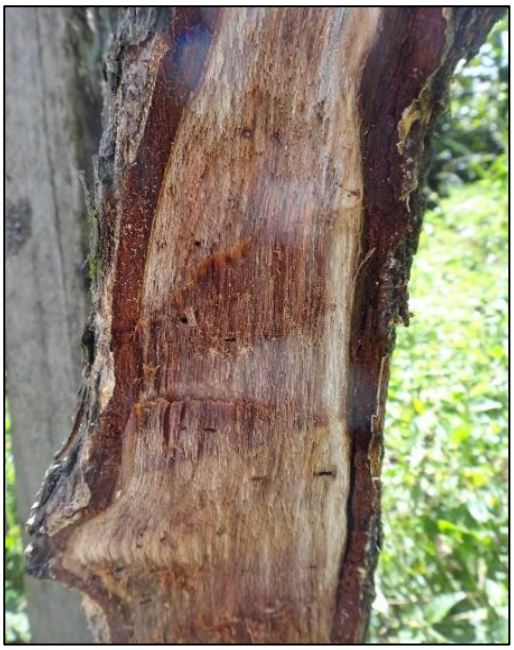
One in 30-year event: the likelihood of *Ceratocystis fimbriata* entering and establishing in New Zealand
50% of vines lost: by growers in Brazil, who say kiwifruit may no longer be a viable crop in the region
No tolerant cultivars: and no effective agrichemicals found by resistance screening to date

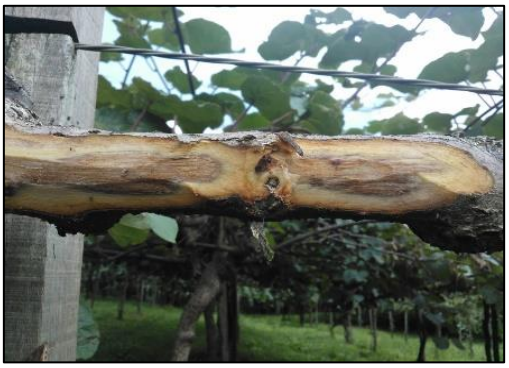
But the measures proposed in the Pathway Management Plan would increase the likelihood of us detecting a new incursion early and limiting spread, which gives the best chance of successful eradication.

Biosecurity risk is increasing

Biosecurity is considered one of the most significant strategic threats to the kiwifruit industry, a view shared by most primary sectors and illustrated by biosecurity ranking as the number one priority in the annual KPMG Agribusiness Agenda, year after year.

Despite increased knowledge, resources, and technology to prevent, respond to and manage incursions, it is widely accepted that biosecurity risk to our industry is ever increasing. This is a result of globalisation bringing the world closer through exponential increases in travel and trade, and the changing nature of pests (insects and disease-causing pathogens). The risk profile of pests is increasing with expanding host range and increasing virulence, as well as moving closer as they invade countries nearby or well connected to New Zealand. The list of biosecurity threats to kiwifruit is increasing not only because we are continually learning with more sophisticated detection techniques, but also because there are more threats out there than there used to be. This is not unique to kiwifruit and is a global phenomenon.





Images above: Vine discolouration as seen in Brazil, caused by Ceratocystis fimbriata

Almost every biosecurity response, simulation and readiness plan has a common message for growers; by maintaining a high level of biosecurity practice and taking responsibility for their own orchard borders, they are more likely to effectively protect their investment when we are faced with our next biosecurity challenge, regardless of whether this is an organism that we have prepared for specifically, a native pest that has evolved, or a threat that was previously unknown and new to science.

For kiwifruit growers, *Ceratocystis fimbriata* is currently the pathogen of greatest concern with growers in Brazil losing 10-30% of their vines each year. This pathogen is a classic example of a native pest that has evolved to infect new hosts. *Ceratocystis* has been known to science for over 100 years on other hosts and is native to parts of South America, however within the last 20 years we have seen a range of epidemics on new hosts, such as kiwifruit and eucalyptus. The pathogen is now spreading – we are seeing equally devastating results in its invasive range including Hawaii where it has been present since 2010 killing native ‘ōhi’a trees (a close relative to our pōhutakawa).

This case study highlights the threat of *Ceratocystis fimbriata* to the New Zealand kiwifruit industry and how a Pathway Management Plan would reduce the impacts of this pathogen if it were to arrive.

What is the risk and potential impact of *Ceratocystis fimbriata* to our industry?

This pathogen is considered a serious biosecurity threat.

The first reports of a wilt disease in kiwifruit in Brazil caused by the soil borne pathogen *Ceratocystis fimbriata* appeared

in 2010. In the following years, significant vine losses occurred, with some orchards losing 20-40% of vines. Over the last five years, some growers have reported 50% vine loss.

There are no efficacious control options available, and once the soil is contaminated, the replanting or re-grafting of new kiwifruit is not sustainable as the new vine will become infected. As a result, growing kiwifruit in southern Brazil is looking less sustainable with many growers simply abandoning their plantings once *Ceratocystis* was discovered.

How could it get here?

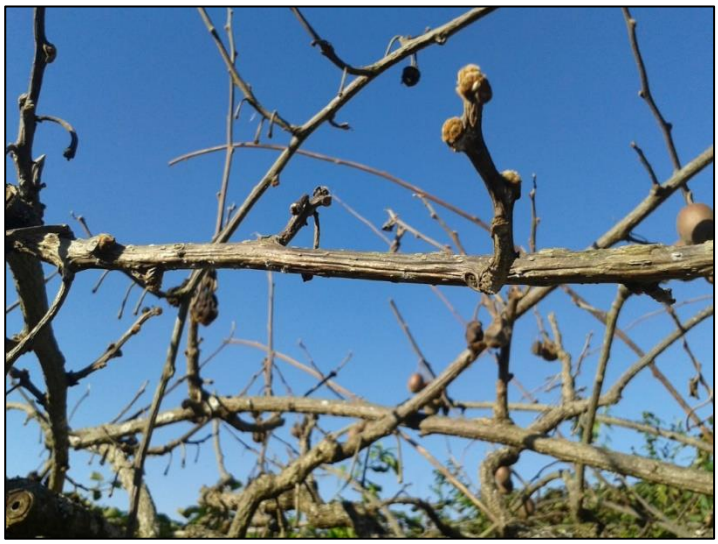
While infected host plant material is the highest-risk pathway for introducing this pathogen to new areas, there are specific Import Health Standard measures to ensure any such material entering New Zealand is free of *Ceratocystis.* Therefore, the most likely pathway for entry is travellers to New Zealand transferring the devastating fungi to kiwifruit vines via their footwear, clothing or pruning tools. Contaminated machinery or illegal plant imports are also potential pathways of entry. Whilst these scenarios require a specific chain of events, it is a real possibility that the disease could enter the country on people as there is an increasing demand for seasonal workers in New Zealand kiwifruit orchards.

The Ministry for Primary Industries (MPI) has recently estimated the odds of specific pathogens entering New Zealand and establishing here at a level that would result in an impact to production. For *Ceratocystis fimbriata* alone these odds are estimated to be a once in a 30-year event. The likelihood of our industry facing a major incursion from any pathogen would be significantly higher.

How could it spread?

Ceratocystis fimbriata does not spread long distances naturally, this only occurs through human assisted means such as the movement of plant material, contaminated tools, equipment, and machinery. Research from Brazil suggests that a native pathogen evolved to become virulent to kiwifruit on a single orchard and was subsequently spread through the distribution of rootstock and budwood, resulting in large scale spread throughout the region before the problem was even identified.

Spread is relatively rapid with the infection in Brazil resulting in significant losses quickly, with 20-40% reported in the first few years after detection, and over 50% within five years.



Images above: Symptoms of Ceratocystis fimbriata infection in kiwifruit in Brazil, showing shrivelled canes (left) and wilting leaves (right)

Why don't we just do what we did for Psa?

A common but mistaken belief is that the kiwifruit industry could respond in a similar manner to other incursions like we did to Psa and achieve a similar outcome – i.e. be back on our feet with record returns within 10 years. There are several reasons why this approach is unlikely to be successful for other threats such as *Ceratocystis fimbriata***.**

- **We are unlikely to have a tolerant cultivar waiting in the breeding programme**. The tolerance of Gold3 to Psa, along with all the other attributes that make this such a successful cultivar, have played a significant role in our industry's recovery. KVH and Zespri, through the Biosecurity Innovation Portfolio, have been screening a wide range of existing cultivars from both New Zealand and Brazil to determine if tolerance to this pathogen exists in kiwifruit. So far, no tolerant varieties have been found, let alone varieties that also have all the other characteristics required to be a successful cultivar**.**
- **There are no known effective crop protection products for *Ceratocystis*.** The other key management tool for Psa has been agrichemicals such as Copper and bactericides which are very effective in reducing inoculum levels. Again, this tool does not exist for *Ceratocystis* and there are no efficacious control options available for *Ceratocystis* in kiwifruit. Furthermore, once the soil is contaminated the replanting or re-grafting of new kiwifruit is not sustainable as the new vine will become infected.

These factors suggest that if a pathogen like *Ceratocystis fimbriata* were to establish in New Zealand it would be very difficult to manage and achieve economical returns like we have done with Psa. Therefore, our best option is to attempt containment. The earlier we can achieve this the greater the chances of eradication may be.

How would the Pathway Plan help?

There are several ways in which the Pathway Plan would help in limiting the impacts of an incursion in kiwifruit.

Firstly, pathway management is critical to limit silent spread of *Ceratocystis fimbriata* within New Zealand before it is detected (i.e. during the latency period when it is not showing any symptoms). This is because there is inevitably a lag phase between the time a new pathogen arrives and when it is detectable, which can vary from days to years. Effective pathway management, including monitoring vine health on-orchard and managing plant movements to ensure the healthiest plants are selected, reduces the risk of *Ceratocystis fimbriata* spreading during this lag phase and therefore, also contributes to preserving response options and giving the best possible chance of successful eradication at lowest cost.

In the absence of pre-emptive pathway management, it is highly likely that the pathogen would have been spread by human assisted movement prior to detection, as was the case in Brazil. This may make eradication no longer feasible and shift the industry into long-term management.

Without successful and effective control tools, or resistant cultivars, the long-term viability of the industry is dependent on either an effective eradication response, which requires early detection, or successfully limiting the spread under a long-term management plan. Under such a plan, without regulated controls in place, the human mediated spread through propagative material, contaminated tools and equipment and soil will be difficult to minimise.

In summary, key pathway management activities that contribute to reducing risk associated with *Ceratocystis fimbriata* include:

- maintaining hygiene and sourcing clean plant material,
- appropriate disposal and disinfection of plant material and equipment, and
- education campaigns to raise awareness and encourage reporting of symptoms.