Feasibility of biological control of bat-wing passionflower (*Passiflora apetala* Killip) in New Zealand

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Summary

Project and client

- The feasibility of developing a biological control programme targeting bat-wing passionflower, *Passiflora apetala* Killip (Passifloraceae), in New Zealand was assessed by the Manaaki Whenua – Landcare Research Group of the Bioeconomy Science Institute Maiangi Taiao (BSI) for Northland Regional Council as part of an Envirolink small advice grant.
- The project was co-funded by Auckland Council.

Objectives

- Review the literature to identify potential arthropod and fungal pathogen biological control agents for *Passiflora apetala*.
- Determine the feasibility of releasing biocontrol agents in areas where *P. apetala* is naturalising – currently in the Northland and Auckland regions.
- Estimate and outline the cost of implementing a biocontrol programme for *P. apetala* in New Zealand.

Results

- *Passiflora apetala* is native to the highlands of Central America and Mexico. New Zealand is the only country where this vine has escaped cultivation to become naturalised. In New Zealand it has adapted to lower altitudes, tolerates deep forest shade, and flowers and fruits year-round.
- *Passiflora apetala* is a 'fast-track' invader, maturing from seed to fruit-bearing adults in just 8 to 10 months. A single mature vine can produce more than 3,000 fruits annually (with 15–20 seeds each), and the seeds – dispersed primarily by birds – remain viable in the soil for more than 10 years.
- This vigorous climber can smother and shade native forests, hedges, and regenerating scrub. By suppressing native vegetation it threatens local biodiversity, alters forest composition, and affects areas of cultural significance to Māori.
- Declared an 'Unwanted Organism', bat-wing passionflower is listed on the National Pest Plant Accord, and it is illegal to sell, propagate, or distribute it in New Zealand. It is currently listed on two Regional Pest Management Plans: Northland, as an eradication plant, and the Bay of Plenty, where it is targeted for total exclusion.
- There should be minimal opposition to a biocontrol programme for the control of *P. apetala* because it has limited use as an ornamental plant, has insignificant flowers, and produces grape-sized fruit that are unpalatable to humans.
- Host specificity of a potential biocontrol agent is vitally important to avoid damage to the commercial *P. edulis* (black passionfruit), the native *P. tetrandra* (kōhia), and, preferably, ornamental *Passiflora* species. Heteroblasty (particularly chemical differences between young and older plant parts) must be taken into account when host testing. Fortuitously, *P. apetala* belongs to a different subgenus (*Decaloba*) to *P. edulis* (subg. *Passiflora*) and *P. tetrandra* (subg. *Tetrapathea*).
- Natural enemy insects in the orders Lepidoptera (butterflies, tribe Heliconiini) and Coleoptera (flea beetles, subfamily Galerucinae) have potential as biocontrol agents for *P. apetala*.

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- Of the Lepidoptera, the butterflies *Heliconius charithonia* and *H. clysonymus montanus* are promising, because they may be tolerant of the Northland winters, utilise *Passiflora* exclusively within the subgenus *Decaloba*, and have been observed on *P. apetala*. There may be concerns that the larvae of both butterflies are spiny and toxic to predators, and adults pollinate the weed lantana.
- The Coleopteran flea beetles *Disonycha quinquelineata*, *D. stenosticha*, and *Monomacra chontalensis* also have potential, because they are considered to be *Passiflora* subgenus *Decaloba* specialists. These flea beetles have not been observed on *P. apetala*, necessitating work in the field.
- While no fungal pathogens are currently recorded for *P. apetala* due to a lack of research, potential candidates from related *Passiflora* species indicate that targeted surveys in its native range could uncover effective, host-specific plant pathogens that could be used as biological control agents. *Pseudocercospora passiflorae* and *Passalora biformis* emerged as two promising candidates because they infect closely related *Passiflora* species. If host-specific strains of them could be found, these could potentially be effective against *P. apetala*.

Conclusions

- As an invasive species in the rapid establishment phase, there remains a place for traditional methods of control for *Passiflora apetala*, including spraying and physical control.
- Because New Zealand is the only country where *P. apetala* has naturalised, biocontrol research on this species is lacking. Despite the research gap, biocontrol of *P. apetala* is a viable control option.
- We have identified five insects – two butterflies (*Heliconius charithonia* and *H. clysonymus montanus*) and three flea beetles (*Disonycha quinquelineata*, *D. stenosticha*, and *Monomacra chontalensis*) – as potential biocontrol agents.
- Of the *Passiflora* pathogens surveyed, two are promising candidates for *P. apetala*: *Pseudocercospora passiflorae* (an ascomycete fungi) and *Passalora biformis* (in the family Mycosphaerellaceae).
- There should be little, if any, opposition to biocontrol of *P. apetala* in New Zealand because the target species has no economic value, provided the biocontrol agent(s) are sufficiently host specific. There may be concerns with proposing *Heliconius* for release because their larvae are toxic and their adults are known to pollinate the weed lantana.
- Survey work in Central America and Mexico, the natural range for *P. apetala*, would need to be undertaken to source the identified candidate agents for further study, and to discover host-specific fungal pathogens and any other natural enemies.

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Recommendations

We recommend the following actions for a biocontrol programme targeting *Passiflora apetala* (all cost estimates are in New Zealand dollars).

- Survey *P. apetala* in New Zealand to obtain baseline information. Estimated cost: $50,000–$90,000.
- Undertake survey(s) of *P. apetala* in its native range to identify potential biocontrol agents (both arthropods and pathogens). Estimated cost: $50,000–$300,000.
- Identify and study the life-cycles of prospective agents found during surveys, including the two butterflies, three flea beetles, and two fungal pathogens identified as potential agents in this study, and develop rearing methods. Estimated cost: $50,000–$200,000 per agent.
- Host-test potential agents and abandon any species that do not appear to be safe or effective enough. Estimated cost: $50,000–$200,000 per agent.
- Apply to the Environmental Protection Authority for permission to release. Estimated cost: $60,000–$85,000 per application.
- Arrange for shipment of agent(s) if not already in containment. Estimated cost: $10,000–$60,000 per agent.
- Develop mass-rearing techniques and make releases of agent(s); or, if agents can't be reared, direct release them and/or set up a site for future collection. Estimated cost: $100,000–$250,000 per agent.
- Monitor the establishment success and spread of biocontrol agent(s). If establishment is unsuccessful, try again. Estimated cost: $15,000–$50,000 and council staff time.
- Harvest and redistribute agent(s). Estimated cost: council staff time.
- Evaluate the biocontrol programme's success and decide if further agents are needed. Estimated cost: $100,000–$500,000.

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1 Introduction

Passiflora apetala Killip is a species of passionflower or passion vine belonging to the Passifloraceae family. It is indigenous to the Central American region. The species name, ‘apetala’, refers to the lack of petals on its flowers (Figure 1). Flowers are yellow/green and 7–12 mm in diameter (Ministry for Primary Industries 2026; New Zealand Plant Conservation Network 2026b).

Figure 1. The distinctive flower of *Passiflora apetala*, showing five basal tepals and an absence of petals. Cultivated, Thailand. (Source: © Yvan, www.inaturalist.nz/observations/54690058, CC-BY-NC)

The common name, bat-wing passionflower, refers to the distinctive bilobed leaves said to resemble bat wings. These leaves often have pale green irregular markings along the midribs (Figure 2). However, the usage ‘bat-wing passionflower’ for *P. apetala* seems to be particular to New Zealand, as other species with that common name also bear a resemblance to bat wings (e.g. *P. coriacea* Juss. and *P. megacoriacea* Port.-Utl.).

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Figure 2. *Passiflora apetala*, showing its distinctive bilobed leaves. Kohumaru Road, Northland. (Source: © mariannafenn, www.inaturalist.nz/observations/286972824, CC-BY-NC)

The earliest cultivated record found for *P. apetala* is an Auckland Botanic Gardens accession (30332–19942165; Taking Stock database 2026) dated 1994.

The small (7–15 mm diameter) purplish-black berries are produced in profusion (Figure 3) and readily spread by birds and mammals (Ministry for Primary Industries 2026). The species has naturalised relatively recently, recorded from 2009 (e.g. Auckland Museum herbarium specimens AK307135–AK307141[1]) and has spread rapidly in less than two decades. This relatively new incursion has attracted media attention (e.g. Northern Advocate 2022).

[1] www.aucklandmuseum.com/discover/collections/record/681734?k=Passiflora%20apetala.

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Figure 3. *Passiflora apetala*, showing a profusion of purple-black berries. Point Wells, Auckland Region. (Source: © glenn_ashwell, www.inaturalist.nz/observations/197166896, CC-BY-NC)

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2 Background

2.1 Global distribution, biology, and ecology of *Passiflora apetala*

Passiflora apetala is native to Mexico and Central America, including Costa Rica, Honduras, south-eastern Mexico, and Panamá (POWO 2026). In its native range *P. apetala* grows at elevations of 1,300–2,200 m (Ulmer & MacDougal 2004), with flowers observed from June to February and fruits found during most of the year (Estrada & Rodriquez 2009).

Flowers and fruit have been found all year round in New Zealand (Christian et al. 2011). In New Zealand the species appears to be shade tolerant and grows at lower altitudes than in its native range (Christian et al. 2011). The minimum temperature for growing *P. apetala* is 5°C (Ulmer & MacDougal 2004).

A mature *P. apetala* vine 2–3 years old produces more than 3,000 fruit, with an average of 15 seeds per fruit (Pearson 2010, in Christian et al. 2011). A study on seed dynamics, commencing in 2010 and using accelerated ageing experiments, indicated high seed viability (90%), while extrapolation of data shows that seeds are likely to remain viable in the natural environment for more than 10 years (Dowsett & James 2011, in Christian et al. 2011). *Passiflora apetala* seeds, germinated and grown in an outdoor environment, can reach maturity and start flowering within 24 weeks (Dowsett & James 2011, in Christian et al. 2011). It is still to be determined how environmental conditions in New Zealand trigger plant growth and affect fertility.

Somewhat unusually for an invasive plant, New Zealand is the only country where it has escaped cultivation to become naturalised. This species is occasionally cultivated elsewhere in the world (Figure 4).

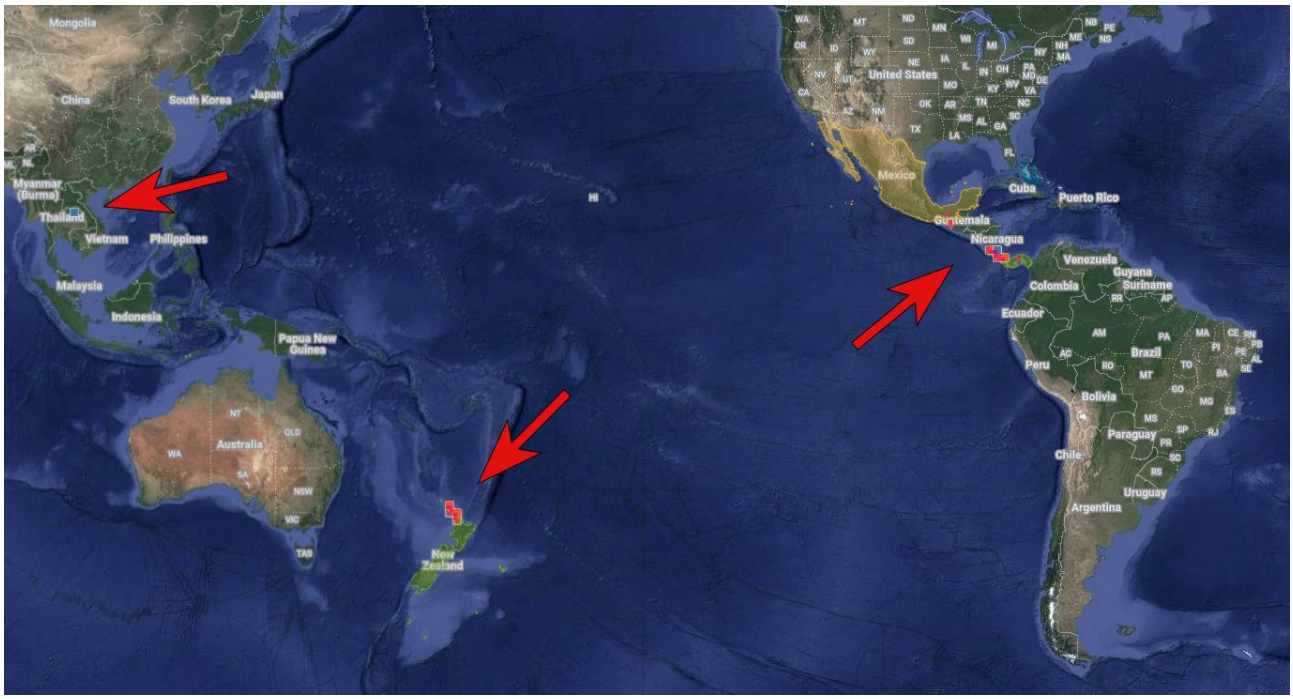

Figure 4. The global distribution of *Passiflora apetala*, showing (arrowed) its central American native range, its naturalised distribution in the upper North Island of New Zealand, and a cultivated record in Thailand. (Source: © Map data, www.inaturalist.org/taxa/430583-Passiflora-apetala, CC0, CC BY, CC-BY NC)

2.2 Pest status and distribution of *Passiflora apetala* in New Zealand

In New Zealand, *P. apetala* is a high-priority 'Unwanted Organism'. Unlike the better-known banana passionfruit (*P. tarminiana* and *P. tripartita*), which are already widespread, *P. apetala* is still in a 'containment and eradication' phase, primarily in the Auckland and Northland regions.

Passiflora apetala has several regulatory statuses as a pest species in New Zealand. Under the Biosecurity Act 1993 it was declared an Unwanted Organism on 25 November 2009 (Biosecurity New Zealand 2026). Under Sections 52 and 53 of the Act it is an offence to knowingly spread, release into the environment, propagate or sell Unwanted Organisms. In 2012 it was listed on the National Pest Plant Accord (NPPA; Ministry for Primary Industries 2026). NPPA species are prohibited from sale, propagation, or distribution.

Passiflora apetala is also currently listed on two Regional Pest Management Plans: Northland Regional Pest and Marine Pathway Management Plan 2017–2027, as an 'eradication plant', making it a high priority to remove all plants (Northland Regional Council 2026); and the Bay of Plenty Regional Pest Management Plan 2020–2030, for 'exclusion', to keep it out of the region entirely (Bay of Plenty Regional Council 2026b).

Passiflora apetala has been found from Northland to Auckland. The Global Biodiversity Information Facility (GBIF) and iNaturalist (Figure 5) currently record more than 30 sites around Kohumaru, two sites in Kaitaia, four sites near Kerikeri, more than 60 sites around the Whangateau / Tāwharanui Peninsula area, five sites east of Helensville, and one site in Birkenhead (iNaturalist NZ 2026). However, there are numerous other confidential (non-public) records of *P. apetala* naturalisations in Northland (Joanna Barr, Northland Regional Council, pers. comm.). It has also been recorded cultivated in a butterfly park in Thames (New Zealand Plant Conservation Network 2026b).

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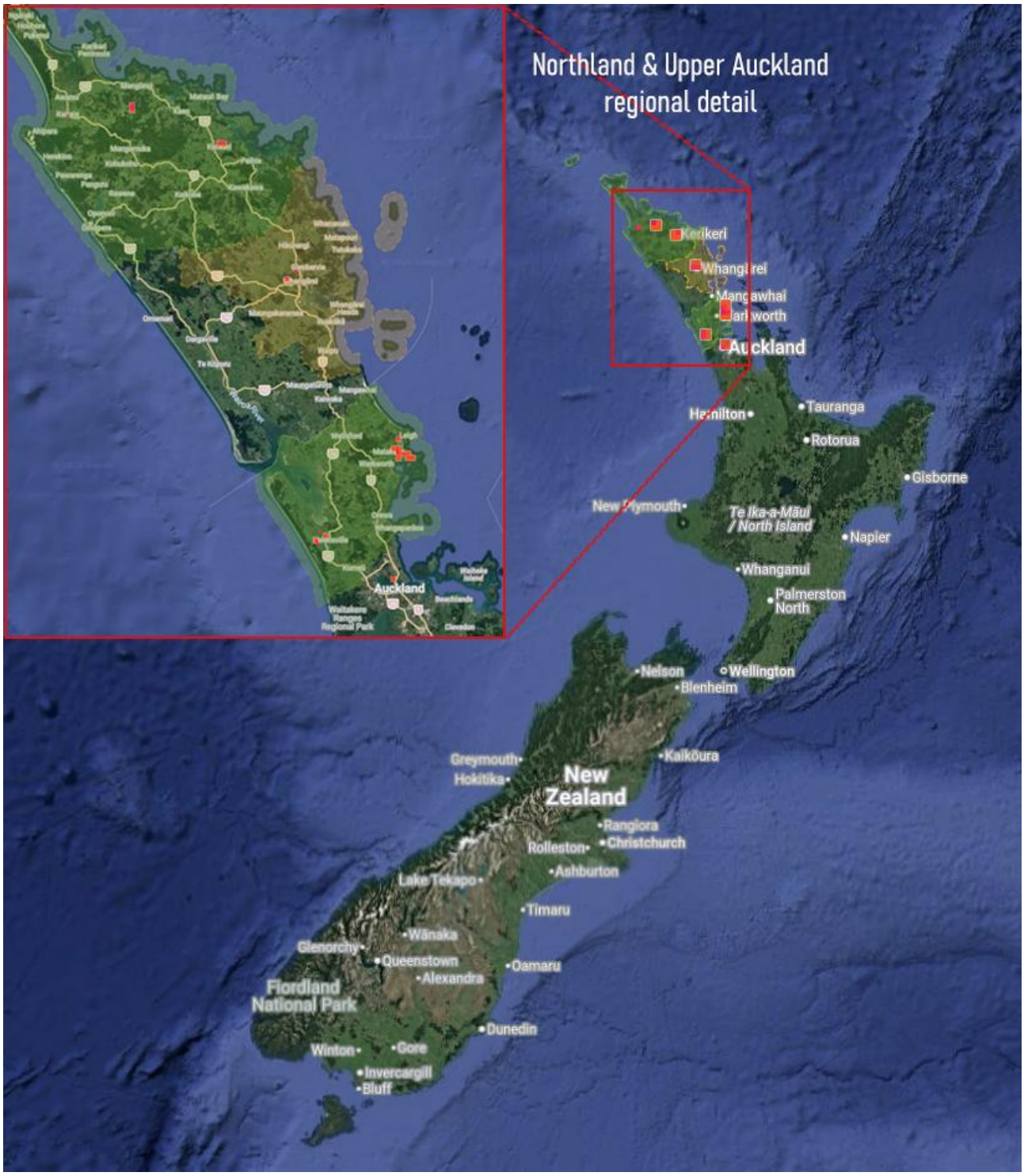

Figure 5. Publicly available distribution of *Passiflora apetala* in the upper North Island, New Zealand. (Source: www.inaturalist.org/taxa/430583-Passiflora-apetala. CC0, CC BY, CC-BY NC, © Map data)

2.3 Detrimental impacts of *Passiflora apetala*

Passiflora apetala is seen as an emerging threat to New Zealand's environment, with the potential to smother regenerating forests and forest margins (Christian et al. 2011). It has been reported invading native forests and scrub and can be found in home gardens and among hedges and fencelines (New Zealand Plant Conservation Network 2026b). The plant is a vigorous climber that grows into and over trees and shrubs, eventually smothering them through shade and the physical weight of dense growth. In native forest environments this capacity to overtop and suppress resident vegetation suggests that *P. apetala* may alter forest composition over time (Tiaki Tāmaki Makaurau – Conservation Auckland 2026).

The species has several traits that facilitate further spread. *Passiflora apetala* is a 'fast-track' invader with rapid generation and seed rain. It can grow from a seed to a fruit-bearing adult in as little as 8 to 10 months. A single mature (2–3-year-old) vine can produce up to 3,000 fruit all year, with an average of 15–20 seeds per fruit (Bay of Plenty Regional Council 2026a). Its seeds are bird-dispersed and seedlings are usually found beneath perching sites (Christian et al. 2011). While seed dispersal by introduced mammalian pests such as possums, rats, and feral pigs has been suggested based on evidence from banana passionfruit (*P. tripartita* var. *mollissima*) (Beavon & Kelly 2015), these dispersers have not been confirmed or disproven for *P. apetala*.

Vegetative spread may also occur, with plants capable of resprouting from stems in contact with the ground or from plant fragments (Bay of Plenty Regional Council 2026a; Hawke's Bay Regional Council 2026). Garden enthusiasts may also contribute to human-mediated spread. While many invasive species need a gap in forest and scrub to establish, *P. apetala* seedlings can germinate and grow in heavy shade. Shade tolerance makes it adaptable to a range of habitats.

Although *P. apetala* is not reported as invasive elsewhere globally, vines and climbing plant species are widely recognised as among the most damaging groups of invasive plants worldwide (David & Lake 2023). Vine species typically allocate fewer resources to structural biomass, allowing greater investment in stem and root elongation, photosynthetic biomass, and reproduction, which provide a competitive advantage over self-supporting plant species. In addition to competing for light, nutrients, and water, climbers can cause mechanical damage to host vegetation, further exacerbating their impacts (King et al. 2021). These effects can modify the structural makeup of plant communities, and in turn influence ecological processes such as transpiration, soil nutrient cycling, and water availability (Scowcroft 1997; King et al. 2021).

Several other *Passiflora* species are invasive in New Zealand (see Table 1). Notably, banana passionfruit (including *P. mixta*, *P. tarminiana*, and two varieties of *P. tripartita*) is also a target for biocontrol in New Zealand. Although no biocontrol agent has been released in New Zealand yet for banana passionfruit (Bioeconomy Science Institute 2026), these species are widespread in coastal regions and they invade forest margins, plantations, hedgerows, scrub, and waste ground (Williams & Buxton 2011; Beavon & Kelly 2012, 2015). Banana passionfruit (including *P. tarminiana* and *P. tripartita* var. *mollissima*) is also invasive in Hawaii, where it frequently forms dense, continuous stands in areas with sparse canopy cover and high feral pig activity, causing severe impacts on native vegetation (Ramadan et al. 2008). These parallels suggest *P. apetala* may become increasingly troublesome if its spread continues largely unchecked.

Passiflora apetala may also have an impact on the native flora and fauna that are culturally significant to Māori, and may affect people's recreational experience (Christian et al. 2011).

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2.4 Beneficial uses of *Passiflora apetala*

In New Zealand, *P. apetala* is considered to have no beneficial uses and is officially classified as a harmful pest plant. Although it was originally introduced into New Zealand as an ornamental plant in the 1990s due to its unique 'bat-wing' shaped leaves, its flowers are tiny, greenish-yellow, and lack the dramatic 'petals' and vibrant colours that make other species more desirable as garden plants.

Butterfly farms have been known to grow *P. apetala* as a host plant for breeding certain butterfly species (Christian et al. 2011). However, this is a limited use case and it's now illegal to propagate, sell, or distribute *P. apetala*. Other host species for rearing butterflies are available.

The small, black, grape-sized fruit are considered inedible for humans. While not strictly toxic, they provide no nutritional value and are generally described as unpalatable. Even in its native range, *P. apetala* is not widely cited for traditional medicinal or culinary uses.

2.5 Phylogeny and taxonomy

The taxonomic classification of *Passiflora apetala* is as follows (POWO 2026; Wikipedia 2026c; Wikispecies 2026):

Kingdom:	Plantae
Clade:	Tracheophytes
Clade:	Angiosperms
Clade:	Eudicots
Clade:	Rosids
Order:	Malpighiales
Family:	Passifloraceae
Subfamily:	Passifloroideae
Tribe:	Passifloreae
Genus:	*Passiflora*
Subgenus:	*P*. subg. *Decaloba*
Supersection:	*P*. supersect. *Decaloba*
Species:	*Passiflora apetala* Killip

Following the reassignment of *Abatia* Ruiz & Pav. and *Aphaerema* Miers to the Salicaceae, the Passifloraceae forms a monophyletic group (Figure 6), comprising more than 750 species and over 30 genera.

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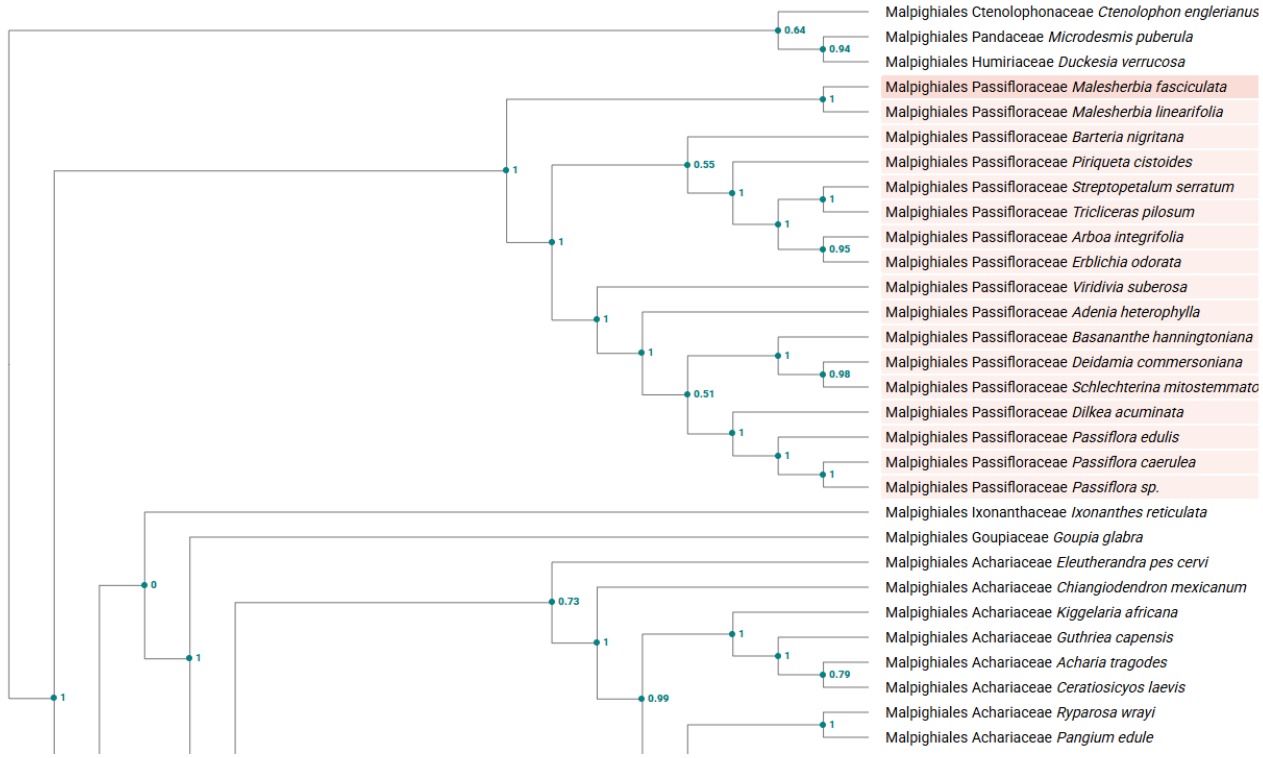

Figure 6. Monophyly of the Passifloraceae. (Source: https://treeoflife.kew.org/tree-of-life)

There are four subfamilies within the Passifloraceae (Figure 7).

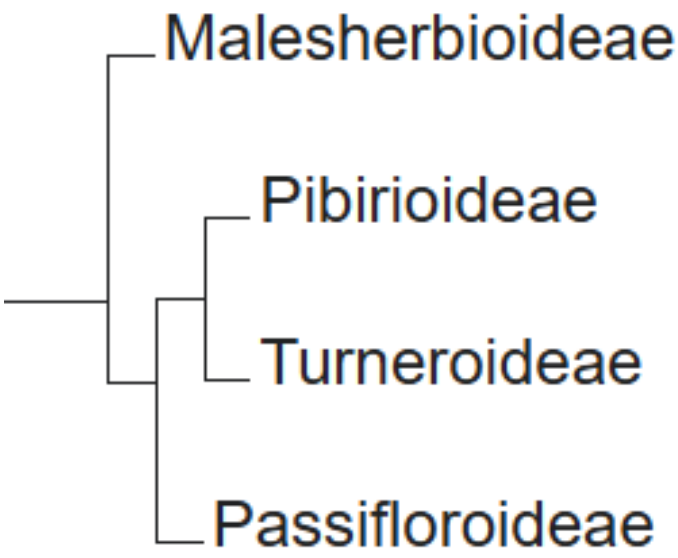

Figure 7. Phylogeny of the Passifloraceae subfamilies. (Source: https://en.wikipedia.org/wiki/Passifloraceae)

The Malesherbioideae and Pibirioideae contain one genus each (*Malesherbia* Ruiz & Pav. and *Pibiria* Maas, respectively).

The Turneroideae comprise 13 genera: *Adenoa* Arbo, *Afroqueta* Thulin & Razafim, *Arboa* Thulin & Razafim, *Erblichia* Seem., *Hyalocalyx* Rolfe, *Loewia* Urb., *Mathurina* Balf.f., *Oxossia* L. Rocha, *Piriqueta* Aubl., *Stapfiella* Gilg, *Streptopetalum* Hochst., *Tricliceras* Thonn. ex DC., *Turnera* L.

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The Passifloroideae are further subdivided into three tribes (Wikipedia 2026d):

1 Tribe Paropsieae
   - *Androsiphonia* Stapf
   - *Barteria* Hook.f. (includes synonym *Smeathmannia* Sol. ex R.Br.)
   - *Paropsia* Noronha ex Thouars
   - *Paropsiopsis* Engl.
   - *Viridivia* J.H.Hemsl. & Verdc.

2 Tribe Jongkindieae Breteler & F.T.Bakker
   - *Jongkindia* Breteler & F.T.Bakker

3 Tribe Passifloreae
   - *Adenia* Forssk.
   - *Ancistrothyrsus* Harms
   - *Basananthe* Peyr.
   - *Crossostemma* Planch. ex Benth.
   - *Deidamia* Noronha ex Thouars
   - *Dilkea* Mast.
   - *Efulensia* C.H.Wright
   - *Mitostemma* Mast.
   - *Passiflora* L.
   - *Schlechterina* Harms

Of the aforementioned genera in the four subfamilies, only *Passiflora* L. is present in New Zealand. *Passiflora* contains about 550 species, mostly tendril-bearing vines, as well as some shrubs and trees. Species can be woody or herbaceous.

Feuillet & MacDougal (2004) divided *Passiflora* into four subgenera:

- *Astrophea* (Americas, about 60 species): trees and shrubs with simple, unlobed leaves
- *Passiflora* (Americas, about 250 species): woody vines with large flowers and elaborate corolla
- *Deidamioides* (Americas, 13 species): woody or herbaceous vines
- *Decaloba* (Americas, Asia, and Australasia, about 230 species): herbaceous vines with palmately veined leaves.

Some studies have shown that the segregate Old World genera *Hollrungia* and *Tetrapathaea* are nested within *Passiflora* and form a fifth subgenus (*Tetrapathaea*) (Krosnick et al. 2009). Other studies support the four-subgenera classification (Hansen et al. 2006).

At least 31 species of *Passiflora* have been reported for New Zealand (Table 1) (Gaddum 2001; Biota of New Zealand 2026; New Zealand Plant Conservation Network 2026a; Taking Stock database 2026). Of these, only *P. tetrandra* Solander ex DC. is native to New Zealand. Several species, varieties and hybrids of *Passiflora* are well-known weeds of New Zealand, including *P. mixta* L.f., *P. pinnatistipula* Cav., *P. tarminiana* Coppens & V.E.Barney, *P. tripartita* var. *azuayensis* Holm-Niels & P.Jørg., *P. tripartita* var. *mollissima* (Kunth) Holm-Niels. & P.Jørg., and *P.* ×*rosea* (H.Karst.) Killip). *Passiflora caerulea* L. is both weedy and cultivated as an ornamental,

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and *P. edulis* Sims f. *edulis* has a dual status as an environmental weed and a cultivated fruit crop. Only a few of the exotic, cultivated-only ornamental species are well known, including *P. antioquiensis* K.Karst., *P. manicata* (Juss.) Pers., and *P. quadrangularis* L.

Table 1. *Passiflora* species, varieties and hybrids recorded as present in New Zealand

Sp./var./hybrid	Common name	Infrageneric rank	Notes
Passiflora adenopoda DC.	n/a	subg. *Decaloba* supersect. *Bryonioides*	Exotic, ornamental
P. alata Curtis	winged-stem passion flower	subg. *Passiflora* supersect. *Laurifolia* ser. *Quadrangulares*	Exotic, ornamental
P. antioquiensis K.Karst.	vanilla bean passionfruit	subg. *Passiflora* supersect. *Tacsonia* sect. *Insignes*	Exotic, ornamental
P. apetala Killip	bat-wing passion flower	subg. *Decaloba* supersect. *Decaloba* sect. *Decaloba*	Exotic, weed
P. aurantia G.Forst.	orange passion flower	subg. *Decaloba* supersect. *Disemma* sect. *Disemma*	Exotic, ornamental
P. bryonioides Kunth	cocapitos	subg. *Decaloba* supersect. *Bryonioides*	Exotic, ornamental
P. caerulea L.	blue passion flower	subg. *Passiflora* supersect. *Stipulatae* sect. *Granadillastrum*	Exotic, ornamental and a weed
P. capsularis L.	capsule-fruited passion flower	subg. *Decaloba* supersect. *Decaloba* sect. *Xerogona*	Exotic, ornamental
P. coccinea Aubl.	red granadilla	subg. *Passiflora* supersect. *Coccineae*	Exotic, ornamental
P. edulis Sims f. *edulis*	black passionfruit	subg. *Passiflora* supersect. *Passiflora* ser. *Passiflora*	Exotic, cultivated for fruit production, environmental weed
P. elegans Mast.	n/a	subg. *Passiflora* supersect. *Stipulatae* sect. *Granadillastrum*	Exotic, ornamental, edible fruit
P. foetida L.	Cinco llagas.	subg. *Dysosmia*	Exotic, ornamental
P. gracilis J.Jacq. ex Link	annual passion flower	subg. *Decaloba* supersect. *Bryonioides*	Exotic, ornamental
P. herbertiana Ker Gawl.	passionfruit	subg. *Decaloba* supersect. *Disemma* sect. *Disemma*	Exotic, ornamental
P. incarnata L.	may apple, maypops	subg. *Passiflora* supersect. *Passiflora* ser. *Passiflora*	Exotic, ornamental
P. leschenaultii DC.	moon-leaf passion flower	subg. *Decaloba* supersect. *Disemma* sect. *Octandranthus*	Exotic, ornamental
P. ligularis Juss.	sweet granadilla	subg. *Passiflora* supersect. *Laurifolia* ser. *Tiliifoliae*	Exotic, ornamental
P. manicata (Juss.) Pers.	red passion flower	subg. *Passiflora* supersect. *Tacsonia*	Exotic, ornamental

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Sp./var./hybrid	Common name	Infrageneric rank	Notes
		sect. *Manicata*	
P. mixta L.f.	banana passionfruit	subg. *Passiflora* supersect. *Tacsonia* sect. *Tacsonia*	Exotic, weed
P. morifolia Mast.	blue sweet calabash	subg. *Decaloba* supersect. *Bryonioides*	Exotic, ornamental
P. ovata DC.	n/a	subg. *Astrophea* supersect. *Pseudoastrophea* sect. *Pseudoastrophea*	Exotic, ornamental
P. pinnatistipula Cav.	yellow passionfruit	subg. *Passiflora* supersect. *Tacsonia*	Exotic, weed
P. quadrangularis L.	badea, granadilla	subg. *Passiflora* supersect. *Laurifolia* ser. *Quadrangulares*	Exotic, ornamental
P. rubra L.	Dutchman's laudanum	subg. *Decaloba* supersect. *Decaloba* sect. *Xerogona*	Exotic, ornamental
P. suberosa L.	cork-barked passion flower	subg. *Decaloba* supersect. *Cieca*	Exotic, ornamental
P. subpeltata Ortega (syn. *P. alba* Link & Otto)	white passionflower, granadina	subg. *Passiflora* supersect. *Stipulatae* sect. *Granadillastrum*	Exotic, ornamental
P. tarminiana Coppens & V.E.Barney	banana passionfruit	subg. *Passiflora* supersect. *Tacsonia* sect. *Elkea*	Exotic, weed
P. tetrandra Solander ex DC.	kōhia, NZ passionflower, NZ passionfruit	subg. *Tetrapathea*	Endemic NZ native
P. tripartita var. *azuayensis* Holm-Niels & P.Jørg.	banana passionfruit	subg. *Passiflora* supersect. *Tacsonia* sect. *Elkea*	Exotic, weed
P. tripartita var. *mollissima* (Kunth) Holm-Niels. & P.Jørg.	banana passionfruit	subg. *Passiflora* supersect. *Tacsonia* sect. *Elkea*	Exotic, weed
P. tuberosa Jacq.	tuberous passion flower	subg. *Decaloba* supersect. *Decaloba* sect. *Decaloba*	Exotic, ornamental
P. vespertilio L.	granadilla, black passion flower	subg. *Decaloba* supersect. *Decaloba* sect. *Decaloba*	Exotic, ornamental
P. ×*exoniensis* (R.T.Veitch ex Mast.) Van Houtte (*P. antioquiensis* H.Karst. × *P. tripartita* var. *mollissima* (Kunth) Holm-Niels. & P. Jørg.)	Exeter passion flower	subg. *Passiflora* supersect. *Tacsonia*	Exotic, ornamental
P. ×*rosea* (H.Karst.) Killip (*P. tripartita* (Juss.) Poir. × *P. pinnatistipula* Cav.)	banana passionfruit hybrid	subg. *Passiflora* supersect. *Tacsonia* nothosect. *Inkea*	Exotic, weed
P. ×*violacea* Loisel. (*P. caerulea* L. × *P. racemosa* Brot.)	violet passion flower	subg. *Passiflora*	Exotic, ornamental

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2.6 Potential for opposition to biocontrol

The closest native relative of *Passiflora apetala* is *P. tetrandra* (kōhia), which is endemic to New Zealand.

Passiflora edulis (black passionfruit) is the species most eaten by people, and its cultivars such as *P. edulis* f. *edulis* 'Black Beauty' is commercially grown in New Zealand. It is considered a specialised niche crop, with up to 120 tonnes of fruit produced in a good season. The industry is supported by the New Zealand Passionfruit Growers Association, with 40 to 50 commercial growers nationwide based mainly in the Bay of Plenty, Northland, and Gisborne (Passionfruit New Zealand 2026).

In addition, several species such as *P. antioquiensis* and *P. quadrangularis* are sold and cultivated in New Zealand for their showy flowers.

As a result, stakeholders may express concerns about the potential for non-target effects on these species, underscoring the importance of rigorous host-range assessment. Spill-over attack by specialist biocontrol agents is considered highly unlikely, as the aforementioned species belong to different subgenera from *P. apetala*. Nevertheless, conflicts of interest may arise if biocontrol agents released against *P. apetala* attacked the native, commercial, or ornamental *Passiflora* species. Conversely, non-target attack of the most invasive *Passiflora*, such as *P. mixta*, *P. pinnatistipula*, and *P. tripartita* (banana passionfruits), would be perceived as beneficial by many regional councils and community control groups.

No literature evidence could be found that listed *P. apetala* as a preferred food source for native birds. Williams and Karl (1996) found that the non-endemic but native silvereye (*Zosterops lateralis*) and the exotic blackbird (*Turdus merula*) eat fruits of the related banana passionfruit, but it is not recorded which bird species actively eat and disperse *P. apetala* in New Zealand – this would be a useful study to undertake. Regardless, a single additional and unconfirmed food resource for native birds provides a poor argument for not controlling such an invasive species.

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2.7 Control options

Traditional (conventional non-biocontrol) methods, including physical and chemical control, are often viable for newly naturalised species that are in the early establishment phase, rather than those undergoing exponential population growth or that have already become widely established. Concerted effort to eliminate (rather than manage) a newly invasive species is the most effective approach.

On the positive side, the distinctive bilobed leaves of *Passiflora apetala* make plants readily identifiable at both the seedling and adult stages, aiding their discovery and enabling conventional control techniques. However, the relatively small number of locations and observations (currently less than 140) recorded in iNaturalist for Auckland and Northland (iNaturalist NZ 2026) is misleading, as numerous other plants have been found and recorded (confidentially) by the regional councils. This means the window for cost-effective traditional control or eradication has likely closed because *P. apetala* has entered an exponential population growth phase and is no longer considered to be able to be eradicated or effectively contained in Northland or in Auckland (Joanna Barr, Northland Regional Council, pers. comm.).

Like other climbing invasive plants, the growth habit of *P. apetala* presents numerous challenges to conventional control methods (King et al. 2021; David & Lake 2023). For example:

- its vines often intertwine with other vegetation, making application of conventional methods such as mechanical removal, herbicide application or burning challenging without inadvertently harming non-target plants
- its vines may grow up into tree canopies, making them difficult and expensive to access and remove
- plants may also grow in remote or steep areas that are not easily accessible for control.

Also, bird dispersal of seeds can be long-distance into new and unrecorded areas, seeds can remain viable for more than a decade, and seedlings can be locally abundant.

For non-biocontrol methods to be effective, ongoing and unimpeded access to private land is essential to remove pockets of established plants and newly establishing populations. Some landowners may be unwilling to grant this access without a widespread awareness campaign to facilitate community and hapū buy-in.

Conventional methods of control for *Passiflora*, including *P. apetala*, are reported by several sources (Environment Canterbury 2026; Hawke's Bay Regional Council 2026; Weedbusters 2026). The following methods, summarised from Environment Canterbury (2026), represent a typical traditional approach for invasive *Passiflora*.

Site management

- Cut and pull vines away from desirable trees and native plants before foliar spraying. Follow up treated areas three times per year.
- Encourage natural regeneration of native plants, or replant treated areas where possible after two to three treatments to establish dense ground cover and minimise reinvasion.

Physical control

- Dig or pull out small plants or seedlings.
- All plant parts require disposal.

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- Contact your local council for appropriate disposal locations.

Chemical control

- Where possible, trace the vines back to ground level, clear a small area around the base, and cut vines close to the ground. Immediately treat with herbicide gel containing glyphosate, metsulfuron-methyl, or picloram.
- Foliar spray with triclopyr.

2.8 Potential advantages and disadvantages of biological control

Advantages

Biocontrol agents can avoid the issues surrounding conventional control, due to their mobility and host-specificity, and may also locate and populate infestations not known to managers. Classical biocontrol, if successful, is more cost-effective than other forms of control because it offers continuous action and self-dispersal to areas that are not likely to be targeted by other control programmes. Biocontrol is an attractive option for a target weed such as *Passiflora apetala*, which is in the earlier stages of invasion and has yet to reach its full weedy potential. While biocontrol is often used as the last-resort management option once all else has failed, it can be even more effective when the pest is targeted at the earlier stages of invasion.

Weed biocontrol programmes have frequently delivered substantial long-term economic benefits. In Australia, a comprehensive economic analysis found a strong positive return on investment, with AUD23.10 generated for every dollar invested in weed biocontrol overall (Page & Lacey 2006). Similarly, in South Africa, benefit–cost ratios for biological control, measured through improvements to ecosystem services, ranged from 50:1 for subtropical shrubs to 3,726:1 for invasive Australian trees such as *Acacia*, *Leptospermum*, and *Paraserianthes* (de Lange & van Wilgen 2010).

For New Zealand, Fowler et al. (2024) estimated that between 1926 and 2022 the overall benefit–cost ratio for all weed biocontrol programmes was strongly positive (155:1) for weeds affecting the productive sector (or 110:1 when accounting for secondary weed invasion). In contrast, the estimated benefit–cost ratio for environmental weed biocontrol was slightly negative (0.88:1) when assessed using readily quantifiable, market-based metrics alone. However, the authors emphasised that conventional economic analyses substantially undervalue environmental weed biocontrol because many benefits, such as biodiversity conservation and ecosystem service restoration, are difficult to monetise reliably. Consequently, strictly economic evaluations based solely on market values may provide a misleading assessment of the true long-term benefits of environmental weed biocontrol (Fowler et al. 2024).

Moreover, biocontrol can result in outcomes that are impossible to achieve using conventional means. For example, the heather beetle *Lochmaea suturalis* successfully controlled heather, *Calluna vulgaris*, over large areas of the Central Plateau of New Zealand at a fraction of the cost of herbicide applications. Herbicide was associated with unacceptable non-target impacts on native dicots, while the heather beetle was demonstrably specific to heather (Peterson et al. 2020).

Overall, when evaluated over appropriate temporal scales, weed biocontrol can provide enduring and substantial economic benefits, particularly where long-term reductions in management costs and sustained ecosystem outcomes are considered.

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Disadvantages

Despite its advantages, biocontrol may not be a 'silver bullet', although multiple analyses have indicated that the success rate of weed biocontrol programmes has been greater than previously supposed (McFadyen 1998; Fowler et al. 2000; Schwarzländer et al. 2018; Hinz et al. 2019; Hulme 2020; Morin 2020). Complete successes, where biological control is so dramatic that no other control methods are required or greatly reduced, account for only approximately a quarter of releases (Schwarzländer et al. 2018). Furthermore, although biological control is often perceived as an environmentally benign alternative to chemicals, some cases of predictable damage to non-target plants have been reported (Hinz et al. 2019).

Nevertheless, the risk of failure and the impacts of non-target attack are likely to be minor compared with the potential benefits. Schwarzländer et al. (2018) showed that, of the weed biocontrol programmes that did not deliver complete control, most resulted in substantial or partial control (i.e. biocontrol contributes to management, but other control methods are still required to achieve adequate control). An example of partial control in New Zealand is that of alligator weed, *Alternanthera philoxeroides*, in which biocontrol of floating weed mats is often successful on static water bodies, but agents do not attack terrestrial infestations (Hayes et al. 2013). Failure (i.e. an inability to find or establish control organisms, or an absence of agent impact) is rarely an outcome of weed biocontrol programmes, and is often the result of funding running out before all options have been exhausted (Fowler 2000; McFadyen 2000).

Decades of pre- and post-release testing demonstrate that insect biocontrol agents rarely attack unintended plants. When non-target attacks do occur, they are almost exclusively limited to species closely related to the target weed, reflecting strong evolutionary limits on what these insects can eat (Wapshere 1974; Briese 2003; Sheppard et al. 2005). The same applies to weed biocontrol pathogens (Barton 2012; Morin 2020). Modern host-range testing protocols are highly reliable, with only four cases (c. 0.3% of all deliberate weed biocontrol releases globally) in which non-target attack occurred on plant species that had been tested and deemed not at risk (Hinz et al. 2019).

Paynter et al. (2020) reported a rare case from Rarotonga, where larvae of *Heliconius erato cyrbia* Godart, released in 2016 to control *Passiflora rubra* L., were observed feeding on *P. edulis*. Pre-release no-choice larval starvation tests using cut *P. edulis* stem tips resulted in rapid larval mortality, correctly indicating that mature *P. edulis* foliage was unsuitable. Subsequent field surveys showed that non-target attack was rare and trivial, with no evidence of major host-range expansion. Follow-up host-range tests demonstrated that heteroblasty (dramatic differences in the leaf morphology and chemistry of seedlings compared to mature plants) explained the unexpected feeding: *P. edulis* seedlings were palatable and supported larval survival comparable to *P. rubra*, whereas mature foliage remained toxic. This case highlights the importance of accounting for heteroblasty during host-range testing, as plant palatability and risk can vary with growth stage (Paynter et al. 2020).

2.9 Predicting the establishment of biocontrol agents

Reliably predicting the likelihood of the establishment and impacts of introduced arthropods and pathogens on plant populations has long been a goal of weed biological control programmes. Research has been conducted to determine the importance of both release size (Grevstad 1999; Memmott et al. 2005; Paynter et al. 2016) and climate matching (Robertson et al. 2008; Harms et al. 2021; Kriticos et al. 2021).

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Release size

The best current predictors of establishment success of new organisms are the number and size of releases. In New Zealand, weed biocontrol agent establishment rates are very high, largely due to the extensive technology transfer programme that BSI operates with regional councils, community and farmer groups, the Department of Conservation, and forestry companies (Fowler et al. 2000; Hayes et al. 2013). This approach allows numerous releases of biocontrol agents to be quickly made at many sites.

Climate matching

In principle, climate matching should not present a major constraint for classical weed biocontrol, because coevolved weeds and their natural enemies are generally adapted to similar climatic conditions. However, this assumption does not hold when a weed is introduced outside the macroclimatic envelope in which the agent–host interaction evolved (Harms et al. 2021).

Passiflora apetala provides an example where a species naturally adapted to a high-altitude equatorial environment has become invasive in a low-altitude region of a high-latitude country with (probably) greater seasonality (Dawes 1979). Another example is provided by *Passiflora tarminiana*, originating from the cool, damp climates of high-altitude South America and widely naturalised in lowland New Zealand.

Within its native Mesoamerican range, *P. apetala* is a tropical montane species occurring at elevations of approximately 1,300–2,200 m a.s.l. (Ulmer & MacDougal 2004). Following the Köppen classification (Wikipedia 2026b), these highland habitats move out of the purely tropical ‘A’ climates found at sea level and shift predominantly into Group C (Temperate/Mesothermal) climates, mainly Cwb (Subtropical Highland Climate) and Cfb (Oceanic / Subtropical Highland with Uniform Rainfall). At lower montane elevations, conditions are characterised by cool but frost-free conditions, high humidity, frequent cloud cover, weak temperature seasonality, limited day-length variation, and effectively a year-round growing season. At higher elevations, temperatures are cooler and seasonal constraints are more pronounced, resulting in increased temperature seasonality and a shorter growing season. Accordingly, *P. apetala* in its native range is adapted to cool tropical environments, ranging from relatively stable, continuously favourable conditions at lower elevations to cooler, seasonally constrained conditions at higher elevations.

The New Zealand distribution of *P. apetala* lies entirely within temperate Köppen C climates, specifically Cf (no dry season) to Cb (warm summer). All New Zealand records on iNaturalist are from Northland and Auckland, regions with mainly low-elevation landscapes (iNaturalist NZ 2026). Consequently, New Zealand populations experience cool to mild temperatures, pronounced winter seasonality, a temperature-limited growing season, substantial day-length variation, and intermittent frost, which may only be partially mitigated by microclimatic buffering. Collectively, these differences suggest that *P. apetala* persists in New Zealand at or near the limits of its climatic tolerance with respect to winter conditions and seasonality, rather than within a climatic analogue of its native tropical montane habitat.

It is expected that natural enemies associated with *P. apetala* in its native range are primarily adapted to cool but frost-free tropical conditions with limited photoperiod variation. In lower montane environments, this may permit near-continuous activity, whereas at higher elevations population activity is probably seasonally constrained by temperature rather than regulated by photoperiod-induced dormancy. In contrast, successful establishment in New Zealand would require survival through cold, inactive winters, exposure to short day lengths, and the possession of cold tolerance, diapause, or other effective overwintering mechanisms. Consequently, agents

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may struggle to establish due to winter mortality or phenological mismatch, even if they exhibit high host specificity and strong impact under laboratory conditions.

This pattern is consistent with broader evidence showing that the limited success of biocontrol against tropical plants that are weedy in temperate regions is frequently driven by climate mismatch, with low temperatures and winter seasonality constraining agents more strongly than their host plants (Harms et al. 2021). Accordingly, potential biocontrol agents for *P. apetala* that cannot reliably overwinter under temperate New Zealand conditions should be excluded early in the selection process, even if they are host-specific and perform well. Agent exploration should prioritise natural enemies originating from the coolest and most climatically seasonal parts of their native or near-native ranges. This includes not only regions outside the tropics, formally defined as areas between the Tropic of Cancer (23.5°N) and the Tropic of Capricorn (23.5°S), but also high-elevation tropical environments, where populations are potentially adapted to cooler temperatures, shorter growing seasons, and seasonal interruption of activity. Selection should favour natural enemies with a demonstrated ability to survive prolonged low temperatures and cold, wet conditions, and that possess effective overwintering strategies such as diapause, quiescence, or resilient life-stages (e.g. eggs or pupae in arthropods, resistant spores in pathogens). Species that attack persistent host tissues such as roots, woody stems, or dormant buds, and are not reliant on continuous leaf flush, or gall-formers, are likely to have greater establishment potential.

Because both *P. tetrandra* and *P. edulis* belong to different subgenera than *P. apetala*, natural enemies that specialise on a range of *Passiflora* species in the subgenus *Decaloba* may potentially be suitable for biocontrol in New Zealand. This may allow for surveying on a suite of *Passiflora* species in areas in the native range experiencing more seasonality (e.g. southern USA, Mexico, Uruguay, Chile). It is recommended that bioclimatic modelling tools be used to guide exploration for candidate biocontrol agents (Robertson et al. 2008; Kriticos et al. 2021). In addition, climatic tolerances of potential agents should be prioritised alongside other evaluations (e.g. host range testing and impact) to acquire *a priori* knowledge of an agent's potential distribution before it is introduced (Harms et al. 2021).

Harms et al. (2021) concluded that climate mismatch often produces patchy establishment, regional success/failure patterns, and false conclusions about 'agent inefficiency'. For *P. apetala*, spatially restricted success (limited to coastal or frost-buffered microclimates) should be regarded as an expected and acceptable outcome rather than evidence of biocontrol inefficacy.

Host range testing

Passiflora species exhibit heteroblasty, involving pronounced differences in leaf morphology and chemistry between seedling and adult growth stages, which alters herbivore interactions (Barlow 2011; Paynter et al. 2020; Moraes et al. 2024). For example, Barlow (2011) found that *Heliconius charithonia* females prefer to oviposit on the youngest *Passiflora biflora* leaves, while *Heliconius hecale* show no ovipositing preference based on leaf age. Heteroblasty of *P. apetala* will need to be taken into consideration during the host range testing of any candidate agents to ensure the risk of attack to different life stages of non-target *Passiflora* species is adequately quantified (Paynter et al. 2020).

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2.10 Predicting the impact of biological agents

Predicting the impact of an exotic organism in a new environment is more challenging than predicting the likelihood of its establishment (Paynter et al. 2018; Schwarzländer et al. 2018). A crucial attribute for successful biocontrol is high population build-up of the agent, because only high densities of the herbivore insect population are expected to result in a significant impact on the populations of the target weed (Myers & Sarfraz 2017; McEvoy 2018).

Based on climate matching, establishment and high population build-up are only expected in coastal and frost-buffered microclimates, and so biocontrol of *P. apetala* in New Zealand is likely to yield partial, spatially variable suppression, limited by winter climate constraints, rather than delivering consistent, landscape-scale control. Nevertheless, agents sourced from cooler and climatically seasonal parts of the native range, including high-elevation tropical populations, may exhibit enhanced tolerance to seasonal interruption and may therefore have slightly broader establishment potential than lower-elevation tropical counterparts.

In addition to climate constraints, introduced organisms are exposed to a range of biotic and ecological factors, including predation, parasitism, competition, and the capacity of the host plant to compensate for damage, all of which can influence establishment success and population growth in the novel environment. Information on the growth habit and phenology of *P. apetala* in New Zealand relative to its native range remains limited, but this is a common knowledge gap at the outset of many weed biocontrol programmes.

Paynter et al. (2010) developed a method for predicting the likelihood of parasitism of a biocontrol agent following release. They found that parasitoid species richness on weed biocontrol agents in New Zealand is positively correlated with parasitoid richness in the area of agent origin, but only agents with native ‘ecological analogues’ (i.e. a native New Zealand insect that is taxonomically related to the agent and has a similar lifestyle niche and feeds on the target weed) contributed significantly to this pattern. Such analogues can be detected during pre-release surveys of the target weed in New Zealand.

Weed biocontrol agents, particularly pathogens, may also be limited by excessive host or genotype specificity, such that close genetic matching between the agent and the weed is required for effective control. For example, multiple isolates of *Puccinia chondrillina*, *P. violaceum*, and *P. spegazzinii* have been introduced in different regions to target distinct forms/genotypes of their respective weeds (Morin 2020). For some candidate agents it is therefore important to determine which forms or genotypes of *P. apetala*, if any exist, are present in the introduced range and, where possible, to survey for agents attacking the most similar material in the native range. Molecular approaches can assist in characterising genetic diversity and identifying the geographical origin of weed populations.

Finally, stakeholder perceptions of the effectiveness of a biological control programme can be unpredictable, leading to conflicting views of success. For this reason, the objectives of any biocontrol programme targeting *P. apetala* should be clearly articulated from the outset, enabling programme outcomes to be assessed objectively against defined and realistic goals.

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3 Objectives

- Review the literature to identify potential arthropod and fungal pathogen biological control agents for *Passiflora apetala*.
- Determine the feasibility of releasing biocontrol agents in areas where *P. apetala* is naturalising – currently in the Northland and Auckland regions.
- Estimate and outline the costs of implementing a biocontrol programme for *P. apetala* in New Zealand.

4 Methods

4.1 Identifying arthropod biocontrol agents for *Passiflora apetala*

Information for this report was obtained by searching published literature, computer databases, and Internet sites. This information was cross-referenced, and we contacted several experts on Passifloraceae and *Passiflora*–herbivore interactions, including:

- John MacDougal (Professor of Biology, Emeritus, Research Associate, Science and Conservation Division, Missouri Botanical Garden; email: jmacdougal@mobot.org, decohere@charter.net)
- Lawrence 'Larry' E. Gilbert (University of Texas at Austin; email: lgilbert@austin.utexas.edu)
- Neil Rosser (University of Miami; email: neil.rosser@miami.edu)

We also used the research web page of John Smiley for information on natural enemies (Smiley 2026). John Smiley is a retired research scientist who studied the natural history of *Passiflora*-feeding flea beetle species and *Heliconius* butterfly species at La Selva Biological Station in Northeastern Costa Rica.

Potential future contacts in Central America include Andres Vega (an expert on *Passiflora* and its herbivores who is familiar with obtaining export permits) and Rodolfo Flores (professor and researcher at the University of Panama, email: rfloresj1184@gmail.com; IG: rfloresj1184).

4.2 Identifying fungal pathogens of *Passiflora apetala*

Despite a comprehensive literature search we found no fungi reported as directly associated with *P. apetala*, and instead compiled a list of all fungi associated with *Passiflora* species. The information was obtained by searching online databases and Internet sites. Online databases searched included:

- USDA Fungus-host database or FDSM: https://fungi.ars.usda.gov/
- HerbIMI (Kew Royal Botanic Gardens): www.herbimi.info/herbimi/searchassorg.htm
- Biota of New Zealand: https://biotanz.landcareresearch.co.nz/

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Once a list had been created (Appendix 3), further information about each fungus was sought in the published literature as well as in the following online databases:

- Index Fungorum: www.indexfungorum.org/Names/Names.asp
- Global Biodiversity Information Facility (GBIF): www.gbif.org/
- MycoBank: www.mycobank.org/

5 Results

5.1 Arthropod invertebrates associated with *Passiflora apetala*

Plant species in *Passiflora* have diverse ecological relationships with many types of organisms, including specialist natural enemy insects in the orders Lepidoptera (particularly in the tribe Heliconiini) and Coleoptera (subfamily Galerucinae, flea beetles). Both insect groups offer potential for biocontrol of *P. apetala.*

Heliconius butterfly species

Heliconius butterflies are a well-studied group and there is strong evidence that some species only utilise *Passiflora* species that belong to the subgenus *Decaloba* as hosts (Benson et al. 1975; Krosnick et al. 2013; de Castro et al. 2018). The *Heliconius* genus currently comprises 45 species and more than 200 subspecies, divided into seven groups: sara-sapho, erato, silvanifom, melpomene-cydno, wallacei, doris, and aoede (Kozak et al. 2015). Species in the sara-sapho and erato groups tend to prefer plants of the subgenera *Astrophea* and *Decaloba* (de Castro et al. 2018). *Heliconius* species are known to sequester cyanogenic glucosides and alkaloids from their host plants, rendering them unpalatable to predators (Nahrstedt & Davis 1981). *Heliconius* species are unique among butterflies in that they are the only genus whose adults actively feed on pollen (Cardoso & Gilbert 2013; Young & Montgomery 2020). This trait is associated with extended adult lifespans (up to 6 months in the wild) and prolonged reproductive output (Cardoso & Gilbert 2013; Young & Montgomery 2020). Consequently, the availability of suitable flowering plants is critical for *Heliconius* establishment and population growth.

Many species collect pollen predominantly from cucurbitaceous vines, with members of the melpomene species group showing a particular reliance on *Psiguria* and *Gurania*, two plant genera that exhibit evidence of coevolution with *Heliconius* (Young & Montgomery 2020). In contrast, species in the erato group predominantly exploit non-cucurbitaceous plants, such as *Lantana* species (Young & Montgomery 2020). In New Zealand the invasive *Lantana camara* overlaps extensively with the distribution of *P. apetala* (inaturalist.org). The widespread presence of lantana could therefore facilitate the establishment of *Heliconius* species from the erato group, should any be found suitable for biocontrol in New Zealand. However, establishment of erato group butterflies might increase the pollination – and therefore fruit production and dispersal – of lantana. Potential increases in fruit production in New Zealand, above that already achieved by generalist and widespread pollinators such as introduced honeybees (*Apis mellifera*), native *Leioproctus* bees, and common butterflies such as the monarch (*Danaus plexippus*) and yellow admiral (*Vanessa itea*), should be considered. Fruit-set in wild forms of lantana has been reported to range from 37% in Australia (Swarbrick et al. 1995) to 85% in Costa Rica (Hilje 1985); there are no comparative studies for New Zealand.

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In Appendix 1 we list *Heliconius* species that could be potential candidates for biocontrol of *P. apetala*. These species are all considered to be *Decaloba* specialists, with *P. apetala* reported as one of their host plants in the native range. For each *Heliconius* species and subspecies we include other *Passiflora* species recorded as hosts, along with their phylogenetic placement (following Krosnick et al. 2013) at the level of subgenus, supersection, and section, to facilitate comparison among host use patterns. Geographical distributions of *Heliconius* species/subspecies are presented as latitudinal ranges (northernmost to southernmost records), based on iNaturalist observations, providing a coarse indication of the range of climatic conditions and potential seasonal environments experienced by each species.

These latitudinal spans can be used to identify *Heliconius* species/subspecies whose distributions extend into cooler or more seasonal regions and therefore may be more likely to tolerate temperate conditions relevant to biocontrol of *P. apetala* in New Zealand. In addition, some species/subspecies may have populations occurring at higher elevations within their latitudinal ranges; such populations experience seasonally constrained activity driven by temperature rather than photoperiod and may warrant particular consideration as potential agent sources. Many species/subspecies of *Heliconius* are readily available from livestock suppliers for butterfly houses (e.g. www.heliconiusworks.com/index.htm; www.butterflyfarm.co.cr), although native range surveys/collections may be necessary to find high-elevation populations.

Heliconius clysonymus montanus (Figures 8 & 9) appears to be a promising prospect, because it is a high-elevation, cool-climate species (Rosser et al. 2012; Figure 10) and utilises *Passiflora* exclusively within the subgenus *Decaloba*.

Figure 8. Larva of *Heliconius clysonymus montanus*. (Source: © Andrey J. Peraza-Sánchez, www.inaturalist.org/observations/38331663, CC-BY-NC)

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Figure 9. *Heliconius clysonymus montanus* adult. (Source: © John D Reynolds, www.inaturalist.org/observations/337720264, CC-BY-NC)

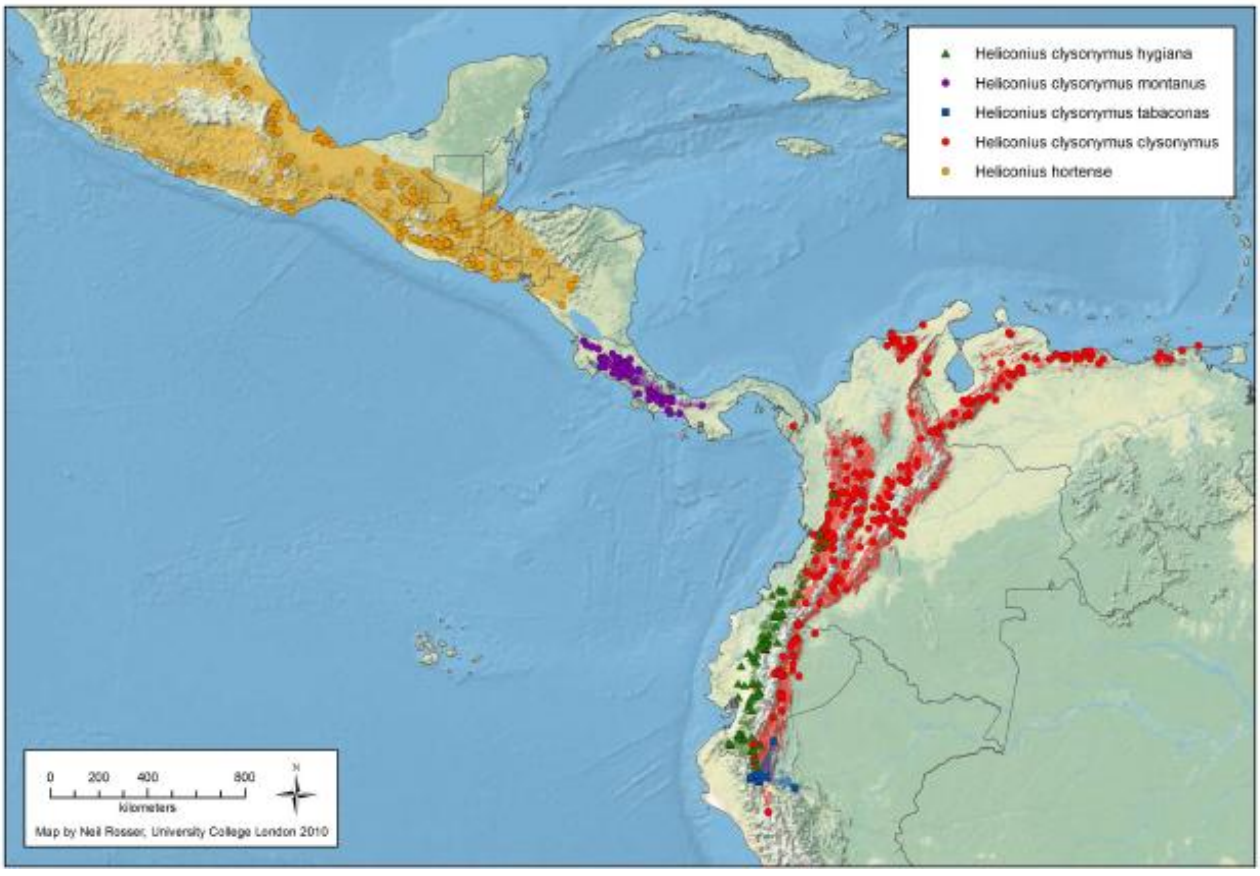

Figure 10. Map of *Heliconius clysonymus* subspecies distribution, as reported in Rosser et al. 2012. (Source: Neil Rosser, https://heliconius-maps.github.io/)

Likewise, *H. charithonia* (Figures 11 & 12) is a candidate with merit, because the larvae also specialise on *Passiflora* subgenus *Decaloba*, and the species experiences seasonal temperature variability in its native range (present through tropics and into southeastern USA, Figure 13), which may provide some level of cold tolerance and increase the probability of overwintering in northern New Zealand. Of all the *Heliconius* species it may be the most cold adapted (Neil Rosser, University of Miami, pers. comm.). *Heliconius charithonia vazquezae* has the widest latitudinal range, and subspecies *tuckeri* is centred around peninsular Florida (Figure 13). However, the northernmost records (to 52ºN) are probably individual butterflies wandering north during the USA summer rather than permanent populations, which appear to be restricted to southern Texas and peninsular Florida (Q. Paynter, BSI, pers. comm.), so New Zealand may prove to be too cool for the successful establishment of this species.

Figure 11. Larva of *Heliconius charithonia*. (Source: © Beach2022 - CJ McCartney, www.inaturalist.org/observations/321402217, CC-BY-NC)

Figure 12. *Heliconius charithonia* subsp. *tuckeri* adult. (Source: © arapp5, www.inaturalist.org/observations/261920421, CC-BY-NC)

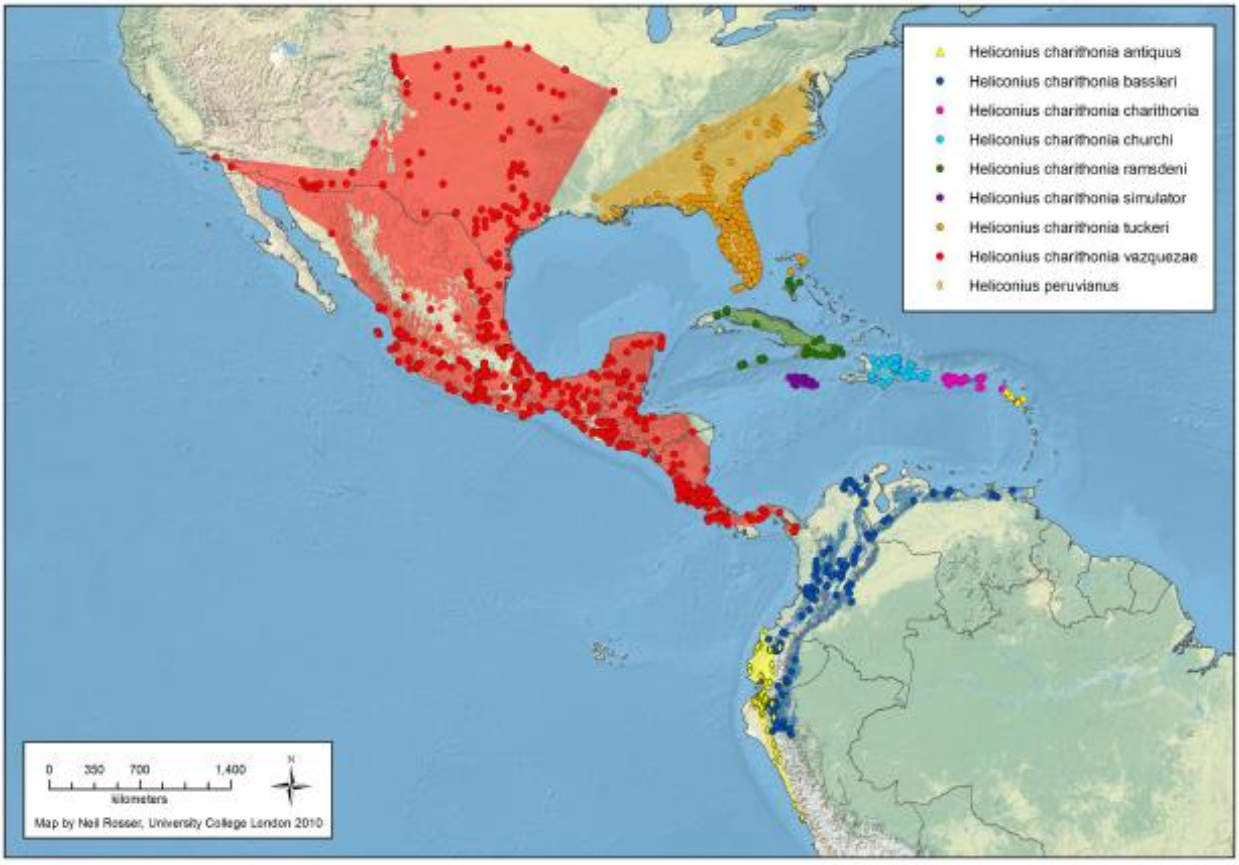

Figure 13. Map of *Heliconius charithonia* subspecies, as reported in Rosser et al. 2012. (Source: Neil Rosser, https://heliconius-maps.github.io/)

Heliconius erato cyrbia (the small red postman) has been released in the Pacific (Cook Islands) as a biocontrol agent for *Passiflora rubra* (Paynter et al. 2020). It has become well established in Rarotonga and provides partial control of *P. rubra* (L. Hayes, BSI, pers. comm.). Our literature review indicates that this species utilises several *Passiflora* hosts in subgenus *Decaloba*, including *P. punctata* (supersection Decaloba), *P. auriculata* (supersection Auriculata), and *P. suberosa* (supersection Cieca) (Jiggins et al. 1996; Checa & Torres 2019). Populations established in Rarotonga are active year-round (Q. Paynter, BSI, pers. comm.).

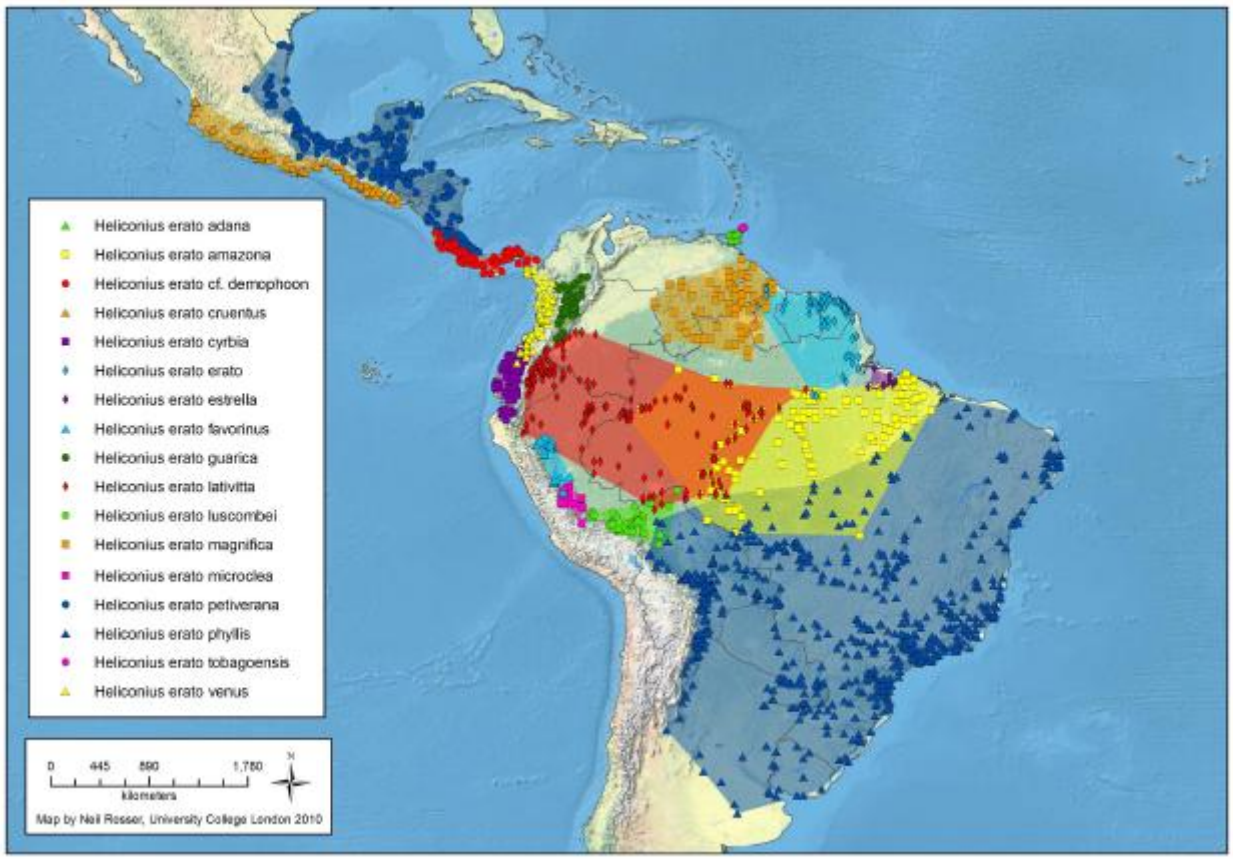

Figure 14. Map of *Heliconius erato* subspecies, as reported in Rosser et al. 2012. (Source: Neil Rosser, https://heliconius-maps.github.io/.)

However, *Heliconius erato cyrbia* is unlikely to be suitable for New Zealand because it is adapted to warm tropical climates (Figure 14).

It is notable that the mature larvae of these *Heliconius* species are toxic due to the cyanogenic glycosides they absorb by feeding on the leaves of *Passiflora* species, and they are highly spiny with prominent rows of black, thorn-like structures covering their bodies (Figures 8 & 11). These spiny hairs, in addition to their toxicity, provide an advantageous deterrent against predators such as native birds, skinks, and geckos. This toxicity primarily acts as a highly effective, non-lethal deterrent rather than a fatal poison. There is no evidence that birds are poisoned by eating the larvae, and the usual response is to taste and release them (Neil Rosser, University of Miami, pers. comm.). Nevertheless, perceptions of a negative impact on native predators caused by the spines and toxicity of the larvae may raise opposition to the use of *Heliconius* in New Zealand.

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Galerucinae (flea beetle species)

Compared to the *Heliconius* species, our literature study could not find as much life-history detail on the flea beetles associated with *Passiflora* species in the native range. Smiley (1982) concluded that the host plant preferences in the two guilds were similar, except for a tendency of the *Heliconius* species to be more host-specific.

In Appendix 2, we list flea beetle species that could be potential candidates for the biocontrol of *P. apetala* in New Zealand, even though no record could be found confirming they utilise *P. apetala* as a field host. These flea beetle species are all considered to be *Decaloba* specialists, which makes them potentially suitable as prospective biocontrol agents. As for Appendix 1 (*Heliconius* species/subspecies), we include all the *Passiflora* species recorded as hosts, as well as their phylogenetic placement and geographical distribution based on iNaturalist observations.

Both *Disonycha quinquelineata* (Figure 15) and *D. stenosticha* (Figure. 16) appear to be promising candidates, because they would probably be relatively straightforward to source given their occurrence in the southern USA. In addition, these species experience seasonal temperature variability in their native range, which may confer a degree of cold tolerance and increase their likelihood of surviving winter conditions in New Zealand.

Figure 15. Larva of *Disonycha quinquelineata*. (Source: © shanix999, www.inaturalist.org/observations/157156769, CC-BY-NC)

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Figure 16. *Disonycha stenosticha* adult. (Source: © Mike Quinn, San Marcos, www.inaturalist.org/observations/36680127, CC-BY-NC)

Monomacra chontalensis (Figure 17) may also warrant consideration, particularly if it is primarily a high-elevation species, because this could indicate pre-adaptation to cooler climatic conditions and enhance its potential to persist through New Zealand winters. Notably, the larval stage of *M. chontalensis* has been reported to feed on roots, a trait that may further contribute to winter survival by buffering larvae from above-ground temperature extremes. Root feeding may also increase overall impact, as damage to below-ground tissues can directly reduce plant vigour and persistence. Root-feeding flea beetles have proven to be highly effective and host-specific biocontrol agents in other systems; for example, the ragwort flea beetle (*Longitarsus jacobaeae*) and the leafy spurge flea beetles (*Aphthona lacertosa* and *A. nigriscutis*), species that have contributed substantially to the suppression of their target weeds (McEvoy et al. 1991; Kalischuk et al. 2004; Joshi & Olson 2009; Fowler et al. 2016).

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Figure 17. *Monomacra chontalensis* adult. (Source: © Carroll Perkins, www.inaturalist.org/observations/263802852, CC-BY-NC)

5.2 Fungal pathogens associated with *Passiflora apetala*

No pathogen species have been reported from *Passiflora apetala* in the literature. This is possibly due to the restricted geographical range of this species and the limited literature on the species in general. Consequently, pathogens recorded from other *Passiflora* species were considered as potential candidates for biological control.

A large diversity of pathogens associated with the genus *Passiflora* were identified (Appendix 3), comprising 184 fungal species as well as several oomycetes and other microorganisms. The majority of these pathogens belong to the Ascomycota, with prominent representation from orders such as Glomerellales, Hypocreales, Mycosphaerellales, and Pleosporales. Most recorded pathogens are associated with leaf and fruit diseases, including leaf spot, anthracnose, scab, and fruit rot.

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Most pathogen records are from *P. edulis*, which is widely cultivated for its edible fruit and has been extensively studied. While numerous pathogens are associated with *P. edulis*, many of these species are broad-host-range pathogens and are therefore not considered for biological control due to their lack of host specificity.

Examples of such broadly distributed Ascomycota include all recorded species in the genus *Aspergillus*, many species of *Cladosporium* and *Diaporthe*, as well as taxa within the family Necteriaceae (*Fusarium*, *Gibberella*, and *Neocosmospora*) and the Glomerellaceae. Some exceptions within these groups may exhibit a degree of host specificity to *Passiflora*, including *Cladosporium kenpeggii*, *C. passiflorae*, *C. passifloricola*, *Diaporthe fructicola*, *D. leucospermi*, *D. tersa*, *Fusarium oxysporum* f. sp. *passiflorae*, *Gibberella passiflorae*, and species within the Glomerellaceae such as *Colletotrichum brasiliense*, *C. colombiense*, *C. passiflorae*, and *Vermicularia fallax*. All of these have been reported from *P. edulis*, which is commercially important in New Zealand and is also relatively distantly related to *P. apetala* within the genus.

Similarly, several *Basidiomycota* recorded from *Passiflora* are generalists, mycorrhizae or saprotrophs associated with plant debris. These include species in the Agaricales (e.g. *Coprinopsis phlyctidospora*, *Armillaria mellea*, *Agroathelia rolfsii*, *A. coffeicola*), the Auriculariales (*Auricularia nigricans*), and *Rhizoctonia solani* (Cantharellales). These taxa are not considered promising candidates for biological control due to their broad host ranges or ecological roles.

Twelve oomycete pathogens from the genera *Pythium* and *Globisporangium* have also been isolated from *Passiflora*. However, all are reported to have wide host ranges, including many economically important crops, and are therefore not suitable for biological control.

Greater potential lies with pathogens recorded from *Passiflora* species that are phylogenetically closer to *P. apetala*. In particular, species within section *Decaloba*, including *Passiflora bogotensis* (syn. *P. alnifolia*), *P. sexflora*, *P. suberosa*, *P. tricuspis*, and *P. tuberosa* (Krosnick et al. 2013; Cauz-Santos et al. 2025), are more relevant due to their closer evolutionary relationship. Pathogens associated with these species are more likely to exhibit narrower host ranges within the genus, although this would require experimental validation.

Geographical origin provides an additional important filter. *Passiflora apetala* is native to Costa Rica, Honduras, south-eastern Mexico, and Panamá (POWO 2026). Pathogens recorded from *Passiflora* species in these regions, as well as adjacent regions in Central America and northern South America, are more likely to have co-evolved with their hosts and may therefore be better adapted to species within section *Decaloba*. The data set includes several such pathogenic taxa, particularly within the genera *Asterina*, *Cercospora*/*Pseudocercospora*, and *Phyllosticta*, and among rust fungi.

Several species of *Asterina* (Asterinaceae) have been reported from Central and northern South America on *Passiflora* species in section *Decaloba*, including *A. arnaudii*, *A. megalospora*, and *A. tacsoniae* var. *passiflorae*. Species of *Asterina* are obligate plant parasites and are often highly host-specific (Hofmann & Piepenbring 2008). However, they mostly grow superficially on living leaves, forming only limited intracellular structures (Hofmann & Piepenbring 2008). As a result, their impact on host health and vigour is generally low, making them unsuitable as biological control agents.

Fungi of the genus *Pseudocercospora* (Mycosphaerellaceae) are considered mostly host specific, and the genus includes important crop pathogens, including fruit and leaf spot diseases on citrus and brown needle blight of pine, which are subject to strict quarantine regulations in some regions (Crous et al. 2013). *Pseudocercospora passiflorae*, recorded in Puerto Rico, the Virgin Islands, and

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the USA on *Passiflora sexflora* and another *Passiflora* sp., may therefore warrant further investigation. *Passalora biformis* (basionym = *Cercospora biformis* Peck), recorded in the USA, Puerto Rico, the Dominican Republic, and the Virgin Islands on *Passiflora bilobata*, *P. incarnata*, *P. rubra*, and *P. sexflora*, could also be investigated.

Species of *Phyllosticta* (Phyllostictaceae) are also predominantly plant pathogens and are responsible for numerous diseases, including the quarantine-significant citrus black spot caused by *Ph. citricarpa* (Wikee et al. 2013). While endophytic and saprobic members of the genus often have broad host ranges, pathogenic species tend to be more host-specific, and host association remains a useful taxonomic indicator, even following molecular revision (Wikee et al. 2013). Three species have been reported from *Passiflora*: *Ph. passiflorae*, *Ph. passifloramaculans*, and *Ph. superficialis*, all of which cause leaf spot symptoms. Although *Ph. passiflorae* and *Ph. superficialis* have been recorded from species within section *Decaloba* (*Passiflora tuberosa* and *P. sexflora*, respectively), all three species have also been reported from *Passiflora edulis* and are therefore unsuitable for biological control in New Zealand.

Septoria passiflorae is the only fungus that has previously been released as a biological control agent against *Passiflora* (Winston et al. 2014). It was released in Hawaii in 1996 to control *P. tripartita* var. *tripartita* and has been reported to be highly successful in many regions (Trujillo et al. 2001). Experimental studies indicated that it is host-specific and does not infect *P. edulis* or *P. edulis* f. *flavicarpa* (Trujillo et al. 1994). However, several reports in the literature list these species as hosts (e.g. Nattrass 1961; Huguenin 1966; Simmonds 1966; Whiteside 1966; Urtiaga 1986; Pennycook et al. 1989; Mendes et al. 2011). This discrepancy may reflect differences between strains, and the species should therefore remain under consideration as a potential candidate.

Rust fungi are obligate biotrophic plant pathogens, often with very narrow host ranges, and represent one of the most successful groups used in classical biological control (Morin 2020). Four rust species have been reported from *Passiflora*, but none appear particularly promising. *Puccinia scleriae* requires an alternate host (*Scleria*, a sedge genus) to complete its life cycle and can therefore be excluded. The same applies to *Puccinia scleriicola*. *Aecidium passiflorae*, reported from a *Passiflora* sp. in Tanzania, lacks sufficient information on its life cycle and host specificity. *Uredo passiflorae*, recorded from Papua New Guinea also from an unspecified *Passiflora*, is similarly poorly known. Both species have been reported far outside the native range of *P. apetala*, further reducing their relevance as potential biological control agents.

Powdery mildews (*Erysiphaceae*) are likewise obligate biotrophs and therefore often exhibit narrow host ranges and can be highly damaging (De Clerck-Floate 1999). Although no biocontrol agent in this group has yet been released, they were considered as potential agents in the past (Hasan 1971; De Clerck-Floate 1999). Five species in this family have been isolated from *Passiflora.* Two of the species (*Erysiphe polygoni* and *Phyllactinia taurica*) have been reported from a range of other hosts, and one (*E. aquilegiae*) is already present in New Zealand. *Ovulariopsis passiflorae* has been isolated from *P. suberosa* in the section *Decaloba*, but it has also been recorded on *P. quadrangularis*, in the same subgenus (*Passiflora*) as *P. edulis.*

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6 Conclusions

Classical (non-biocontrol) methods of control, including spraying and physical removal, will continue to have a place (especially for new or localised infestations) because:

- plants of *Passiflora apetala* are easily identified at the seedling and adult stages
- successful establishment of biocontrol agents takes time and is never guaranteed.

However, the window of opportunity for widespread and effective control using traditional methods has probably closed because the establishment of bat-wing passionflower has entered an exponential population growth phase. Aside from resource constraints, access to private land, along with community 'buy-in', would be essential for effective use of traditional control methods.

Because New Zealand is the only country where *P. apetala* has naturalised, there is a lack of relevant biocontrol research and its practical application for this species. Nevertheless, biocontrol of *P. apetala* is a viable control option, with some potential insect and fungal agents identified in this feasibility study. Provided these potential biocontrol agents are proven to be sufficiently host specific, there should be little, if any, opposition because the target species has no economic values.

Of the invertebrates considered as biocontrol candidates, *Heliconius* butterflies emerged as candidates because they are well studied, with good evidence that some species only utilise as hosts *Passiflora* plants belonging to subgenus *Decaloba*, of which *P. apetala* is a member. Of these, *Heliconius charithonia* and *H. clysonymus montanus* have potential as biocontrol agents, because they possess some cold tolerance, favouring establishment in New Zealand. However, public and stakeholder consultation would need to demonstrate support for introducing species that (as adults) can pollinate the invasive weed *Lantana camara* and (as larvae) are toxic through sequestration of cyanogenic glycosides from feeding on the leaves of *Passiflora*. For this reason, the flea beetles *Disonycha quinquelineata*, *D. stenosticha*, and *Monomacra chontalensis*, may have better potential. All three flea beetles are considered to be *Decaloba* specialists, although no record was found verifying that they utilise *P. apetala* as a field host. Other invertebrates not reported in the literature may offer potential as biocontrol agents, so native range surveys should also focus on exploration for natural enemies not considered in this study.

No fungal pathogens have been reported from *Passiflora apetala*, likely reflecting the limited research conducted on either the species or its region of origin. In contrast, a total of 184 pathogen species has been recorded from the genus *Passiflora*. While many of these are generalists or are primarily associated with the widely cultivated *P. edulis*, a subset of taxa may be considered for their potential as biocontrol agents. In particular, *Pseudocercospora passiflorae* and *Passalora biformis*, which infect closely related *Passiflora* species in the Caribbean, may have the potential to cause significant damage and therefore may warrant further investigation. In addition, *Septoria passiflorae* has been successfully deployed as a biological control agent against *Passiflora tripartita* var. *tripartita*, suggesting that suitably host-specific strains within this group may exist and could be effective against *P. apetala*.

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7 Recommendations

The absence of pathogens recorded on *Passiflora apetala* highlights a critical knowledge gap. Targeted surveys in the species' centre of origin will be essential to identify pathogens, and any other natural enemies, with the appropriate levels of host specificity and impact for use as biological control agents.

Host specificity testing, at least to the taxonomic level of *Passiflora* subg. *Decaloba*, is important for avoiding spillover damage to the New Zealand endemic *P. tetrandra* (subg. *Tetrapathea*) and commercial edible black passionfruit, *P. edulis* (subg. *Passiflora*).

We recommend the following actions for a biocontrol programme targeting *Passiflora apetala* (all cost estimates are in New Zealand dollars).

- Survey *P. apetala* in New Zealand to obtain baseline information (e.g. health, occurrance). Estimated cost: $50,000–$90,000.
- Undertake survey(s) of *P. apetala* within its native range to identify potential biocontrol agents (both arthropods and pathogens). Estimated cost: $50,000–$300,000.
- Identify and study the life-cycles of prospective agents found during surveys, including the two butterflies, three flea beetles, and two fungal pathogens identified as potential agents in this study, and develop rearing methods. Estimated cost: $50,000–$200,000 per agent.
- Host-test potential agents and abandon any species that do not appear to be safe or effective enough. Estimated cost: $50,000–$200,000 per agent.
- Apply to the Environmental Protection Authority for permission to release. Estimated cost: $60,000–$85,000 per application.
- Arrange for shipment of agent(s) if not already in containment. Estimated cost: $10,000–$60,000 per agent.
- Develop mass rearing techniques and make releases of agent(s); or, if agents can't be reared, direct release them and/or set up site for future collection. Estimated cost: $100,000–250,000 per agent.
- Monitor the establishment success and spread of biocontrol agent(s). If establishment is unsuccessful, try again. Estimated cost: $15,000–$50,000 and council staff time.
- Harvest and redistribute agent(s). Estimated cost: council staff time.
- Evaluate the biocontrol programme success and decide if further agents are needed. Estimated cost: $100,000–$500,000.

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Appendix 1 – *Heliconius* species recorded utilising *Passiflora* species in the subgenus *Decaloba* in their native range, with potential as biocontrol agents for *P. apetala* in New Zealand

***Heliconius* species / subspecies**	***Heliconius* group (Kozak et al. 2015)**	**Ecological notes on *Heliconius* species**	**Range span of iNaturalist records (latitudes)**	***Passiflora* host species**	**Infrageneric ranks**			**Reference**
					Subgenus	**Supersection**	**Section**	
H. charithonia (zebra longwing)	sara/sapho	Beyond tropics, also present in southern USA. Official butterfly of Florida (1996). *H. charithonia* would probably be more damaging because the larvae are gregarious.	35ºN–6ºS Permanent populations have a narrower northern range (peninsular Florida and S. Texas).	*P. lobata*	*Decaloba*	*Bryonioides*		John Smiley
				P. biflora	*Decaloba*	*Decaloba*	*Decaloba*	de Castro et al. 2018
				P. apetala	*Decaloba*	*Decaloba*	*Decaloba*	Neil Rosser
				P. apetala	*Decaloba*	*Decaloba*	*Decaloba*	Larry Gilbert
H. charithonia tuckeri		Southeastern US, Bahamas		*P. lutea*	*Decaloba*	*Decaloba*	*Decaloba*	Wikipedia 2026a
H. erato (small postman, crimson-patched longwing)	erato	Beyond tropics, present in southern Texas.	26ºN–35ºS	*P. biflora*	*Decaloba*	*Decaloba*	*Decaloba*	John Smiley
				P. apetala (possibly)	*Decaloba*	*Decaloba*	*Decaloba*	John MacDougal
				Prefers plants in subgenus *Decaloba* (de Castro et al. 2018)				de Castro et al. 2018
				H. erato reported on *P. edulis* and several other hosts in subgenus *Passiflora* (*P. alata,*	*Passiflora* & *Astrophea*	various	various	Natural History Museum 2026

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				P. caerulea, P. laurifolia, P. miersii, P. mucronata, P. pohlii, P. porophylla (syn. P. organensis), P. reticulata, P. ×violacea) and one in subgenus *Astrophea (P. rhamnifolia)*				
H. erato petiverana	erato	Tropical – any high-elevation populations?	26ºN–7ºN	*P. apetala*	*Decaloba*	*Decaloba*	*Decaloba*	Estrada & Rodriquez 2009
H. erato cyrbia	erato	Tropical only – any high-elevation populations? Released in Pacific as biocontrol agent for *P. rubra.* Occurs at 1–1,500 m elevational range, in forest vegetation typical of secondary wet forest (Paynter et al. 2020). Population of *H. erato cyrbia* also reported from west Ecuadorian dry forest habitat, occurs at 10–300 m, dry season may last 5 months (Checa & Torres 2019).	1ºN–5ºS (native range) (c. 21.2°S) (introduced range – Rarotonga)	*P. rubra* *P. punctata*	*Decaloba*	*Decaloba*	*Xerogona*	Jiggins et al. 1996; Paynter et al. 2020
				P. punctata	*Decaloba*	*Decaloba*	*Decaloba*	
				P. auriculata	*Decaloba*	*Auriculata*		
				P. suberosa	*Decaloba*	*Cieca*		Checa & Torres 2019
				Not specifically recorded on *P. apetala*				

H. clysonymus	erato	Tropical only – any high-elevation populations?	11ºN–5ºS	*P. apetala*	*Decaloba*	*Decaloba*	*Decaloba*	Neil Rosser
				P. apetala	*Decaloba*	*Decaloba*	*Decaloba*	Larry Gilbert
				P. apetala	*Decaloba*	*Decaloba*	*Decaloba*	John MacDougal
				P. apetala	*Decaloba*	*Decaloba*	*Decaloba*	Natural History Museum 2026
				H. clysonymus only reported on species in subgenus *Decaloba* on HOSTS database (including: *P. cuneata*, *biflora*, *filipes*, *standleyi*)	*Decaloba*			Natural History Museum 2026
H. clysonymus montanus	erato	Tropical only – as the name 'montanus' suggests, it is a high-elevation subspecies.	11ºN–8ºN	*P. apetala*	*Decaloba*	*Decaloba*	*Decaloba*	Estrada & Rodriquez 2009

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Appendix 2 – Flea beetle species recorded utilising *Passiflora* species in the subgenus *Decaloba* in their native range, with potential as biocontrol agents for *P. apetala* in New Zealand

Flea beetle species	Ecological notes on flea beetle species	Range span of iNaturalist records	*Passiflora* host species	Infrageneric ranks			Reference
				Subgenus	Supersection	Section	
Monomacra chontalensis	Uncommon, usually in shady environments. Specimens in D. Furth collection, US National Museum, revealed greater abundance at higher elevations. La Selva (Costa Rica) population may be stragglers drifting down from nearby mountains where alternative host may be available (*P. lancearia*). Larvae possibly root feeding (similar to *Monomacra violacea*).	no records	*P. lobata*	*Decaloba*	*Bryonioides*		John Smiley
			P. biflora	*Decaloba*	*Decaloba*	*Decaloba*	John Smiley
			P. arbelaezii	*Deidamioides*			John Smiley
			P. costaricensis	*Decaloba*	*Decaloba*	*Xerogona*	John Smiley
			P. lancearia	*Decaloba*	*Decaloba*	*Decaloba*	John Smiley
Ptocadica sp. (*stramnea*?)	Commonly found on *P. lobata*. Eggs found on leaves, larvae leaf feeding.	no records	*P. lobata*	*Decaloba*	*Bryonioides*		John Smiley
			P. auriculata	*Decaloba*	*Auriculata*		John Smiley

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Ptocadica bifasciata	Primarily found on *P. auriculata*. Eggs possibly laid on leaves. Larvae leaf feeding. Only one record on iNaturalist.	One record in Panama	*P. biflora*	*Decaloba*	*Decaloba*		John Smiley
			P. lobata	*Decaloba*	*Bryonioides*		John Smiley
			P. auriculata	*Decaloba*	*Auriculata*		John Smiley
Disonycha quinquelineata (Florida five-lined yellow *Disonycha*)	Distributed from the Mexican states of Guerrero, Veracruz, and Yucatán to northwestern Colombia (Morrison & Armstrong 2024).	21ºN–2ºN	*P. auriculata*	*Decaloba*	*Auriculata*		John Smiley and Morrison & Armstrong 2024
	Eggs are laid on underside of leaves, with larvae feeding on leaves. Described as rare in Costa Rica. Both adults and larvae found on *P. biflora.*		*P. biflora*	*Decaloba*	*Decaloba*	*Decaloba*	John Smiley and Morrison & Armstrong 2024
			P. talamancensis	*Decaloba*	*Decaloba*		Morrison & Armstrong 2024
				Decaloba			Thomas 1987
	Reported in Florida for first time in 2015.		*P. suberosa* (corkystem passionflower)	*Decaloba*	*Cieca*		Skelley 2015; Skelley et al. 2025
			P. coriacea	*Decaloba*	*Cieca*		Thomas 1987
Disonycha stenosticha (Texas	Distributed from Rio Grande Valley of south Texas to states of Tamaulipas	28ºN–19ºN	*P. suberosa*	*Decaloba*	*Cieca*		Morrison & Armstrong

thin-lined yellow *Disonycha*)	and Veracruz along Gulf Coast of Mexico. Reported as minor pest on *P. suberosa* (corkystem passionflower) in southern Texas.						2024; Skelley et al. 2025
			P. biflora	*Decaloba*	*Decaloba*		Morrison & Armstrong 2024
			P. filipes	*Decaloba*	*Decaloba*		Morrison & Armstrong 2024

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Appendix 3 – Record of fungal pathogens associated with *Passiflora*

Phylum/order/ family	Species	Symptoms or lifestyle	Geographical range on *Passiflora*	Likely to be sufficiently host specific?	Present in NZ? Likely to be highly damaging?
ASCOMYCOTA					
Amphisphaeriales					
Apiosporaceae	*Nigrospora sphaerica* (Sacc.) E.W. Mason	Leaf blight	China (Wang, Cernava et al. 2022).	No; pathogen of many hosts including blueberry (Wright et al. 2008).	Present in NZ.
Capnodiales					
Capnodiaceae	*Capnodium* Mont.	Sooty mould	Venezuela (Urtiaga 1986).	Not specific.	Yes, species of *Capnodium* present in NZ.
Cladosporiales					
Cladosporiaceae	*Cladosporium herbarum* (Pers.) Link (heterotypic synonym = *Mycosphaerella tassiana* (De Not.) Johanson)	Scab and lesions	Colombia (Riascos et al. 2012), Brazil (Santos-Jiménez et al. 2022), South Africa (Crous et al. 2000).	*P. edulis* (Riascos et al. 2012). No, also infects tea, barley, rice and pepper (Kwon et al. 2001), oats, tomato, pea, soybean and other plants (Zhang et al. 2024).	Present in NZ.
	Cladosporium kenpeggii Bensch	Not specified	Australia (Marin-Felix et al. 2017).	*P. edulis* (Marin-Felix et al. 2017).	Absent from NZ.

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Cladosporium maracuja Viégas	Scab	Brazil (Marin-Felix et al. 2017).	*Passiflora* sp. (Marin-Felix et al. 2017).	Absent from NZ.
Cladosporium oxysporum Berk. & M.A. Curtis	Seedling blight (Liberato & Zerbini 2003)	Cuba (Mckemy & Morgan-Jones 1991).	No; also infecting *Alnus*, *Bambusa*, *Citrus*, *Helianthus* and *Pseudotsuga* (Mckemy & Morgan-Jones 1991) and species of *Ananas*, *Chenopodium*, *Cenchrus*, *Paspalum*, *Zea*, *Adenanthera*, *Cassia* and many more (Urtiaga 1986).	Present in NZ.
Cladosporium passiflorae A.W.C. Rosado & O.L. Pereira	Leaf spot	Brazil (Rosado et al. 2019).	*P. edulis* (Rosado et al. 2019).	Absent from NZ.
Cladosporium passifloricola A.W.C. Rosado & O.L. Pereira	Scab	Brazil (Rosado et al. 2019).	*P. edulis* (Rosado et al. 2019).	Absent from NZ.
Cladosporium pseudocladosporioides Bensch	Leaf spot, fruit rot	Brazil (Rosado et al. 2019).	No; reported on *P. edulis,* also on *Actinidia deliciosa* (Rosado et al. 2019), raspberry (Delisle-Houde et al. 2024), pecan tree, sunflowers, papaya (Walker et al. 2016).	Present in NZ.
Cladosporium subuliforme Bensch	Scab, leaf spot	Brazil (Rosado et al. 2019).	No; also infects *Capsicum annuum* (Ramos et al. 2016), tomato (Palemón-Alberto et al. 2025),	Absent from NZ.

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				P. edulis (Rosado et al. 2019).	
	Cladosporium tenuissimum Cooke	Blossom blight, postharvest rot, postharvest sooty spot	Brazil (Rosado et al. 2019).	No; reported causing fruit diseases on papaya (Rosado et al. 2019), fig, peach, melon and dekopon citrus (Nakano 2026) and blossom blight on strawberry (Santos et al. 2020).	Present in NZ.
Diaporthales					
Diaporthaceae	*Diaporthe eres* Nitschke	Not specified	NZ (Gadgil & Dick 2005).	No; associated with a wide range of plant families (Udayanga et al. 2014).	Present in NZ.
	Diaporthe fructicola Minosh., T. Ono & Hirooka	Fruit rot	Japan (Minoshima et al. 2020).	*P. edulis*, no other hosts reported (Crous et al. 2019).	Absent from NZ.
	Diaporthe leucospermi Crous & Summerell (synonym = *Diaporthe infecunda* R.R. Gomes, Glienke & Crous)	Phomopsis rot	Brazil (Moreira et al. 2020).	Reported in *P. edulis* as pathogen, endophytic in other plants (Moreira et al. 2020). Recently reported as pathogen in blueberry (Hilário et al. 2021).	Present in NZ.
	Diaporthe passiflorae Crous & L. Lombard (anamorph = *Phomopsis passiflorae* J.F. Lue & P.K. Chi according to Andrés Ares 2020)	Phomopsis rot	Brazil (Crous et al. 2012), Portugal (Andrés Ares 2020), China (Zhuang 2001).	No; reported on *P. edulis* but also reported to cause postharvest rot in kiwifruit (Li et al. 2019).	Present in NZ.

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	Diaporthe ueckeri Udayanga & Castl. (synonym = *Diaporthe passifloricola* Crous & M.J. Wingf.)	Root rot, stem canker, dieback, brown spot	Malaysia (Crous, Wingfield, Richardson et al. 2016).	*P. foetida* (Crous, Wingfield, Richardson et al. 2016) but also reported as pathogenic on citrus, peanut, soybean, mango and cassava (Silva et al. 2024).	Absent from NZ.
	Diaporthe tersa (Sacc.) Udayanga & Castl. (basionym = *Phomopsis tersa* (Sacc.) B. Sutton)	Phomopsis fruit rot	Mauritius, India, Malaysia, Sri Lanka, Australia, Fiji, Malta, Portugal, Grenada, Brazil (CAB International (UK) 1995), China (Zhuang 2001).	*Passiflora* sp., *P. edulis* (CAB International (UK) 1995), *P. ligularis* (Moreira et al. 2020), *P. edulis* f. *flavicarpa* (Fischer & Rezende 2008).	Absent from NZ.
Eurotiales					
Aspergillaceae	*Aspergillus aculeatus* Iizuka	Causing post-harvest rot (Yang et al. 2026); also plant growth promoting in ryegrass (Li et al. 2021)	Brunei (Peregrine & Kassim bin Ahmad 1982).	No; causes post-harvest rot in kiwi, citrus, peach and grape (Yang et al. 2026); found on *Trichilia*, *Zea mays*, grass roots (Schutte 1994).	Absent from NZ.
	Aspergillus flavus Link	Saprophytic soil fungus that infects seed crops, and an opportunistic animal and human pathogen causing aspergillosis diseases (Amaike & Keller 2011)	Brazil (Mendes et al. 2011).	No; infects a range of crops; also human pathogen (Amaike & Keller 2011).	Present in NZ.

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	Aspergillus niger Tiegh.	Post-harvest soft rot (Huang et al. 2026)	Brazil (Mendes et al. 2011), Brunei (Peregrine & Kassim bin Ahmad 1982).	No; causes soft rot in range of fruits and vegetables including grapes, onions and peanuts (Huang et al. 2026).	Present in NZ.
	Aspergillus oryzae (Ahlb.) Cohn	Mould	New Caledonia (Huguenin 1966).	No; grows on many foods; e.g., rice, soybeans (Barbesgaard et al. 1992).	Present in NZ.
	Aspergillus restrictus G. Sm.	Mould	New Caledonia (Huguenin 1966).	No; grows on dry, cellulose-containing materials (Hurraß et al. 2024).	Present in NZ.
Asterinales					
Asterinaceae	*Asterina arnaudii* R.W. Ryan	*Asterina* are obligate plant parasites growing superficially on living leaves of plant species, characterised by a surface mycelium with lateral appressoria forming intracellular haustoria (Hofmann & Piepenbring 2008)	Virgin Islands (USA), Puerto Rico (Stevenson 1975).	Possibly host-specific as biotrophic genus *Asterina* thought to be host-specific (Hofmann & Piepenbring 2008). Reported on *Passiflora* sp., *P. multiflora* and *P. sexflora* (Stevenson 1975).	Absent from NZ; likely to cause only minor damage.

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Asterina confertissima Syd. & P. Syd.	Leaf parasite	Costa Rica (Farr 1973).	Reported on *Passiflora* sp. (Farr 1973) and *Arthrostemma campanularis* (Mendes et al. 2011).	Absent from NZ; likely to cause only minor damage.
Asterina cubensis Sacc. & P. Syd.	Leaf parasite	Trinidad and Tobago (Baker & Dale 1951), Cuba (Urtiaga 1986).	*P. rubra* (Baker & Dale 1951) and *P. suberosa* (Urtiaga 1986).	Absent from NZ; likely to cause only minor damage.
Asterina megalospora Berk. & M.A. Curtis	Leaf parasite	Cuba, Brazil (Theissen 1913), Colombia, Venezuela (Chardón & Toro 1934), Dominican Republic (Ciferri 1961), Virgin Islands, Puerto Rico (Stevenson 1975).	*Passiflora* sp. (Theissen 1913), *P. mollissima*, *P. pallida* (Chardón & Toro 1934), *P. rubra* (Ciferri 1961), *P. sexflora*, *P. suberosa* (Stevenson 1975).	Absent from NZ; likely to cause only minor damage.
Asterina mulleri J.A. Stev.	Leaf parasite	Brazil (Stevenson 1943).	*P. speciosa* (Stevenson 1943).	Absent from NZ; likely to cause only minor damage.
Asterina passiflorae (Henn.) Sacc.	Leaf parasite	Venezuela (Chardón & Toro 1934).	*P. rubra* (Chardón & Toro 1934).	Absent from NZ; likely to cause only minor damage.
Asterina passifloricola R.W. Ryan	Leaf parasite	Puerto Rico (Ryan 1924).	*P. rubra* (Ryan 1924).	Absent from NZ; likely to cause only minor damage.
Asterina platasca Berk. & M.A. Curtis	Leaf parasite	Dominican Republic (Ciferri 1961), Cuba (Hosagoudar & Abraham 2000).	*P. multiflora*, *P.* sp. (Ciferri 1961).	Absent from NZ; likely to cause only minor damage.

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	Asterina tacsoniae Pat.	Leaf parasite	Ecuador (Dennis 1970) and Ecuador (on *Tacsonia*) (Theissen 1913).	On *P. mixta* (Dennis 1970) and *Tacsonia* (Passifloraceae) (Theissen 1913).	Absent from NZ; likely to cause only minor damage.
	Asterina tacsoniae var. *passiflorae* R.W. Ryan	Leaf parasite	Porto Rico (Ryan 1924).	*Passiflora* sp., *P. sexflora* (Ryan 1924).	Absent from NZ; likely to cause only minor damage.
	Asterostomella gregariella Petr. & Cif.	Leaf parasite	Dominican Republic (Ciferri 1961).	*Passiflora* sp. (Ciferri 1961).	Absent from NZ; likely to cause only minor damage.
Botryosphaeriales					
Botryosphaeriaceae	*Diplodias* sp.	Not specified	Cuba (Urtiaga 1986).	*P. suberosa* (Urtiaga 1986).	Unknown damage; absent from NZ.
	Lasiodiplodia theobromae (Pat.) Griffon & Maubl. (synonym = *Botryodiplodia theobromae* Pat)	Lasiodiplodia fruit rot	Taiwan, China, USA (Weber et al. 2025), Ghana (Honger et al. 2026), Fiji, Niue, Samoa (Dingley et al. 1981), Brazil (Mendes et al. 2011), Australia (Burgess et al. 2019), Venezuela (Urtiaga 1986), Ghana (Dade 1940), Tanzania (Ebbels & Allen 1979), Brunei (Peregrine & Kassim bin Ahmad 1982).	No; also reported to infect a range of species including avocado, pawpaw, mango, pine and peanuts (Salvatore et al. 2020; Honger et al. 2026), about 500 plant hosts; also a human pathogen (Punithalingam 1976).	Presence in NZ uncertain.
	Macrophomina phaseolina (Tassi) Goid	Not specified	Venezuela (Urtiaga 1986).	No; generalist, affecting more than 500 plant species (Marquez et al. 2021).	Present in NZ.

	Sphaeropsis punicae Shreem. & Bilgrami	Leaf spot	India (Jamaluddin et al. 2004).	On *Passiflora* sp. (Jamaluddin et al. 2004); also on *Punica granatum* (Sarbhoy et al. 1980) and *Ruscus aculeatus* (Mathur 1979).	Absent from NZ.
Phyllostictaceae	*Phyllosticta passiflorae* McAlpine	Large, irregular leaf spots	Dominican Republic (Ciferri 1961), Australia (Stevenson 1926).	*P. tuberosa* (Ciferri 1961), *P. edulis* (Stevenson 1926).	Absent from NZ.
	Phyllosticta passifloramaculans Bat.	On living leaves	Brazil (Mendes et al. 2011).	*P. edulis* (Mendes et al. 2011).	Absent from NZ.
	Phyllosticta superficialis F. Stevens	Irregular, brown leaf spots	Brazil (Mendes et al. 2011), Puerto Rico, Virgin Islands (Stevenson 1975).	*P. edulis* (Mendes et al. 2011), *P. sexflora* (Stevenson 1926).	Absent from NZ.
Glomerellales					
Glomerellaceae	*Colletotrichum acutatum* J.H. Simmonds	Fruit rot	USA (Guerber et al. 2003).	No; common fruit rot pathogen on many hosts (Guerber et al. 2003).	Present in NZ; likely to be damaging.
	Colletotrichum boninense Moriwaki, Toy. Sato & Tsukib.	Anthracnose	Japan, NZ, USA, Brazil, Colombia (Damm et al. 2012).	No; very wide host range; when considering the split of the species complex, *C. boninense* s. str. has wide and diverse host range that does not even include *Passiflora* (Damm et al. 2012).	Present in NZ; likely to be damaging.

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Colletotrichum brasiliense Damm, P.F. Cannon, Crous & Massola	Anthracnose	Brazil (Damm et al. 2012).	*Passiflora edulis* (Damm et al. 2012). Reported only on *Passiflora* (Damm et al. 2012), except recent report on *Smilax glabra* in China (Tan et al. 2025).	Absent from NZ; likely damaging.
Colletotrichum brevisporum Phouliv., Noireung, L. Cai & K.D. Hyde	Anthracnose	Japan (Damm et al. 2019), China (Du et al. 2017), Australia (Shivas et al. 2016).	No; reported on numerous hosts, including *Neoregelia,* papaya, chayote and others (Du et al. 2017).	Absent from NZ; likely to be damaging.
Colletotrichum truncatum (Schwein.) Andrus & W.D. Moore (synonym = *Colletotrichum capsici* (Syd. & P. Syd.) E.J. Butler & Bisby)	Anthracnose	USA (Du et al. 2017), Taiwan, China (Chen & Huang 2018).	No; causes diseases in many hosts in the Solanaceae and Fabaceae (Shivas et al. 2016).	Present in NZ; likely to be damaging.
Colletotrichum colombiense Damm, P.F. Cannon & Crous	On leaves	Colombia (Damm et al. 2012).	Only reported from *P. edulis* (Damm et al. 2012).	Absent from NZ; likely to be damaging.
Colletotrichum constrictum Damm, P.F. Cannon, Crous, P.R. Johnst. & B.S. Weir	Anthracnose	NZ (Damm et al. 2012), China (Wang et al. 2021).	No; also occurs on *Citrus* and *Solanum betaceum* (Damm et al. 2012) and mango (Wang et al. 2021).	Present in NZ; likely to be damaging.
Colletotrichum crassipes (Speg.) Arx	Anthracnose	South Africa (Gorter 1977).	Reported on *P. edulis* but also associated with anthracnose in poplar (Li et al. 2012).	Present in NZ; likely to be damaging.

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Colletotrichum dematium (Pers.) Grove	Anthracnose	Japan (Crouch et al. 2009), Niue, Samoa (Dingley et al. 1981).	No; reported to cause disease on many species including strawberry, pea, cowpea, spinach, radish and mulberry (Machowicz-Stefaniak 2010).	Present in NZ; likely to be damaging.
Colletotrichum gloeosporioides (Penz.) Penz. & Sacc. (heterotypic synonym = *Gloeosporium fructigenum* Berk., *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk)	Anthracnose	Brazil (Mendes et al. 2011), Australia (Shivas 1989), USA (Alfieri Jr et al. 1984), NZ (Gadgil & Dick 2005), India (Sharma 2013), USA (Agricultural Research Service 1960), Barbados (Norse 1974), Brunei (Peregrine & Kassim bin Ahmad 1982), Cook Islands, Fiji (Dingley et al. 1981), Japan (Kobayashi 2007) and elsewhere.	No; associated with at least 470 host genera (Shivas et al. 2016).	Present in NZ; likely to be damaging.
Colletotrichum karsti You L. Yang, Zuo Y. Liu, K.D. Hyde & L. Cai	Anthracnose	Brazil, USA (Damm et al. 2012).	No; occurs on many host plants; common and geographically diverse (Damm et al. 2012).	Present in NZ; likely to be damaging.
Colletotrichum passiflorae Siemaszko	Anthracnose	Hawaii, Armenia/Azerbaijan/Georgia (Damm et al. 2012), Kenya (Amata et al. 2011).	*P. edulis*, *P. laurifolia* (Damm et al. 2012), possibly host specific.	Absent from NZ; likely to be damaging.
Colletotrichum plurivorum Damm, Alizadeh & Toy. Sato	Anthracnose	Japan (Damm et al. 2019).	No; very large host range (Damm et al. 2019).	Absent from NZ; likely to be damaging.
Colletotrichum queenslandicum B.S. Weir & P.R. Johnst.	Fruit rot	Australia (Shivas et al. 2016).	No; also infects avocado, papaya, lychee, and	Absent from NZ; likely to be damaging.

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				pawpaw (Shivas et al. 2016).	
	Colletotrichum torulosum Damm, P.F. Cannon, Crous, P.R. Johnst. & B.S. Weir	Leaf blotch	NZ (Damm et al. 2012).	No; known from *Solanum* and *Passiflora* (Damm et al. 2012).	Present in NZ; likely to be damaging.
	Colletotrichum tropicale Rojas, Rehner & Samuels	Anthracnose	Brazil (Silva et al. 2021).	No; causes anthracnose; also infects important fruit crops such as avocado, mango, banana (Zakaria 2021).	Absent from NZ; likely to be damaging.
	Glomerella phomoides Swank	Anthracnose	Fiji (Firman 1972).	*P. edulis* (Firman 1972); specificity unclear; possibly infects tomato (as *Colletotrichum phomoides*) (Swank 1953; Loprieno 1961).	Presence in NZ uncertain; likely to be damaging.
	Vermicularia fallax Sacc.	On leaves	Philippines (Saccardo 1920).	*P. edulis* (Saccardo 1920).	Absent from NZ; likely to be damaging.
Helotiales					
Sclerotiniaceae	*Botrytis cinerea* Pers. (syn: *Botryotinia fuckeliana* (de Bary) Whetzel)	Botrytis fruit rot (Liberato & Zerbini 2003)	NZ (Pennycook et al. 1989), Japan (Kobayashi 2007), and elsewhere.	No; infects almost all of the plant groups, over 1,600 hosts identified (Singh et al. 2024).	Present in NZ; likely to be damaging.
	Sclerotinia sclerotiorum (Lib.) de Bary	Sclerotinia rot	NZ (Pennycook et al. 1989), Japan (Kobayashi 2007), Australia (Shivas 1989), China (Tai 1981).	Important pathogen with a wide host range worldwide (Purdy 1979).	Present in NZ; likely to be damaging.

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Dermateaceae	*Gloeosporium passiflorae* Speg.	Anthracnose	Argentina (Farr 1973), possibly Peru (only identified as *Gloeosporium* sp.) (Neyra & Pilar 2015).	*Passiflora* sp. (Farr 1973), possibly *P. mollisima* (Neyra & Pilar 2015).	Presence in NZ uncertain; likely to be damaging.
	Gloeosporium passifloricola Sawada	Not specified	Taiwan (Damm et al. 2012).	*P. quadrangularis* (Damm et al. 2012).	Absent from NZ; likely to be damaging.
	Phlyctema passiflorae Cooke & Massee	Not specified	Spain (Fragoso 1916), Australia (Simmonds 1966).	*Passiflora caerulea* (Fragoso 1916), *P. edulis* (Simmonds 1966).	Absent from NZ.
Erysiphaceae	*Erysiphe aquilegiae* DC. (heterotypic synonym = *Pseudoidium passiflorae* (Politis) U. Braun & R.T.A. Cook)	Powdery mildew	Germany, Greece, Netherlands, Switzerland, USA, India, Australia, Sri Lanka (Bolay et al. 2021).	*P. caerulea*, *P. subpeltata* (syn. *P. calcarata*), *P. foetida*, *P. loefgrenii* (Bolay et al. 2021).	Present in NZ.
	Erysiphe polygoni DC. (heterotypic synonym = *Erysiphe communis* Schltdl)	Powdery mildew	Australia (Amano 1986), USA (Gardner et al. 1970).	*P. foetida* (Amano 1986), *P. caerula* (Gardner et al. 1970). *Erysiphe polygoni* also infects species of *Polygonym*, *Persicaria*, *Muehlenbeckia*, *Rumex* and others (Darsaraei et al. 2023).	Absent from NZ.
	Oidium goosii Bappamm., Hosag. & Udaiyan	Powdery mildew	India (Bradshaw et al. 2026).	*P. subpeltata* (Bradshaw et al. 2026).	Absent from NZ.
	Ovulariopsis passiflorae Syd. (heterotypic synonym =	Powdery mildew	South Africa, Asia (India), and South America (Bolay et al. 2021),	Various *Passiflora* spp. (Bolay et al. 2021), *P. suberosa*,	Absent from NZ.

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	Streptopodium passiflorae (Syd.) Liberato & R.W. Barreto)		Dominican Republic (Ciferri 1961), Venezuela (Amano 1986).	*P. quadrangularis*, *P. rubra.*	
	Phyllactinia taurica (Lév.) M. Bradshaw, Khodap. & U. Braun (homotypic synonym = *Leveillula taurica* (Lév.) G. Arnaud)	Powdery mildew	India, Greece, France, Israel, Italy, Spain (Amano 1986; Ciferri 1961; Liberato & Barreto 2005).	No; recorded on onion, artichoke, cotton, chili pepper, tomato and others (Correll et al. 1987).	Absent from NZ.
Hypocreales					
Bionectriaceae	*Nectriella philippina* Rehm	On dead branches, probably saprophytic	Philippines (Baker 1914a).	*Passiflora quadrangularis* (Baker 1914a).	Absent from NZ.
	Synnemellisia aurantia D.O. Lisboa, J.L. Alves & R.W. Barreto	Not specified	Brazil (Crous, Winfield, Burgess et al. 2016).	*P. edulis* (Crous, Wingfield, Burgess et al. 2016).	Absent from NZ.
Myrotheciomycetaceae	*Trichothecium roseum* Fr.	Fruit rot	Malaysia, China, South Africa (Doidge 1950b; Johnston & Thompson 1960; Li et al. 2022).	*P. edulis*, *P.* sp. (Doidge 1950b; Johnston & Thompson 1960; Li et al. 2022).	Absent from NZ.
Nectriaceae	*Fusarium avenaceum* (Fr.) Sacc. (heterotypic synonym = *Gibberella avenacea* R.J. Cook)	Not specified	NZ (Gadgil & Dick 2005).	No; infects a broad range of plant hosts worldwide (Pollard & Okubara 2019).	Present in NZ.
	Fusarium fujikuroi Nirenberg (synonym = *Gibberella fujikuroi* (Sawada) Wollenw.)	Bakanae disease	Brunei (Peregrine & Kassim bin Ahmad 1982), Sri Lanka (Rajapaksha et al. 2019).	No; infects rice (Nirenberg & O'Donnell 1998).	Present in NZ.
	Fusarium incarnatum (Roberge ex Desm.) Sacc. (synonym =	Not specified	Argentina (Farr 1973).	Reported on *P. mooreana* (syn. *P. tweedieana*) (Farr	Absent from NZ.

Fusarium gloeosporioides Speg.)			1973), but also infects solanaceous crops such as tomato, brinja, and chili (Parihar et al. 2025).	
Fusarium lateritium Nees (heterotypic synonym = *Gibberella baccata* (Wallr.) Sacc.)	Wilt, tip or branch dieback, and Cankers (Vitale et al. 2011)	NZ (Gadgil & Dick 2005).	*P. edulis* (Gadgil & Dick 2005), but reported on c. 180 hosts, mainly woody and fruit trees (Vitale et al. 2011).	Present in NZ.
Fusarium nirenbergiae L. Lombard & Crous	Fusarium wilt	Italy (Aiello et al. 2021), Brazil (Mangeiro et al. 2022).	Not specific; causes root rot in potato (Li et al. 2025), fusarium wilt in common bean (Kızılay & Özer 2026) and wilt in *Acer negundo* (Zhao et al. 2020).	Present in NZ.
Fusarium oxysporum f. sp. *passiflorae* W.L. Gordon	Fusarium wilt	Kenya (Amata et al. 2011), Brazil (Mendes et al. 2011), Australia, Hawaii, Malaysia, Panama, South Africa, Venezuela and NZ (Thangavel et al. 2021).	*P. edulis*, *P. mollissima*, and other *Passiflora* spp. (Thangavel et al. 2021).	Present in NZ.
Fusarium oxysporum var. *redolens* (Wollenw.) W.L. Gordon	Not specified	NZ (Pennycook et al. 1989).	No; reported to cause wilting in oil palms (Ho et al. 1985).	Present in NZ.
Fusarium pernambucanum A.C.S. Santos, C.S. Lima, P.V. Tiago & N.T. Oliveira	Flower dry rot	China (Liu et al. 2021).	*P. edulis* (Liu et al. 2021), but also reported to cause top rot in peanut and	Absent from NZ.

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			peduncle rot in grape (Shen et al. 2026).	
Fusarium sambucinum Fuckel (heterotypic synonym = *Fusarium roseum* Link, synonym = *Gibberella cyanogena* (Desm.) Sacc.)	Not specified	Brazil (Mendes et al. 2011), NZ (Gadgil & Dick 2005).	No; also reported on *Ficus carica* and *Arachis hypogaea* (Mendes et al. 2011).	Present in NZ.
Fusarium tricinctum (Corda) Sacc.	Fusarium head blight	NZ (Harrow et al. 2010).	No; one of the most economically important plant pathogens in cereals and many other crops (Wang, Wang et al. 2022).	Present in NZ.
Gibberella passiflorae Cooke & Massee (*Lisiella passiflorae* (Cooke & Massee) Cooke & Massee)	On stems	Australia (Simmonds 1966).	Reported on *P. edulis* (Simmonds 1966); specificity unknown.	Absent from NZ.
Neocosmospora haematococca (Berk. & Broome) Samuels, Nalim & Geiser (basionym = *Nectria haematococca* Berk. & Broome)	Not specified	Brazil (Mendes et al. 2011), Japan (Kobayashi 2007), Samoa (Dingley et al. 1981), NZ (Lombard et al. 2015).	No; pathogen of green peas, alfalfa, chickpea, cottonwood, potato, sainfoin, and tulip tree (Sandoval-Denis et al. 2019).	Present in NZ.
Neocosmospora ipomoeae (Halst.) L. Lombard & Crous (homotypic synonym = *Haematonectria ipomoeae* (Halst.) Samuels & Nirenberg)	Stem, root, tuber rot	Japan (Kobayashi 2007).	Cosmopolitan plant pathogen known to cause rot on a wide range of hosts, including crops like eggplant, pepper, potato,	Present in NZ.

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				tomato (Custódio & Pereira 2023).	
	Neocosmospora passiflorae C.J. Bueno, I.H. Fischer, D.D. Rosa, A.C. Firmino, Harakava, C.M.G. Oliveira & E.L. Furtado ex H. Zhang & Y.L. Jiang (basionym = *Fusarium solani* f. sp. *passiflorae* C.J. Bueno, I.H. Fischer, D.D. Rosa, A.C. Firmino, Harakava, C.M.G. Oliveira & E.L. Furtado)	Collar rot	Brazil (Bueno et al. 2014).	No; also infects zucchini and tomato, although to a lesser degree (no wilting, no plant death) (Bueno et al. 2014).	Absent from NZ.
	Neocosmospora solani (Mart.) L. Lombard & Crous (homotypic synonym = *Fusarium solani* (Mart.) Sacc., heterotypic synonym = *Fusarium striatum* Sherb.)	Collar rot	China (Hao et al. 2021), NZ (Thangavel et al. 2021), Brazil (Mendes et al. 2011), Kenya (Nattrass 1961), Australia (Simmonds 1966), Germany (Nirenberg & Brielmaier-Liebetanz 1996).	No; infects citrus and guava, *Solanum tuberosum*, *S. melongena*, and *Cucurbita ficifolia* (Nirenberg & Brielmaier-Liebetanz 1996; Veloso et al. 2021).	Present in NZ.
Hypocreaceae	*Trichoderma hamatum* (Bonord.) Bainier	Beneficial endophyte	Sri Lanka (Kindermann et al. 1998).	*Passiflora* sp., soil and other plants (Kindermann et al. 1998).	Present in NZ.
Stachybotryaceae	*Paramyrothecium roridum* (Tode) L. Lombard & Crous (basionym = *Myrothecium roridum* Tode)	Leaf spots, stem lesions	Many countries including NZ (www.gbif.org/species/9695387).	No; has wide host range including over 300 plant species of vegetables, fruits, ornamental plants, and field crops (Soliman 2020).	Present in NZ.

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Meliolales					
Meliolaceae	*Meliola glabra* Berk. & M.A. Curtis (homotypic synonym = *Irenina glabra* (Berk. & M.A. Curtis) F. Stevens)	Black mildew	Dominican Republic (Ciferri 1961).	No; reported on *Hypelate trifoliata* and *Drypetes* sp. (Stevens 1916).	Absent from NZ.
	Meliola aristata Toro	Black mildew	Dominican Republic (Ciferri 1961).	*Passiflora* sp. (Ciferri 1961); potentially specific.	Absent from NZ.
	Irenopsis passiflorae Hansf.	Not specified	Ecuador (Dennis 1970).	Unknown.	Absent from NZ.
Microascales					
Ceratocystidaceae	*Berkeleyomyces basicola* (Berk. & Broome) W.J. Nel, Z.W. de Beer, T.A. Duong & M.J. Wingf. (homotypic synonym = *Thielaviopsis basicola* (Berk. & Broome) Ferraris, *Trichocladium basicola* (Berk. & Broome) J.W. Carmich.)	Black root rot	NZ (Gadgil & Dick 2005).	On many important agricultural and ornamental plant species (Nel et al. 2018).	Presence in NZ uncertain.
	Ceratocystis fimbriata Ellis & Halst.	Causes wilt-type disease (Engelbrecht & Harrington 2005)	Brazil (Firmino et al. 2013).	No; affects many plants, including important crops (Engelbrecht & Harrington 2005).	Present in NZ.
Micropeltidales					

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Micropeltidaceae	*Dictyothyrium hieronymi* (Rehm) Bat.	Not specified	Brazil (Mendes et al. 2011).	Reported on *Passiflora* sp., *Calathea* sp. and *Siparuna* sp. (Mendes et al. 2011).	Not damaging, epiphytic (Marasinghe 2023).
Microthyriales					
Microthyriaceae	*Haplopeltis bakeriana* (Rehm) Theiss. (basionym = *Muyocopron bakerianum* Rehm)	On dead stems	Philippines (Baker 1914a).	*P. quadrangularis* (Baker 1914a).	Absent from NZ.
Muyocopronales					
Muyocopronaceae	*Muyocopron sahnii* Hern.-Restr. & Crous (homotypic synonym = *Mycoleptodiscus indicus* (V.P. Sahni) B. Sutton)	Fruit rot	Brunei (Peregrine & Kassim bin Ahmad 1982), America, India, NZ (Hernández-Restrepo et al. 2019).	*Passiflora edulis* f. *flavicarpa* and *P. edulis*, but host preferences not completely known (Hernández-Restrepo et al. 2019).	Present in NZ.
Mycosphaerellales					
Mycosphaerellaceae	*Cercospora apii* Fresen.	Cercospora leaf spot (Groenewald et al. 2006)	Brazil (Braun & Freire 2006), USA (Braun & Crous 2005).	No; pathogen of celery, *Helianthemum*, *Moluccella*, *Plantago*, *Plumbago* (Groenewald et al. 2006).	Present in NZ.
	Cercospora canescens Ellis & G. Martin	Cercospora leaf spot	India (Kamal 2010).	No; causes *Cercospora* leaf spot in legumes, including mungbean and black gram (Joshi et al. 2006).	Present in NZ.

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Cercospora granadillae Chupp	Cercospora spot	India (Kamal 2010), Uganda (Ragazzi & Marino 1990).	*P. edulis* (Kamal 2010).	Absent from NZ.
Cercospora passifloricola Chupp	Cercospora spot	Thailand (Torres 2019), Venezuela (Dennis 1970), Barbados (Norse 1974), China (Yinglan 2001).	*P. foetida* (Torres 2019), *Passiflora* sp. (Dennis 1970), *P. edulis* (Norse 1974), *P. coerulea* (Yinglan 2001).	Absent from NZ.
Cercospora regalis Tharp	Cercospora spot	USA (Lieneman 1929), El Salvador (Stevenson & Wellman 1944).	*Passiflora* sp. (Lieneman 1929), *P. quadrangularis* (Stevenson & Wellman 1944).	Absent from NZ.
Cercospora truncatella G.F. Atk.	Cercospora spot	USA (Lieneman 1929), Venezuela (Dennis 1970).	*P. incarnata* (Lieneman 1929), *Passiflora* spp. (Agricultural Research Service 1960).	Absent from NZ.
Eriocercospora balladynae (Hansf.) Deighton	Mycoparasite	Papua New Guinea (Shaw 1984).	*P. foetida* (Shaw 1984). No; reported as mycoparasite (Braun 2002).	Absent from NZ.
Passalora biformis (Peck) U. Braun & Crous (basionym = *Cercospora biformis* Peck)	Cercospora spot (Liberato & Zerbini 2003)	USA (Ray 1944), Puerto Rico (Solheim & Stevens 1931), Dominican Republic (Ciferri 1961), Virgin Islands (Stevenson 1975).	*P. incarnata* (Ray 1944), *P. sexflora* (Solheim & Stevens 1931), *P. bilobata* (Stevenson 1975), *P. rubra* (Ciferri 1961).	Absent from NZ.
Passalora fuscovirens (Sacc.) U. Braun & Crous (basionym = *Cercospora fuscovirens* Sacc., homotypic synonym =	Cercospora leaf spot	USA (Lieneman 1929), Trinidad & Tobago (Dennis 1970), Myanmar	*P. incarnata* (Atkinson 1891), *P. foetida* (Torres	Absent from NZ.

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Pseudocercospora fuscovirens (Sacc.) Y.L. Guo & X.J. Liu)		(Thaung 1984), China (Zhuang 2001).	2019), *P. lutea* (Lieneman 1929).	
Pseudocercospora calospilea (Syd.) Deighton (basionym = *Cercospora calospilea* Syd.)	Cercospora spot (Liberato & Zerbini 2003)	Venezuela (Urtiaga 1986), Colombia, Ecuador (Dennis 1970).	*P. foetida* (Urtiaga 1986), *P. ligularis* (Dennis 1970).	Absent from NZ.
Pseudocercospora passiflorae U. Braun & Crous (synonym = *Cercospora passiflorae* A.S. Mull. & Chupp)	Cercospora spot	Puerto Rico, Virgin Islands (Stevenson 1975), USA (Alfieri Jr et al. 1984).	*P. sexflora* (Stevenson 1975), *P.* sp. (Alfieri Jr et al. 1984).	Absent from NZ.
Pseudocercospora passiflorae-setaceae A.C. Dianese, A.M. Costa & Dianese	Leaf spots	Brazil (Dianese et al. 2008).	*P. setacea* (Dianese et al. 2008); potentially specific.	Absent from NZ.
Pseudocercospora stahlii (F. Stevens) Deighton (homotypic synonym = *Helicomina stahlii* (F. Stevens) M.B. Ellis, *Cercospora passiflorae-foetidae* J.M. Yen, *Cercospora stahlii* (F. Stevens) Subram., basionym = *Helminthosporium stahlii* F. Stevens)	Cercospora spot	India (Bagyanarayana & Braun 1999), Vanuatu (Braun et al. 1999), Puerto Rico, Virgin Islands, Dominican Republic and 16 other countries in Asia and Australia (Dianese et al. 2008), Singapore (Yen 1964), Africa, North America, Singapore, Malaysia, Puerto Rico, New Guinea, India, Taiwan, Trinidad (Yen & Lim 1980).	Mainly affects *Passiflora foetida* (Braun et al. 1999; Dianese et al. 2008), *Passiflora* sp. (Bagyanarayana & Braun 1999).	Absent from NZ.
Septoria fructigena Berk. & M.A. Curtis	Septoria spot	Brazil (Mendes et al. 2011), South Africa (Gorter 1977), Puerto Rico, Virgin Islands (Stevenson 1975), USA (Agricultural Research Service 1960).	*Passiflora* sp. (Agricultural Research Service 1960), *P. edulis* (Mendes et al. 2011), *P. quadrangularis* (Gorter 1977).	Absent from NZ.

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Septoria passiflorae Syd.	Septoria spot	Brazil (Mendes et al. 2011), Kenya (Nattrass 1961), NZ (Pennycook et al. 1989), Australia (Simmonds 1966), Venezuela (Urtiaga 1986), New Caledonia (Huguenin 1966), Zimbabwe (Whiteside 1966).	*P. edulis*, *P. edulis* f. *flavicarpa*, *P. quadrangularis* (Nattrass 1961; Huguenin 1966; Simmonds 1966; Whiteside 1966; Urtiaga 1986; Pennycook et al. 1989; Mendes et al. 2011), *P. tripartita* var. *tripartita* (Trujillo et al. 1994). Note: *S. passiflora* was released as a biocontrol agent against *P. tripartita* var. *tripartita* in Hawaii in 1996 with high a success rate (Trujillo et al. 2001). Previous testing showed its specificity to the target with no infections on *P. edulis* or *P. edulis* f. *flavicarpa* (Trujillo et al. 1994).	Present in NZ.
Septoria passifloricola Punith.	Leaf, blossom, fruit and stem spot	Africa (Ethiopia, Kenya, South Africa, Tanzania, Zambia); Australasia & Oceania (Australia, New Caledonia, NZ); Central America and West Indies (Trinidad); South America (Venezuela) (Punithalingam 1980).	*Passiflora alata* (syn. *P. brasiliana*), *P. edulis*, *P. quadrangularis* (syn. *P. macrocarpa*), *P. quitensis* (a name of doubtful status, probably referrable to *P. mixta*) (Punithalingam 1980).	Present in NZ.

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	Septoria pastinacina Peck	Not specified	Japan (Kobayashi 2007).	*P. edulis* (Kobayashi 2007); also on *Pastinaca sativa* (Martin 1887).	Absent from NZ.
	Zasmidium mirzapurense (S.K. Singh, Bhalla & Bhat) Kamal	Not specified	India (Kamal 2010).	*P. foetida* (Kamal 2010).	Absent from NZ.
Pezizales					
Rhizinaceae	*Phymatotrichopsis omnivora* (Shear) Hennebert (homotypic synonym = *Phymatotrichum omnivorum* (Shear) Duggar)	Phymatotrichum root rot	USA (Agricultural Research Service 1960).	No; pathogen of more than 2,000 plant species (EFSA et al. 2019).	Absent from NZ.
Pleosporales					
Corynesporascaceae	*Corynespora cassiicola* (Berk. & M.A. Curtis) C.T. Wei	Lesions	USA (Alfieri Jr et al. 1984), Guam (Dixon et al. 2009).	No; wide host range, including basil, bean, cowpea, cucumber, papaya, soybean, sweet potato, and tomato (Dixon et al. 2009).	Present in NZ.
Cucurbitariaceae	*Pyrenochaeta* sp. De Not.	On the fruit	Venezuela (Urtiaga 1986).	*P. edulis* (Urtiaga 1986).	Present in NZ.
Dictyosporiaceae	*Dendryphiella vinosa* (Berk. & M.A. Curtis) Reisinger) (synonym = *Dendryphiella interseminata* (Berk. & Ravenel) Bubák & Ranoj.)	Saprobic	Kenya (Nattrass 1961).	No; saprobic (Iturrieta-González et al. 2018).	Not damaging; saprophytic fungus (Iturrieta-González et al. 2018).

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Didymellaceae	*Didymella passiflorae* Höhn.	Not specified	Samoa (Dingley et al. 1981).	*Passiflora alata* (Dingley et al. 1981), specificity unknown.	Absent from NZ.
	Leptosphaerulina trifolii (Rostr.) Petr.	Not specified	India (Pande 2008).	No; has been observed colonising several host genera, including *Agropyron*, *Arachis*, *Glycine*, *Lespedeza*, *Medicago*, *Oryza*, *Panicum*, *Phaseolus*, *Poa*, *Trifolium*, *Vigna*, and *Zea* (Abler 2003).	Present in NZ.
	Phoma passiflorae Penz. & Sacc.	Phoma canker	South Africa (Doidge 1950a); also mentioned to cause fruit rot in Peru (Grijalva 2010).	*P. edulis*, *P. quadrangularis* (Doidge 1950a).	Absent from NZ.
Leptosphaeriaceae	*Leptosphaeria doliolum* (Pers.) Ces. & De Not. (heterotypic synonym = *Leptosphaeria subconica* (Cooke & Peck) Sacc.)	Not specified	USA (Hanlin 1963).	No; also reported on *Solanum tuberosum, Rubus* sp., *Urtica* sp., *Oenothera biennis*, *Solidago* sp. and *Psoralea orbicularis* (Farlow & Seymour 1888).	Present in NZ.
Massarinaceae	*Helminthosporium velutinum* Link	Saprobe	Australia (Simmonds 1966).	No; saprobe recorded from various woody hosts (Voglmayr & Jaklitsch 2017).	Present in NZ.
	Stagonospora sp. (Sacc.) Sacc.	On twig	Venezuela (Urtiaga 1986).	On *P. quadrangularis* (Urtiaga 1986).	Present in NZ.

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Periconiaceae	*Periconia cookei* E.W. Mason & M.B. Ellis	Saprobe	Japan (Kobayashi 2007).	On *P. edulis* (Kobayashi 2007); also reported saprobic on dead culms of Poaceae (Su et al. 2023).	
Phaeosphaeriaceae	*Ophiobolus passiflorae* Gonz. Frag. & Cif.	Not specified	Dominican Republic (Ciferri 1961).	*P. suberosa* (Ciferri 1961).	Absent from NZ.
Pleosporaceae	*Alternaria aliena* E.G. Simmons	Brown lesions on leaves	Australia (Simmons 1993).	Observed on *P. edulis* (Simmons 1993).	Absent from NZ.
	Alternaria alternata (Fr.) Keissl.	Brown spot (Liberato & Zerbini 2003)	Cosmopolitan species with wide host range (DeMers 2022).	No; observed on many plants, *Abies*, *Acer*, *Allium*, *Avena*, *Beta*, *Brassica* … (Ginns 1986).	Present in NZ; not specific.
	Alternaria aragakii E.G. Simmons	Brown spot (Fischer & Rezende 2008)	Hawaii (Simmons 1993).	Observed on *P. edulis* (Simmons 1993).	Absent from NZ.
	Alternaria bannaensis W.Q. Chen & T.Y. Zhang	Brown spot (Fischer & Rezende 2008)	China (Chen & Zhang 1997).	*P. gracilis* (Chen & Zhang 1997).	Absent from NZ. Damage unknown.
	Alternaria gossypina (Thüm.) J.C.F. Hopkins	Stem base rot (Feng et al. 2024)	China (Luo et al. 2024).	No; observed on *P. edulis*, *Mikania micrantha*, *Solanum lycopersicum*, tobacco and other agricultural crops (Feng et al. 2024). Note: considered as biocontrol agent for *Mikania micrantha* (Feng et al. 2024).	Not present; likely to be damaging.

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Alternaria guangxiensis W.Q. Chen & T.Y. Zhang	Brown rot (Fischer & Rezende 2008)	China (Chen & Zhang 1997).	*Passiflora* sp.	Absent from NZ.
Alternaria hawaiiensis E.G. Simmons	Brown rot (Fischer & Rezende 2008)	Hawaii (Simmons 1993).	Unknown; reported on *P. edulis* (Simmons 1993).	Absent from NZ.
Alternaria latifunda E.G. Simmons	Not specified	Hawaii (Simmons 1993).	*P. mollissima* (Simmons 1993).	Absent from NZ.
Alternaria obclavoidea E.G. Simmons	Not specified	Colombia (Simmons 1993).	*Passiflora* sp. (Simmons 1993).	Absent from NZ.
Alternaria passiflorae J.H. Simmonds	Brown rot (Fischer & Rezende 2008)	Australia, Canada, Hawaii, Indonesia, Kenya, NZ, Papua New Guinea, Tanzania, Zambia (Ellis & Holliday 1970).	*P. edulis* and other species of *Passiflora*, including *P. quadrangularis* and *P. foetida* (Ellis & Holliday 1970).	Present in NZ.
Alternaria tenuissima (Kunze) Wiltshire	Brown spot (Fischer & Rezende 2008)	Cosmopolitan (Simmons 2007).	Cereals, oilseeds, tomatoes, cucumbers, cauliflowers, peppers, apples, melons, tangerines, oranges, lemons, and sunflower seeds (Lee et al. 2015).	Present in NZ.
Alternaria tomato (Cooke) L.R. Jones	Brown spot (Fischer & Rezende 2008)	Possibly misidentified as infecting *Passiflora* (Simmons 1993).	Causes fruit rot in tomato (Patel et al. 2005).	Absent from NZ.
Alternaria tropica E.G. Simmons	Brown spot (Fischer & Rezende 2008)	USA, Hawaii (Simmons 1993).	*P. edulis* (Simmons 1993).	Absent from NZ.

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Curvularia australiensis (Bugnic. ex M.B. Ellis) Manamgoda (synonym = *Bipolaris australiensis* (Bugnic. ex M.B. Ellis) Tsuda & Ueyama)	Brown leaf spot (Fang et al. 2007)	Japan (Kobayashi 2007).	No; reported to be pathogenic on *Chloris*, *Pennisetum*, *Cynodon*, *Piper betle* and *Setaria italica* (Mirzaee et al. 2010). Also a human pathogen causing peritonitis, subcutaneous phaeohyphomycosis, fungal sinusitis, and disseminated infection (Pai et al. 2017).	Present in NZ.
Curvularia senegalensis (Speg.) Subram.	Not specified	Samoa (Dingley et al. 1981).	No; causes disease in crops like pupunha tree and real palm tree; also agent of some allergic sinusitis, keratitis and endophtalmitis (Lucas et al. 2008).	Absent from NZ.
Stemphylium beticola Woudenb. & Hanse	Not specified	NZ (Woudenberg et al. 2017).	Pathogen of sugar beet, Chenopodiaceae, and several other plant groups (Köhl et al. 2024).	Present in NZ.
Stemphylium vesicarium (Wallr.) E.G. Simmons (heterotrophic synonym = *Pleospora herbarum* (Pers.) Rabenh. ex Ces. & De Not.)	Not specified	NZ (Pennycook et al. 1989).	Causing brown spot in onion, garlic, asparagus and pear (Köhl et al. 2009).	Present in NZ.

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Torulaceae	*Torula herbarum* (Pers.) Gray	Leaf and stem spots	Venezuela (Urtiaga 1986).	*Passiflora suberosa* (Urtiaga 1986); also coriander, *Ziziphus mauritiana* and common on dead herbaceous stems, wood, soil air, rock, concrete, linoleum and other substrates (Bogomolova & Minter 2003).	Present in NZ.
Didymellaceae	*Ascochyta passiflorae* Penz. & Sacc.	Leaf spot (Adikaram & Yakandawala 2020)	Sri Lanka (Adikaram & Yakandawala 2020).	*P. edulis* (Adikaram & Yakandawala 2020).	Absent from NZ.
Rhytismatales					
Rhytismataceae	*Lophodermium passiflorae* Rehm	On dead stems	Philippines (Baker 1914b).	*Passiflora quadrangularis* (Baker 1914b).	Absent from NZ.
Trichosphaeriales					
Trichosphaeriaceae	*Stachylidium bicolor* Link	Mould	Cuba (Hughes 1951).	Grows on great variety of herbaceous and woody hosts (Hughes 1951).	Present in NZ.
Xylariales					
Microdochiaceae	*Microdochium passiflorae* Samuels, E. Müll. & Petrini	On dead stems	NZ (Pennycook et al. 1989).	*Passiflora edulis* (Pennycook et al. 1989).	Present in NZ.
Zygosporiaceae	*Zygosporium oscheoides* Mont.	Leaf spot	Cuba (Urtiaga 1986).	*P. suberosa* (Urtiaga 1986), but reported from decaying leaves of a very	Present in NZ.

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				wide range of plants (Whitton et al. 2003).	
Incertae sedis					
Seuratiaceae	*Domingoella asterinarum* Petr. & Cif.	Not specified	Dominican Republic (Ciferri 1961).	No; other hosts reported are *Justicia adhatoda*, *Cocos nucifera*, *Dillenia pentagyna*, *Woodfordia fruticosa* and others (Dubey & Neelima 2025).	Absent from NZ.
	Pithosira sydowii Petr.	Scab	Ecuador (von Arx & van der Aa 1981).	*Passiflora bogotensis* (syn. *P. alnifolia*) (von Arx & van der Aa 1981).	Absent from NZ.
	Seuratia millardetii (Racib.) Meeker (synonym = *Atichia millardetii Racib.*)	On leaves	Hawaii (Petrak 1953).	No; recorded on *Psychotria* (syn. *Straussia*), *Pipturus albidus*, *Suttonia*, *Smilax*, *Gardenia*, *Passiflora* sp., *Cyrtandra*, *Syzygium*, *Scaevola* (Petrak 1953).	Present in NZ.
	Sphaeronaema innatum Har. & P. Karst.	On dry twigs	France (Jachevski 1898).	*Passiflora caerulea* (Jachevski 1898).	Absent from NZ.
	Spiropes dorycarpus (Mont.) M.B. Ellis	Mycoparasite	Malaysia (Turner 1971).	No; hyperparasite on various fungal species, growing on various plants (Bermúdez-Cova et al. 2024).	Absent from NZ.

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Vizellaceae	*Vizella passiflorae* Rehm	Leaf parasite	Philippines (Rehm 1913).	*Passiflora quadrangularis* (Rehm 1913).	Absent from NZ.
BASIDIOMYCOTA					
Agaricales					
Agaricineae	*Coprinopsis phlyctidospora* (Romagn.) Redhead, Vilgalys & Moncalvo	Not specified	Australia (Suzuki et al. 2002).	Only once recorded from a rotted basal stem tissue of *P. edulis*, otherwise isolated from forest floor with high nitrogen content (Suzuki et al. 2002).	Absent from NZ; not damaging.
Physalacriaceae	*Armillaria mellea* (Vahl) P. Kumm.	Armillaria root rot	Zimbabwe (Whiteside 1966), Australia (Shivas 1989).	No; common disease of root rot in woody plants (Ren et al. 2023).	Present in NZ.
Amylocorticiaceae	*Agroathelia rolfsii* (Sacc.) Redhead & Mullineux (basionym = *Sclerotium rolfsii* Sacc., homotypic synonym = *Athelia rolfsii* (Sacc.) C.C. Tu & Kimbr., *Pellicularia rolfsii* (Sacc.) E. West, *Corticium rolfsii* (Sacc.) Curzi)	Stem rot, foot rot, crown rot, sclerotium wilt, blight (Mordue 1974)	Fiji (Dingley et al. 1981), Australia (Simmonds 1966), USA (Alfieri Jr et al. 1984), Ghana (Dade 1940), Brunei (Peregrine & Kassim bin Ahmad 1982).	No; economically important pathogen on a range of crops (Patra et al. 2023).	Present in NZ.
	Agroathelia coffeicola (Stahel) Redhead (basionym = *Sclerotium coffeicola* Stahel)	Zonal spot	Brazil (Mendes et al. 2011).	Infects a range of plants, including *Mangifera indica*, *Coffea*, *Eucalyptus*, *Citrus* (Gasparotto et al. 2025).	Absent from NZ.
Auriculariales					

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Auriculariaceae	*Auricularia nigricans* (Sw.) Birkebak, Looney & Sánchez-García (heterotypic synonym = *Auricularia polytricha* (Mont.) Sacc.)	Not specified	Samoa (Dingley et al. 1981).	No; common wood decaying fungus that grows on a wide range of woody substrates (Duncan 1972). Reported on *P. edulis* (Dingley et al. 1981).	Present in NZ; not damaging (growing on dead wood).
Cantharellales					
Ceratobasidiaceae	*Rhizoctonia solani* J.G. Kühn (heterotypic synonym = *Thanatephorus cucumeris* (A.B. Frank) Donk, *Corticium solani* (Prill. & Delacr.) Bourdot & Galzin)	Damping off, seed decay, stem cankers, root rots, fruit decay, foliage diseases (*Rhizoctonia solani*) (Parmeter 1970)	Australia, Brazil, USA (Simmonds 1966; Alfieri Jr et al. 1984; Mendes et al. 2011), Samoa, Fiji (Dingley et al. 1981).	Important pathogen on many plant species worldwide (Cubeta & Vilgalys 1997).	Present in NZ.
Pucciniaceae	*Aecidium passiflorae* Henn.	Rust	Reported in Tanzania (Stevenson 1926).	On *Passiflora* sp. (Stevenson 1926).	Absent from NZ. Life-cycle seems unknown.
	Puccinia scleriae (Pazschke) Arthur (syn. *Rostrupia scleriae* Pazschke, *Aecidium passifloricola* Henn.)	Rust. Note: aecial form (0-1) occurs on the genus *Passiflora* and the telial form (II, III, IV) on the genus *Scleria* (Freire 2022)	Reported as widespread in warmer regions of Africa, Asia and the Americas (Hennen et al. 2005), in Guyana (Hernandez et al. 2005), Brazil (Freire 2022), USA (Cummins et al. 1956), Australia (Atlas of Living Australia 2026).	Reported on *P. edulis*, *P. glandulosa*, *P. cyanea*, *P. rubra*, *P. serratodigitata*, *P. suberosa*, *P. tricuspis*, and *P. tuberosa* (Fischer & Rezende 2008), and on several species of *Scleria* (Cyperaceae) (Hennen et al. 2005).	Absent from NZ. Damage unknown. Second host, *Scleria*, not present in NZ, therefore completion of life cycle not possible.

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	Puccinia scleriicola Arthur	Rust	Colombia (Pardo-Cardona 1998).	*P. capsularis* and *Scleria* (Kern et al. 1933; Pardo-Cardona 1998).	Absent from NZ.
	Uredo passiflorae Cummins	Rust	Papua New Guinea (Cummins 1941).	On *Passiflora* sp. (Cummins 1941).	Absent from NZ.
Russulales					
Russulaceae	*Gloeopeniophorella sacrata* (G. Cunn.) Hjortstam & Ryvarden) (homotypic synonym = *Gloeocystidiellum sacratum* (G. Cunn.) Stalpers & P.K. Buchanan)	Root rot	NZ (Gadgil & Dick 2005).	*Passiflora tetrandra* (Gadgil & Dick 2005); also reported as disease on apples and pears (Sutton et al. 2014) and conifers (Hansen et al. 2018).	Present in NZ.
Incertae sedis					
Mucorales					
Rhizopodaceae	*Rhizopus stolonifer* (Ehrenb.) Vuill.	Soft rot	Venezuela (Urtiaga 1986).	*P. quadrangularis*, *P. edulis f. flavicarpa* (Urtiaga 1986), wide host range worldwide (Bautista-Baños et al. 2014).	Present in NZ.
Incertae sedis					
Trentepohliaceae	*Cephaleuros virescens* Kunze ex Fr.	Algal leaf spot (Pitaloka et al. 2015)	NZ (Pennycook et al. 1989).	No; has been reported on a range of plants including citrus fruits, avocado, jasmines, magnolia and others (Wolf 1930).	Present in NZ.

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Englerulaceae	*Sarcinella mirabilis* (Höhn.) Seifert (basionym = *Schiffnerula mirabilis* Höhn.)	Parasitic black mildew	Java (Ramakrishnan & Sundaram 1953), India (Sabeena & Hosagoudar 2018), Malaysia (Turner 1971), Venezuela (Dennis 1970), Papua New Guinea (Shaw 1984).	*P. edulis*, *P. foetida* (Sabeena & Hosagoudar 2018), *P. quadrangularis* (Turner 1971).	Absent from NZ.
	Schiffnerula malabarensis T.S. Ramakr. & Sundaram	Parasitic black mildew	India (Ramakrishnan & Sundaram 1953).	*P. edulis* (Ramakrishnan & Sundaram 1953).	Absent from NZ.
Oomycota					
Peronosporales					
Peronosporaceae	*Phytophthora cinnamomi* Rands	Not specified	Australia (Simmonds 1966), Brazil (Mendes et al. 2011), Fiji (Dingley et al. 1981), NZ (Pennycook et al. 1989).	No; infects close to 5,000 species. (Hardham & Blackman 2018).	Present in NZ.
	Phytophthora nicotianae Breda de Haan (heterotypic synonym = *Phytophthora nicotianae* var. *parasitica* (Dastur) G.M. Waterh., synonym = *Phytophthora parasitica* Dastur)	Phytophthora wild and crown rot	Japan (Kobayashi 2007), Malaysia (Turner 1974), Australia, India, South Africa, Taiwan (Erwin & Ribeiro 1996), Fiji (Dingley et al. 1981).	No; infects more than 255 species worldwide (Panabières et al. 2016).	Present in NZ.
Pythiales					
Pythiaceae	*Globisporangium debaryanum* (R. Hesse) Uzuhashi, Tojo & Kakish. (basionym = *Pythium debaryanum* R. Hesse)	Root rot	Australia (Simmonds 1966).	Causes root rot on *Cajanus*, *Canavalia*, *Saccharum* & *Zea* (Raabe et al. 1981); reported on a large range of hosts,	Presence in NZ uncertain.

			including many important crops (Middleton 1943).	
Globisporangium irregulare (Buisman) Uzuhashi, Tojo & Kakish. (basionym = *Pythium irregulare* Buisman)	Root rot	Australia (Shivas 1989).	Important pathogen in floricultural greenhouses (Garrido et al. 2023); reported on a large range of hosts, including many important crops (Middleton 1943).	Present in NZ.
Globisporangium middletonii (Sparrow) Uzuhashi, Tojo & Kakish. (basionym = *Pythium middletonii* Sparrow)	Root rot	Malaysia (Liu 1977).	Pathogenic to tomato seeds and seedling roots (Robertson 1973).	Present in NZ.
Globisporangium spinosum (Sawada) Uzuhashi, Tojo & Kakish. (basionym = *Pythium spinosum* Sawada)	Associated with root rot	Australia (Shivas 1989).	Reported on a range of hosts, including many important crops (Middleton 1943).	Present in NZ.
Globisporangium splendens (Hans Braun) Uzuhashi, Tojo & Kakish. (basionym = *Pythium splendens* Hans Braun)	Associated with root rot	USA (Raabe et al. 1981), Australia (Shivas 1989).	Reported on a range of hosts, including many important crops (Middleton 1943).	Present in NZ.
Globisporangium ultimum (Trow) Uzuhashi, Tojo & Kakish. (basionym = *Pythium ultimum* Trow)	Root rot	Australia (Simmonds 1966).	Reported on a range of hosts, including many important crops (Middleton 1943).	Present in NZ.
Phytopythium vexans (de Bary) Abad, de Cock, Bala, Robideau, Lodhi & Lévesque	Root rot	Australia (Shivas 1989).	Reported on a large range of hosts, including many	Present in NZ.

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(basionym = *Pythium vexans* de Bary)			important crops (Middleton 1943).	
Pythium acanthicum Drechsler	Root rot	Australia (Shivas 1989), Kenya (Nattrass 1961).	No; highly pathogenic to seeds and seedling roots of tomato (Robertson 1973) and known from *Citrullus lanatus* (syn. *C. vulgaris*), *Dahlia* sp., *Pisum sativum*, *Phaseolus vulgaris* and *Solanum melongena* (Middleton 1943).	Present in NZ.
Pythium aphanidermatum (Edson) Fitzp.	Root rot	USA (Raabe et al. 1981).	Major pathogen of cucumber (El-Ghaouth et al. 1994); also recorded causing root rot on *Ananas*, *Capsicum*, *Citrullus*, *Musa*, *Oryza* & *Passiflora* (Raabe et al. 1981); reported on a large range of hosts, including many important crops (Middleton 1943).	Present in NZ.
Pythium monospermum Pringsh.	Associated with damping off	Australia (Shivas 1989).	Reported on a large range of hosts, including many important crops (Middleton 1943).	Present in NZ.
BACTERIA				

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Pseudomonadales					
Pseudomonadaceae	*Pseudomonas syringae* pv. *passiflorae* (Reid 1938) Young et al. 1978 (synonym = *Pseudomonas passiflorae* (Reid) Burkholder)	Grease spot	South Africa, Dominica, Australia, NZ (CABI 2019).	*Passiflora* sp., *P. edulis* (CABI 2019).	Present in NZ.