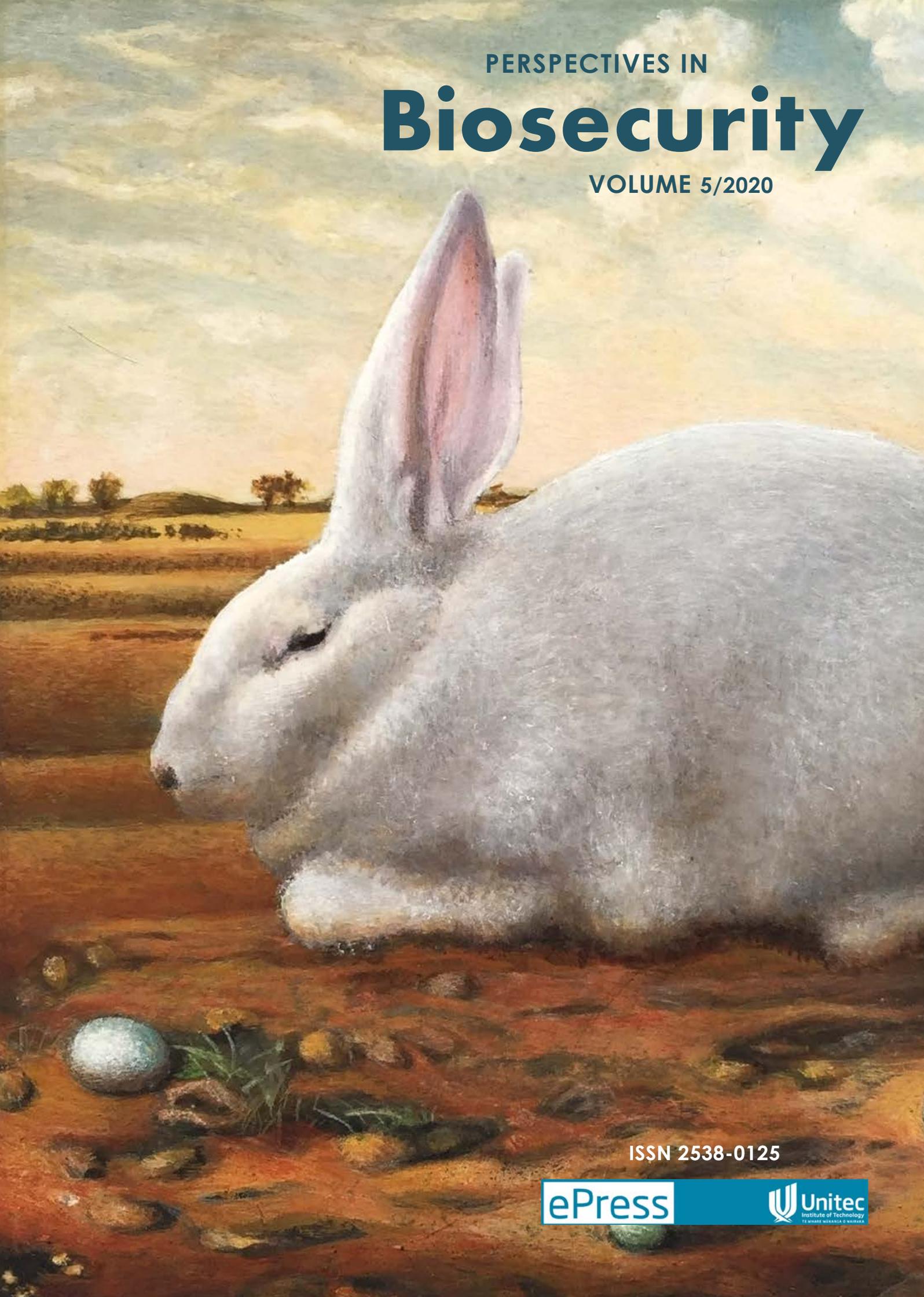


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Cover image: Hamish Foote, *White Rabbit* (detail), 2018, egg tempera on gessoed kauri panel, 115 x 115mm. Private collection.



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When we launched *Perspectives in Biosecurity*, we emphasised the need for a transdisciplinary approach if management of invasive species was to reach beyond the realm of science (Galbraith & Blanchon 2015). While the 'nuts and bolts' (Richardson 2011) of invasion biology is essential to provide evidence-based research to inform management decisions, the comprehensive adoption of biosecurity issues, responses and responsibilities is dependent on collaboration and co-operation across the wider society.

Critical barriers to biosecurity management have been identified to include those that are sociologically based (e.g., Sutcliffe et al. 2018; Rutebemberwa et al. 2020), and limited connectivity between the sectors of biosecurity is still recognised despite a growth of research within the respective disciplines (Hulme 2020). This suggests little change from an analysis of biosecurity research literature a decade ago in which a mere 1.8% of 500 outputs addressed the transdisciplinarity of biosecurity (Richardson 2011). In this issue of *Perspectives in Biosecurity*, we are delighted to present two papers that demonstrate the socio-ecological aspect of biosecurity and two papers representing the ecological 'nuts and bolts.'

The art of Hamish Foote is used as a vehicle to explore both the impact of invasive species and the history of their translocation throughout the globe, and is the second article in *Perspectives in Biosecurity* to do so (see Foote et al. 2017). Our second article celebrates an award-winning community project, Te Arawa Catfish Killas, to manage brown bullhead catfish (*Ameiurus nebulosus*) in the Rotorua Te Arawa Lakes. The Predator Free New Zealand initiative has mobilised communities throughout Aotearoa New Zealand to actively engage in the management of invasive species, and we hope that this model is an inspiration to communities elsewhere.

The third paper is an exploration of the ecological community of an iconic species, the pōhutukawa (*Metrosideros excelsa*), at risk from the recent arrival of myrtle rust (*Austropuccinia psidii*). Understanding ecological complexities of the hosts of myrtle rust is an essential precursor to managing any impacts that may arise from the pathogen. The fourth paper is a further documentation of the ongoing naturalisation of adventive plants in New Zealand.

We thank the authors for their contributions to this issue.

Mel Galbraith and Dan Blanchon
Editors

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The rabbit, the ermine and the gaze: An account of introduction, ramifications and the role art plays as a mechanism to create awareness of scientific issues

Annabel Pretty and Hamish Foote

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The rabbit, the ermine and the gaze: An account of introduction, ramifications and the role art plays as a mechanism to create awareness of scientific issues

Annabel Pretty and Hamish Foote
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Abstract

This paper provides an account of the process and ramifications of the introduction of exotic species into Aotearoa New Zealand during the late 19th century. These introductions, which comprised both flora and fauna, commenced with the voyages of discovery and were motivated in the first instance by the necessity for food. While some species failed to acclimatise, others, such as the rabbit and the domestic cat, flourished, and in time began to wreak havoc on the landscape and existing biota. The response to these unexpected outcomes, which included parliamentary debate and various biological control measures, again produced unexpected consequences. At present in Aotearoa, these include naturalised populations of exotic predators, the occurrence of leucism due to a shrinking gene pool, and a variety of endemic species now poised on the cusp of extinction. The role literature and fine art played during the period of introduction in the 19th century, and continues to play, is also examined. At the outset, 'picturesque' depictions were commonplace; these have given way to more contemporary approaches, which provide a means for understanding, establishing and defining the identity of place and the species that inhabit it. The paper concludes with a case study of a series of contemporary egg tempera paintings, which illustrates various species; draws attention to their status; highlights the consequences of their existence in Aotearoa; and demonstrates how the confluence of art and science can act as a mechanism to raise awareness.

Introduction

"Rabbits, rabbits, rabbits" ('Rabbits' for luck 1909: 208) or "White rabbit, white rabbit, white rabbit": the first person to chant the word rabbit thrice within a household on the first day of the month is considered to gain good luck for the whole month; this tradition

has been conducted in most British Isles homes, if not further afield, for at least the last century. An abundance of rabbits monthly is apt, but why luck, and why further afield? Is it the fact that from the 15th century onwards they were considered an excellent food source? Or is it their predilection for incredible survival, combined with their natural fecundity? These are, after all, essential ingredients in the process of colonisation by flora and fauna.

In Aotearoa, the arrival of exotic species such as rabbits (rāpeti, *Oryctolagus cuniculus*), has occurred through a variety of means. There were assorted rationales for these introductions and the outcomes have been similarly various. Artists and writers have been inextricably entwined in this process and have played a significant role in the establishment of settler, and species, identity (Foote 2004: 8). Picturesque landscape paintings (Phillips n.d.) helped fuel the process of colonisation by English settlers hoping for a new beginning, and early depictions of flora and fauna were an invaluable tool for scientists in the process of cataloguing. In an extension of this relationship artists now work independently, or closely with organisations such as the Ministry for Primary Industries, to help protect and enhance the unique biota of Aotearoa. This is demonstrated by the numerous poster series and brochures featuring artists' impressions of threatened or invasive pests (Ministry for Primary Industries Manatū Ahu Matua n.d.).

An evolving biota and the ramifications

The evolving assortment of flora and fauna in Aotearoa is a result of long-distance dispersal, evolution, and the coming and going of people. However, it is people that have had, by far and away, the greatest impact. South Island traditions speak of ancestral canoes arriving laden with tī kōuka (cabbage trees, *Cordyline*



Figure 1. School boys hanging out rabbit skins to dry, at Petone. *New Zealand Free Lance*. Source: Photographic prints and negatives. Ref: PAColl-5936-22. Alexander Turnbull Library, Wellington, New Zealand. /records/22524466. Published in the *New Zealand Free Lance*, June 1, 1932, p. 25 (photographer unknown).

australis), aruhe (fern root, *Pteridium esculentum*) and mamaku (black tree fern, *Cyathea medullaris*), as well as many species of birds (Salmond 1993: 239). Captain James Cook's (1728–1779) ships were also generously stocked. Emeritus Professor Alan Frost writes, in 'Life on eighteenth-century navy / Life on Cook's *Endeavour*,' of Cook's provisioning of the *Endeavour*:

On the third voyage, Cook left England with a bull, two cows with calves and sixteen sheep 'with a view of stocking Otahiete and the Neighbouring Islands with these usefull animals'. At the Cape of Good Hope he added to these 'two young Bulls, two Heifers, two young stone Horses, two Mares, two Rams, several Ewes and Goats and some Rabbits and Poultry [Turkeys, Geese, Ducks, Guinea fowl, & one Peacock and Hen], all of them intended for New Zealand, Otahiete and the Neighbouring Islands. (Frost 2012: 21)

There were unintended consequences of these early interactions: Norway rats (pouhawaiki, *Rattus norvegicus*) were on the ships of the first settlers in c. 1772, and these were accompanied by cats (ngeru, *Felis catus*) (Cook [1777] 2005). Accounts of the impact of these arrivals followed soon after: Cook's journal

of his voyages includes the first written description, in 1777, of native birds falling victim to predation by cats; Johann Reinhold Forster (1729–1798), naturalist on Cook's second Pacific voyage, also references the relationship of cats and birds in his description of Dusky Sound, Fiordland. His son George Forster (1754–1794) recounted these observations:

This little boldness in reality at first protected them from harm, since it was impossible to shoot them when they approached so near; but in a few days it frequently proved the means of their destruction; for a sly cat on board, had no sooner perceived so excellent an opportunity of obtaining delicious meals, than she regularly took a walk in the woods every morning and made great havock among the little birds, that were not aware of such an insidious enemy. (Forster & Forster 1777: 127–128)

By the 1830s cats had become more common in New Zealand, and after a period of more intense introduction in the late 1870s to control rabbit numbers, their successful naturalisation was ensured. No matter that cats are companionable and useful in keeping rats at bay on ships, they certainly were not an advantageous

introduction to Aotearoa.

The introduction of another exotic species had similarly unintended consequences. The brushtail possum (paihamu, *Trichosurus vulpecula*), now one of the most common and virulent of pests currently in Aotearoa (New Zealand Plant Conservation Network n.d.), was first introduced from Australia in 1837, to Riverton in Southland to initiate a fur-trade industry. They failed to acclimatise on this occasion, but thrived when reintroduced from 1858 at multiple sites, and now occupy up to 95% of farmland, scrubland and bush (Wodzicki & Wright 1984).

Rabbits were introduced in 1838, and their viability as colonisers was soon established. Rampant breeding and the ensuing population explosion resulted in plagues, which scourged the landscape. These occurred in the early 1870s (Papers Past n.d.: 4), again in the 1920s (Wells 2006: 299), and there were population explosions during the 1940s and 1980s (Figure 1). Unfettered, rampant breeding of this creature in the countryside caused mayhem and devastation, bringing despair to the farming community and those caring for pristine native bush (Wodzicki & Wright 1984: 101).

Brown hares (*Lepus europaeus*) arrived in 1851, ferrets (tori hura, *Mustela putorius furo*) in 1879 and the stoat (toriura, ermine, *Mustela erminea*) in 1884; both the rabbit and the hare, like the possum, were introduced for meat and the fur trade. Unfortunately, the absence of an endemic predator for each of these species resulted in exponential growth, particularly within the South Island (Te Wai Pounamu). This was the catalyst for the introduction of ferrets and ermine in an attempt to control them (Wells 2006: 299); it was an optimistic response, given the natural fecundity of rabbits. In 1886, the Chief Superintending Rabbit Inspector, James C. W. Crommelin, provided the following, alarming formula:

Rabbits consort at three months, and at four months the does have their first litter... The progeny, then, of two rabbits left undisturbed, and allowing them to breed only nine times in the year... would amount [in three years] to thirteen million seven hundred and eighteen thousand (13,718,000). (*Evening Star* 1886: 4)

This sobering account appeared in an article entitled 'Rabbits, and how to deal with them,' which was published in Dunedin's *Evening Star* – a clear indication that the farming community of the late 1880s was cognisant of the terrible plague that could result from wild rabbits.

Environmental historian Philippa Wells adds to the discourse in "An enemy of the rabbit": The social context of acclimatisation of an immigrant killer.' She notes that

colonial administrator and politician Sir George Grey (1812–1898), a member of the New Zealand House of Parliament in 1867, was acquainted with the issues and perils of introducing an exotic species to control an earlier import. Grey was also aware of the threat mustelids, such as polecats (*Mustela putorius*), stoats and weasels (*Mustela nivalis*), posed for the bird life of New Zealand. He explained during a parliamentary sitting that the most undesirable of the family were weasels, as "they 'would materially interfere with the agriculture of the country' because they would kill the birds which destroyed the grain-eating insects" (Wells 2006: 303). Much debate regarding the introduction of mustelidae (carnivorous mammals) was held within the committee stage, specifically concerning "the basis that their economic value exceeded their noxiousness" (Wells 2006: 303). On this occasion, a government-sanctioned introduction was formally defeated, at various stages within the legislative process, and introduction was temporarily held off. However, the South Island rabbit boom in 1881, which led to The Rabbit Nuisance Act 1881 (45 VICT 1881 No6), empowered the government to act and as a result, between 1884 and 1886 alone, 4000 ferrets, 3099 weasels and 137 stoats were liberated (Wells 2006: 309).

Environmental researcher Carolyn M. King, in her 2017 journal article 'Pandora's box down-under: Origins and numbers of mustelids transported to New Zealand for biological control of rabbits,' continues the narrative: "Over the 50 years after 1870, upwards of 75,000 ferrets, most imported from Australia or locally bred, were released in the South Island" (para. 1).

These are extraordinary numbers, and are all the more alarming when one considers the species involved. Times have changed, but the mustelid family is now naturalised in Aotearoa and, as zoologists Kazimierz Wozicki and Shelly Wright note: "Thirty-three species of introduced birds and thirty-two species of introduced mammals are now widely accepted as a part of New Zealand fauna" (1984: 79). Opportunistic and accidental introductions of other species continue to occur, ensuring the ongoing modification of the biota of Aotearoa.

Nature and the making of culture

In the early phases of human occupation in Aotearoa, the introduction of species was motivated primarily by the need to establish a reliable food source (Sullivan 1998: 8), but in time a desire to replicate a distant (European) homeland, complete with the comforting sights and

sounds of home, became an important motivation (Crosby 1986). As Philippa Wells states: New Zealand offered a romantically-envisioned, even Utopian, 'Britain of the South' [and] Settlers, who through duty, necessity or desire were compelled to leave a land corrupt, urbanised, overcrowded and polluted, had the 'British plough' to convert the New Zealand 'desert' into 'its original garden-like condition' and the things of 'home' to fill it – including game birds and songsters (for example, pheasants, quail, larks and thrush), shade trees (oak and elm) and small animals (including rabbits and hares). (2006: 299)

The Auckland Acclimatisation Society, established in 1867, provided the means for much of this transformation. They worked feverishly to fill the 'garden' with 'things of home' and in their first year introduced exotic birds, fish and animals of over 30 varieties (Ashby 1967: 34).

Artists were also involved from the outset. Many of them helped to repackage the 'alien' environment of Aotearoa in a more Euro-palatable guise (Foote 2004). Sydney Parkinson (1745–1771) and William Hodges (1744–1797) produced botanical images during the voyages of Captain Cook; during the early years of European settlement Reverend John Kinder (1819–1903), Alfred Sharpe (1836–1908) and John Barr Clarke Hoyte (1835–1913) generated picturesque landscape paintings; and romantic versions of these were produced by Petrus van der Velden (1837–1913). Artists such as the famous, self-taught Liverpoolian animal and anatomical painter George Stubbs (1724–1806) were also instrumental in generating a perception, without leaving Europe, of South Pacific environs. When Sir Joseph Banks (1743–1820), who sailed with Cook on his first voyage to the Pacific, returned to England in 1771 with the pelt of a Kangaroo (Gelder 2018), he commissioned Stubbs to imagine and paint the species. His painting *The Kongouro from New Holland (Kangaroo)* (1772) reveals how adroitly he managed this task (Figure 2). A previous, lengthy investigation of horse forms enabled Stubbs to perceive the skeletal form, and other underlining anatomical details of the kangaroo. In fact, the resultant work could be seen as a metaphor of Stubbs reinterpreting the form of a kangaroo: art triumphing over science. Royal Museums Greenwich describes this episode:

In the absence of live models, the artist worked from written and verbal descriptions provided by Banks himself and, in the case of the kangaroo, a small group of slight pencil sketches made by [Sydney] Parkinson and a stuffed or inflated pelt (now lost) that was in Banks'

possession (n.d.).

Apropos the background, it is picturesque, with more than a passing resemblance to the English countryside. Stubbs, whose artistic practice is inextricably connected to this time and the phenomenon of colonisation, thus assisted in generating an illusion of a South Pacific utopia.



Figure 2. George Stubbs, *The Kongouro from New Holland (Kangaroo)*, 1772, beeswax on mahogany panel, 605 x 715mm. Source: National Maritime Museum Collections, Greenwich, London.

Other animal occupants of these 'fabricated' landscapes have been reimagined at the hand of both authors and artists. Beatrix Potter's (1866–1943) books *Peter Rabbit* (Potter [1901] 1995) and *The Tale of the Flopsy Bunnies* depict rabbits as cute anthropomorphised creatures. Potter's illustrations (Figure 3) are human scale, and wear blue or red coats and blue pinafore dresses. They carry woven shopping baskets and invariably try to escape the clutches of the elderly gardener Mr McGregor – and always just manage to do so (ironically, a tale to learn much from). Miffy,¹ created by Dutch author and artist Dick Bruna (1927–2017) in 1953, continued this saccharine bunny theme, and bunnies continue to be much loved by further generations of children. The Easter mythology, surrounding Easter bunnies, is yet another example and illustrates the means by which 'identity' is generated. These narratives stand in stark contrast to the reality of rabbits' impact on the landscape of Aotearoa.

1 Her name in Dutch, Nijntje, is a contraction of the Dutch 'konijntje' meaning 'little rabbit,' and she is a highly stylised graphic white rabbit with black outlines and orange clothes.



Figure 3. Beatrix Potter, An original illustration of Peter Rabbit from 1902. Source: Wikimedia Commons.

Case study: *White Rabbit, Leucism I and Ermine*

THE ARTIST

Dr Hamish Foote is an artist and architectural educator who has researched the impact of colonisation on native and endemic flora, fauna and landscape (Foote 2004). These investigations often combine (his own) fine-art images with an accompanying text outlining the context and findings. Interdisciplinary collaboration has been a recurring theme, whereby science and art have combined to examine subjects such as placemaking (Foote & Blanchon 2013) – how the introduction of foreign flora and fauna creates a sense of place; the role of art to promote conversation and debate about controversial issues; and the potential spread of invasive species in Aotearoa (Foote et al. 2017). During 2018 and 2019, Foote generated a series of

paintings that focused on endangered endemic species and assorted exotic fauna. A selection of these works, some of which were exhibited in an exhibition entitled *Psalm* in 2019 (Foote & Cornish), is the subject of this case study, where we provide an account of the means artists and galleries employ to communicate: to alert a distracted and often ignorant populous to the perilous state of the natural environment of Aotearoa.

THEMES AND METHOD

Picturesque

The paintings in this case study feature ‘picturesque’ landscapes, which are a reference to the late-19th century period of species introduction and the work of artists such as George Stubbs who were practising at that time. Stubbs’ paintings extend and reveal the eurocentric gaze (a eurocentric painter in a eurocentric landscape), and exemplify the notion of ‘ecological imperialism,’ a term introduced by historian Alfred W. Crosby (1931–2018) in 1986. Crosby highlights this phenomenon in a description of Aotearoa:

In whatever part of either Island they have been planted, European vegetables, fruits, grasses, and many sorts of grain, flourish remarkably, but not more than the different animals which have hitherto been imported, such as rabbits, goats, swine, sheep, cattle, and horses. (Crosby 1986: 249)

Foote is urging the viewer to consider the impact of this colonial eurocentric gaze on Aotearoa; the determination to overwrite endemic bush with picturesque 19th-century depictions. It was of course motivated, in part, by the craving of homesick settlers for the sounds, smells and sights of their homeland – a yearning for the familiar as opposed to the foreign – but at what cost?

White animals

The striking whiteness of each subject, with connotations of purity, is a recurring theme within the paintings. This theme may be interpreted in a variety of ways, but there are two distinct yet entwined readings. One draws on the pragmatic world of science, while the other is concerned with paradox.

Science

In the case of the rabbit and the kiwi, whiteness is due to leucism or partial albinism, which transpires when genetic bottlenecks (Makino et al. 2018) occur within a species as a result of “a multitude of variables: artificial

selection, such as within pedigree breeding [rabbits]; partial extinction, due to introduced species predated on the creature [kiwi]; or a reduction in population size” (Foote & Pretty 2020: 216).

Ermine presents itself with its white winter coat, which is an evolutionary adaptation to ensure survival in winter habitat (Pallardy n.d.), as opposed to any manifestation of leucism.

Paradox

Humans have a fascination with leucistic or albino (white-coloured) native and endemic fauna, as illustrated by the frequent news items concerning these animals (Hanne 2020), and the white heron (kōtuku, *Ardea modesta*) has mythical status for Māori because of its rarity and beauty. The white rabbit is also compelling, as a result of its long association with magic (Middleton 2020). However, the delight and wonder associated with encountering these curiosities disguises an uncomfortable truth: the increasing incidence of leucism in a species reflects a plummeting gene pool and may imply impending extinction (Rayner 2019). To make matters worse, white specimens are conspicuous and therefore more vulnerable to predation. The ermine, in contrast, has connotations of prestige and exclusivity, as a result of a long-running association with royalty and the upper echelons of civilisation. In light of this, the devastating impact of this species on the unique birdlife of Aotearoa (New Zealand Plant Conservation Network 2019) is a horrific paradox.

Composition

The depiction of a subject in profile, prioritised within the frame, is a recurring strategy in the collected works. On one hand it is a reference to standard scientific practice, and also police mugshot protocol, that privileges a record of defining characteristics. On the other it is intended to bring a certain gravitas to the works by association with history, in particular the depictions of deities, monarchs and emperors on coins. In the history of painting, there are obvious parallels with the work of European artists, such as Piero della Francesca’s (1416/17–1492) *The Duke and Duchess of Urbino Federico da Montefeltro and Battista Sforza* (Figure 4). This desire for ‘gravitas’ reflects the serious underpinning themes of habitat loss, predation and extinction.

Medium and technique

The paintings are executed with egg tempera on gessoed kauri panel. The use of this historical and exacting medium



Figure 4. Piero della Francesca, *The Duke and Duchess of Urbino Federico da Montefeltro and Battista Sforza*, c. 1473–1475, oil on wood, 470 x 330mm each. Source: Le Gallerie Degli Uffizi, Florence.

reinforces associations with Renaissance portraiture and contributes to a sense of sobriety. The notion of a native kauri panel overlaid with (European) gesso and a picturesque landscape replicates the process of colonisation whereby native bush was overlaid with a neo-European alternative (Grey 1994: 17).

THE PAINTINGS

White Rabbit

The painting *White Rabbit* (2018, Figure 5), featuring its namesake, alludes to various allegories: the three eggs in the foreground are representational of rebirth and of fertility – they unambiguously draw attention to the Easter mythology surrounding Easter bunnies and eggs; the association of whiteness with purity; and the obvious reference to the magician’s prop. These buoyant themes of fertility, resurrection, purity and magic are contrasted with a desiccated landscape, which hints at the impact of this established pest. This darker, antithetical side exemplifies the necessity for the core biosecurity principle of prevention, and failing that, eradication or management (Biosecurity New Zealand Tiakitanga Pūtaiao Aotearoa 2020). As mentioned previously, the distant land and sky scape are intentionally picturesque – in this instance, they have been appropriated from the George Stubbs painting *Turf, with Jockey up, at Newmarket*.



Figure 5. Hamish Foote, *White Rabbit*, 2018, egg tempera on gessoed kauri panel, 115 x 115mm. Private collection.



Figure 6. Hamish Foote, *Leucism I*, 2019, egg tempera on gessoed kauri panel, 115 x 115mm. Private collection.



Figure 7. Hamish Foote, *Ermine*, 2019, egg tempera on gessoed kauri panel, 115 x 290mm. Private collection.

Leucism I

Leucism I (2019, Figure 6) depicts a leucistic kiwi (tokoeka, *Apteryx australis*). There is an underlying paradox in this image: the wonder and rarity of this spectacle belies the foreboding dimension of leucism, and the precarious status of this species. The desiccated bones in the foreground emphasise the transience of life in the manner of vanitas painting, and reveal the unexpected impact of introduced species on endemic fauna. As we are now aware, the ermine has had no real impact on the reduction of the rabbit population. Kiwi, on the other hand, have not been as fortunate. Most species are now listed as either vulnerable or endangered (Robertson & Miskelly 2013) with the mustelid their most feared predator (Department of Conservation Te Papa Atawhai n.d.).

Ermine

Foote's painting *Ermine* (2019, Figure 7) draws attention to unexpected outcomes arising from the introduction of an exotic species to control an earlier arrival. It is not only rabbits and ground-nesting birds such as the kiwi that are endangered by this predator. Mustelids are excellent climbers and will attack, kill and eat eggs, chicks and even full-grown native tree-dwelling birds (Taylor 2020). The lonely kererū (wood pigeon, *Hemiphaga novaeseelandiae*) feather in the foreground alludes to this alarming reality. In the background, to left and right, are stands of native bush, receding bays and offshore Islands, all of which are easily accessible and a happy hunting ground for this voracious predator (Taylor 2020).

The three images in this case study are all concerned with the ramifications of colonisation, in particular the unexpected impact of introduced species on endemic fauna.

Art as a mechanism for raising awareness

Why do we need artists, designers and writers to repackage, elucidate and reinforce the clarion call of scientists? Why is it useful that we have other forms of consuming information, and why is it important? Educationalists Stathis Stivaktakis and Evangelia Krevetakis, who work within the field of education and science, discuss the merits and essential necessity for the arts to highlight and to reformulate scientific notions; to recast them in a more tangible, accessible modality for a wider audience to consume. They suggest, “Art... by encouraging a more focused way of seeing reality... can facilitate a change in... perspective/outlook on the world in general” (Stivaktakis & Krevetakis 2018: 69). The repackaging and re-presentation of information can be very beneficial, whether it be raising awareness of kauri dieback (The Kauri Dieback Programme 2014), or alerting the population to the arrival of an invasive pest, such as the gypsy moth (*Lymantria dispar*) (Ministry for Primary Industries Manatū Ahu Matua, 2020) or the brown marmorated stink bug (*Halyomorpha halys*).

These types of biosecurity issues are now being highlighted by artists, and made palatable and consumable for the ‘everyday person.’ As mentioned, artists are working with scientists to produce visual material, such as posters and brochures, to reach a wide audience with an immediacy and impact, more reminiscent of an aggressive advertising campaign, or the propaganda machinery of nations during wartime. In the case of galleries and fine art, perhaps not all patrons will comprehend, in the first instance, the depth or complexity of biosecurity issues addressed in images such as *White Rabbit*, *Leucism I* and *Ermine*; viewers and consumers may privilege and enjoy the mechanism of style and aesthetics but, fortuitously, there are advantages in the public nature of exhibitions. The theatre of the opening night, and the accompanying press coverage, provoke dialogue and allow for the dissemination of more complex, underpinning concepts to a wide audience. The opportunity to supplement images with an informative narrative, as occurred with *Psalm* in *The New Zealand Herald* (2019), reinforces the merits of using art as a mechanism to raise awareness.

Conclusion

The remoteness and isolation of Aotearoa, which once insulated and enabled the evolution of unique flora and fauna, ended as the ‘voyages of discovery’ began. As outlined, a flood of species entered and mingled with

our endemic biota during the late 19th and early 20th centuries, with devastating consequences. As stated earlier, the number of now-naturalised exotic species is extraordinary, and the extent to which our environment has been modified seems to have escaped the notice of many New Zealanders. The grim reality of leucism, as a harbinger of potential extinction, seems also to have eluded attention – the focus instead resides in the category of wonder and novelty. Foote’s paintings, which are just one of the many manifestations of a type of citizen science (Bonney et al. 2016) occurring throughout the globe, provide a means to address this deficit, and to educate; an opportunity for the voice of science to be interpreted and amplified so as to reach a wider audience. The fact that it is possible to elucidate and consume science in multifaceted ways makes our society much stronger, and perhaps counters the damage of science denialism. As Polish artist Magdalena Abakanowicz states, “Art does not solve problems but makes us aware of their existence. It opens our eyes to see and our brain to imagine” (Grounds for Sculpture n.d.).

Multidimensional understandings can be cultivated, and colonial narratives reframed in a more contemporary modality – one that allows us to gaze at, and hopefully learn from, the past: no matter how cute the rabbit, the ermine (or the cat) is, their introduction to Aotearoa has had devastating consequences.

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Iwi and local government partnerships in biosecurity: A case study of Te Arawa Catfish Killas in response to a pest fish incursion in the Bay of Plenty, New Zealand

Lucas MacDonald and William Anaru

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Iwi and local government partnerships in biosecurity: A case study of Te Arawa Catfish Killas in response to a pest fish incursion in the Bay of Plenty, New Zealand

Lucas MacDonald and William Anaru

Abstract

Māori are the indigenous people of New Zealand and throughout the country, local government relationships with hapū (a group or family from a common ancestor) and iwi (a post-colonial term for groups of hapū who have common ancestral links or share a geographical location) are critical to the sustainable management of natural resources. Here we describe an initiative formed in response to an incursion of brown bullhead catfish (*Ameiurus nebulosus*) in Lake Rotoiti and (as of December 2018) Lake Rotorua, two of the ancestral lakes under the mana whakahaere (a self-determination and decision-making role) of Te Arawa Lakes Trust. The programme involves a full-time staff member from Te Arawa Lakes Trust working directly alongside the Bay of Plenty Regional Council to progressively contain the catfish population in Lakes Rotoiti and Rotorua. To date, this project has removed over 80,000 catfish from the lakes, generated significant research findings, engaged over 500 volunteers and delivered an educational programme to over 1500 school students across the district. This partnership approach to a biosecurity project has strengthened relationships between local government, iwi, hapū and the wider community while delivering positive environmental outcomes.

Introduction

The need for greater participation of stakeholders and communities in the management of natural resources has become widely accepted in recent years (Allen et al. 2018). Wider stakeholder engagement is crucial to capturing local knowledge, with scientific organisations and regulatory agencies no longer seen as the sole repositories of relevant knowledge and expertise (Aslin & Lockie 2013). It is widely acknowledged that indigenous peoples have traditional knowledge relevant



Figure 1. Juvenile brown bullhead catfish (*Ameiurus nebulosus*). Photograph: Bay of Plenty Regional Council.

to modern environmental management (Lambert et al. 2018). Indigenous knowledge in New Zealand is referred to as mātauranga Māori, and has an increasingly important role including protection of our biological heritage from biosecurity risks and threats (Lambert et al. 2018). The traditional Māori worldview acknowledges a natural order, built around the living and non-living and the central belief that all parts of the environment are interrelated or interdependent through the domains of Atua (a being with god-like attributes) or departmental gods (Harmsworth & Tipa 2006). Te Arawa Lakes Trust (TALT) is a key management partner in the Rotorua Te Arawa Lakes, representing 56 hapū (a group or family from a common ancestor) from the confederated tribes of Te Arawa, Ngā Pumanawa e Waru o Te Arawa, and is the legal owner of 14 of the Te Arawa Lakes under the Te Arawa Lakes Settlement Act 2006. The Bay of Plenty Regional Council (BOPRC) is a regulatory agency with multiple statutory requirements to sustainably manage natural resources in the Bay of Plenty region. BOPRC works towards the vision of “Thriving Together – mō

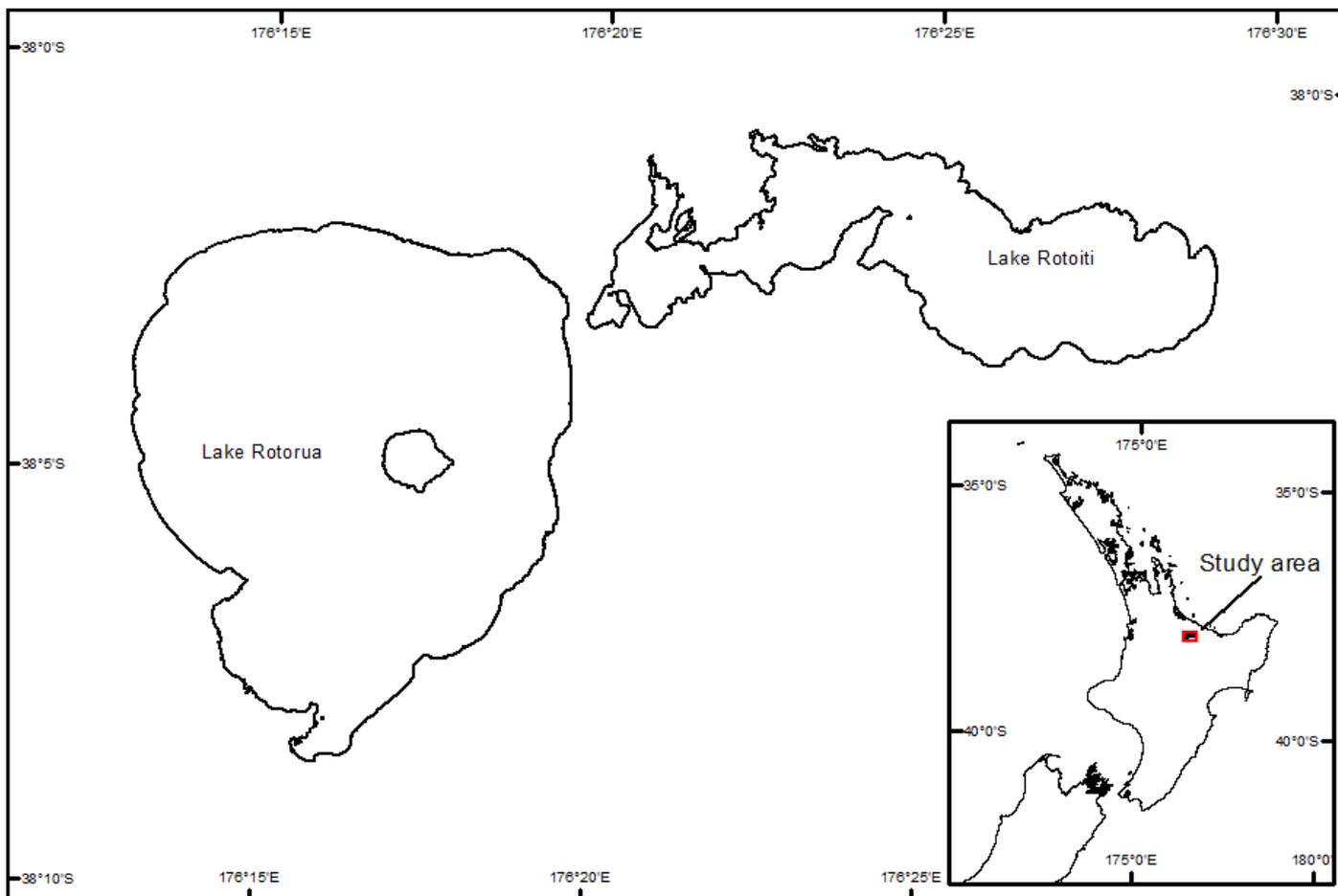


Figure 2. Lake Rotorua and Lake Rotoiti, Bay of Plenty, New Zealand. Brown bullhead catfish were discovered in Lake Rotoiti in March 2016 and Lake Rotorua in December 2018. Source: Bay of Plenty Regional Council.

te taiao, mō ngā tāngata,” and focuses on delivering a healthy environment, fresh water for life, safe and resilient communities and a vibrant region. TALT’s strategic goal of “Te mā o te wai e rite ana kia kite i ngā tapuwae ā te kōura” (the quality of the water is such that you can see the footsteps of the kōura) ensured that both parties’ aspirations aligned when the brown bullhead catfish (*Ameiurus nebulosus*), considered a noxious, unwanted species under the Bay of Plenty Regional Pest Management Plan (RPMP), was first discovered.

The discovery of brown bullhead catfish in the Rotorua Te Arawa Lakes

Globally, the successful management of large self-sustaining pest fish populations is considered difficult (LERNZ 2015). Brown bullhead catfish (Figure 1) have been reported as having unanticipated adverse effects on native ecosystems (Froese & Pauly 2017). The first live capture of catfish in the Bay of Plenty lakes was in March 2016 by a mechanical weed harvester operating in Te Wētā Bay, Lake Rotoiti.

The live capture generated significant political and public concern around the long-term ecological, cultural

and economic impacts caused by the catfish incursion and the risk of further spread to more of the Rotorua Te Arawa Lakes. Generally, impacts of *Ameiurus nebulosus* in New Zealand waterbodies occur through the combined effects of nutrient excretion, bioturbation, predation, food-web modification and interspecific aggression and competition (Dedual 2019). These direct impacts can lead to loss of macrophytes and a decline in water quality. Although difficult to quantify and not well researched, there is potential for an economic aspect to the local impact in the form of decreased tourism. To Māori, kōura (freshwater crayfish, *Paranephrops planifrons*) are a taonga (treasured) species, an important traditional food source (Hiroa 1921) and an indicator of lake health (Te Arawa Lakes Trust 2019). The proliferation of catfish within Lake Rotoiti has negatively impacted kōura populations, especially in locations where catfish are in high abundance (Francis 2019). Following the initial discovery, delimiting netting surveys using fyke nets were undertaken across Lakes Rotoiti and Rotorua, and Lake Tarawera (a high-use lake in the area), to determine the distribution of catfish. Subsequent to the delimiting survey, the Bay of Plenty Regional Council engaged a

contractor to undertake systematic fyke netting across Lake Rotoiti between September and May annually to reduce the number of catfish in high-density areas.

Management strategies for a pest fish incursion

The RPMP classification of catfish states that eradication must be attempted should the species be found in the Rotorua Te Arawa Lakes. Therefore the Bay of Plenty Regional Council established a co-management response with the Te Arawa Lakes Trust. Initially, it was proposed that BOPRC would manage the operational, research and communication components of the programme, with TALT managing the community-engagement response. This has since evolved to both parties collaborating heavily on all aspects of the programme with each party providing a unique perspective on a contemporary issue. Fundamentally, the aim of the response is to protect the unique cultural, environmental, social and economic values of the Rotorua Te Arawa Lakes and reduce the likelihood of this pest fish being introduced to other waterbodies.

Community engagement

The project Te Arawa Catfish Killas is a key component of the response. It is funded from the operational budget outlined in the RPMP and resources TALT to establish a full-time co-ordinator, managed by TALT. William Anaru (Ngāti Whakauae, Ngāti Tūwharetoa, Te Whānau-ā-Apanui), as a full-time co-ordinator, has engaged members of the community to undertake regular pest fish control and surveillance while also becoming local ambassadors for the protection of their lakes. The volunteers are from a range of backgrounds, including educational institutions (early childhood, primary, secondary and tertiary), aged-care facilities, at-risk youth and lakeside residents. Volunteers undertaking netting can contribute to and observe the temporal and spatial catch rates of catfish throughout the lakes using a custom electronic application developed by Regional Council, through ArcGIS Survey123 (Esri, Redlands, USA). The data is then analysed to determine catch rates relative to effort, which then inform contractors of where high-intensity netting should be undertaken. The second component of Te Arawa Catfish Killas is an education programme that has been delivered to over 1500 primary- and secondary-school students in both English and te reo Māori (the language spoken by the indigenous people of New Zealand and Cook Islands), within a focus on the



Figure 3. William Anaru of Te Arawa Lakes Trust holding a brown bullhead catfish, with Te Arawa Catfish Killas onlookers. Photograph: Te Arawa Lakes Trust.

wider biodiversity of the Rotorua Te Arawa Lakes. The work is undertaken in line with the values framework established by Te Arawa Lakes Trust: Te Tūāpapa o ngā wai o Te Arawa – Waiora, Waiata, Waiariki (TALT n.d.). Students implement mātauranga and tikanga in a variety of ways, including performing a karakia after native fish are released back into the waterbody, and learning the history, whakapapa and kōrero of the land they are present on. Some students investigate the patterns of native species catch and how this may align with the Maramataka (the Māori calendar).

Outcomes and discussion

Human vectors are the highest risk factor in catfish proliferation throughout the Rotorua Te Arawa Lakes. For this reason, increased awareness and community engagement are considered crucial for the generational behaviour change that is fundamental to the reduction of the long-term risk for this vector. The current operational approach is suppressing the catfish population and containing catfish within the Rotorua catchment. Ongoing investment in research initiatives ensures that long-term eradication or further suppression options are investigated, while a hands-on community-engagement

approach ensures that public support is maintained until such breakthroughs become available. The educational programme throughout schools surrounding the Rotorua Te Arawa Lakes ensures the role of kaitiaki (a person who has responsibilities for the care and protection of a specific area, specific process or area of knowledge) is passed on to the next generation. Kaitiakitanga has been enhanced, and will continue to increase for the foreseeable future, as the majority of students have not been engaged in freshwater biosecurity prior to this programme being established. By having such a large pool of volunteers and students, an increase in awareness of taonga species and pest species alike is certainly occurring, and is reflected in advocacy and awareness data that the Bay of Plenty Regional Council collects annually.

To date, the co-management approach has removed over 150,000 catfish from the Rotorua Te Arawa Lakes. Over 750 volunteers are engaged in regular fyke netting across the Rotorua Te Arawa Lakes, which has removed over 30,000 catfish. Taking into account nets set per year, the substantial effort by volunteers has contributed to an 18% decrease in catfish catch between the 2018 and 2019 seasons. Fyke netting in five other currently catfish-free lakes is undertaken by volunteers as a cost-effective surveillance tool in combination with environmental DNA surveillance. The collaborative effort ensures the community feels they are making a contribution to the care and protection of their lakes. Throughout the response, the Te Arawa Catfish Killas project has been recognised as a blueprint for a partnership approach to biosecurity, having been awarded the Department of Conservation Pihanga New Initiatives Award and the Supreme Award at the Kō Tātou Biosecurity Awards in November 2019. In May 2020, the

Bay of Plenty Regional Council and Te Arawa Lakes Trust were recognised in the Society of Local Government Managers (SOLGM) Excellence Awards as winners of the Supreme Award, along with the Te Puni Kōkiri Award for Bicultural Leadership. The Te Arawa Catfish Killas project has been commended for the positive behaviour change in at-risk youth, and the educational programme has reached over 25 schools, with over 1500 students participating in lessons in the classroom. A 20% growth in this service is expected in 2020. The Te Arawa Catfish Killas project reaches over 30,000 recipients on social media and is often utilised to promote freshwater biodiversity within the Rotorua Te Arawa Lakes (Figure 3).

Overall, the approach of involving iwi and hapū in decision making, and resourcing iwi to lead projects that have previously been undertaken in-house by local or central government, has been shown here to strengthen relationships between iwi and local government. This model of managing a natural-resource issue is widely applicable globally and is shown here to be an effective and authentic way to engage with communities, incorporate tikanga (activities and processes associated with ensuring the cultural safety of oneself and the wider community), kaitiakitanga and general indigenous knowledge on contemporary issues to provide for positive environmental outcomes.

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Ecological communities of tree species threatened by myrtle rust (*Austropuccinia psidii* (G. Winter) Beenken): The lichenised mycobiota of pōhutukawa (*Metrosideros excelsa* Sol. ex Gaertn., Myrtaceae)

**Dan J. Blanchon, Dhahara Ranatunga,
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Ecological communities of tree species threatened by myrtle rust (*Austropuccinia psidii* (G. Winter) Beenken): The lichenised mycobiota of pōhutukawa (*Metrosideros excelsa* Sol. ex Gaertn., Myrtaceae)

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Abstract

Myrtle rust (*Austropuccinia psidii*) poses a serious threat to the New Zealand Myrtaceae. While the threat to the host tree is reasonably well-known, the threat myrtle rust poses to the associated biota is poorly understood. As a contribution to our knowledge of this, a preliminary list of the lichenised mycobiota that utilise pōhutukawa (*Metrosideros excelsa*) as a phorophyte is presented, based on a survey of the specimens in two herbaria with extensive collections from the natural range of this endemic tree species. We report 187 lichen species (and lower ranks) from 76 genera and 32 families.

Introduction

New Zealand has 28 indigenous Myrtaceae (de Lange & Rolfe 2010; de Lange 2014; Schönberger et al. 2020); all are endemic, with the exception of *Leptospermum scoparium* J.R.Forst. et G.Forst. as currently circumscribed. Probably the best known of the indigenous Myrtaceae is pōhutukawa (*Metrosideros excelsa* Sol. ex Gaertn.), the so-called New Zealand Christmas tree, a widely acknowledged iconic species, which is popular throughout New Zealand, and indeed worldwide, as an ornamental (Simpson 2005; Bylsma et al. 2014) (Figure 1). While the tree is culturally important, it and the leaf litter it produces are also a critical food source and habitat for a diverse array of life (Anderson 2003; Bylsma et al. 2014; Cummings et al. 2014; Galbraith & Large 2017; Hosking & Hutcheson 1993; Pattemore & Wilcove 2012; Schmidt-Adam et al. 2000; Taylor et al. 2007).

Pōhutukawa is part of a Pacific radiation centred on *Metrosideros collina* (J.R.Forst. et G.Forst.) A.Gray (Wright et al. 2000; Gardner et al. 2004). The biological flora of the species was reviewed by Bylsma et al.



Figure 1. Pōhutukawa (*Metrosideros excelsa*). (A) Mature trees, Tāwharanui, Omaha Bay, North Auckland. Photograph: A. J. Marshall. (B) Flowers, Tawhitokino Beach, east of Papanui Point, Kawakawa Bay, South Auckland. Photograph: P. J. de Lange.

(2014), who considered it indigenous to the northern portion of the North Island of New Zealand, ranging from Manawatāwhi Three Kings Islands south to Urenui (38° 59' 28.76" S) in the west and to Poverty Bay (38° 45' 29.715" S) in the east (Bylsma et al., 2014) (Figure 2), though exact southern limits are unclear due to possible plantings by iwi and more recently European settlers.

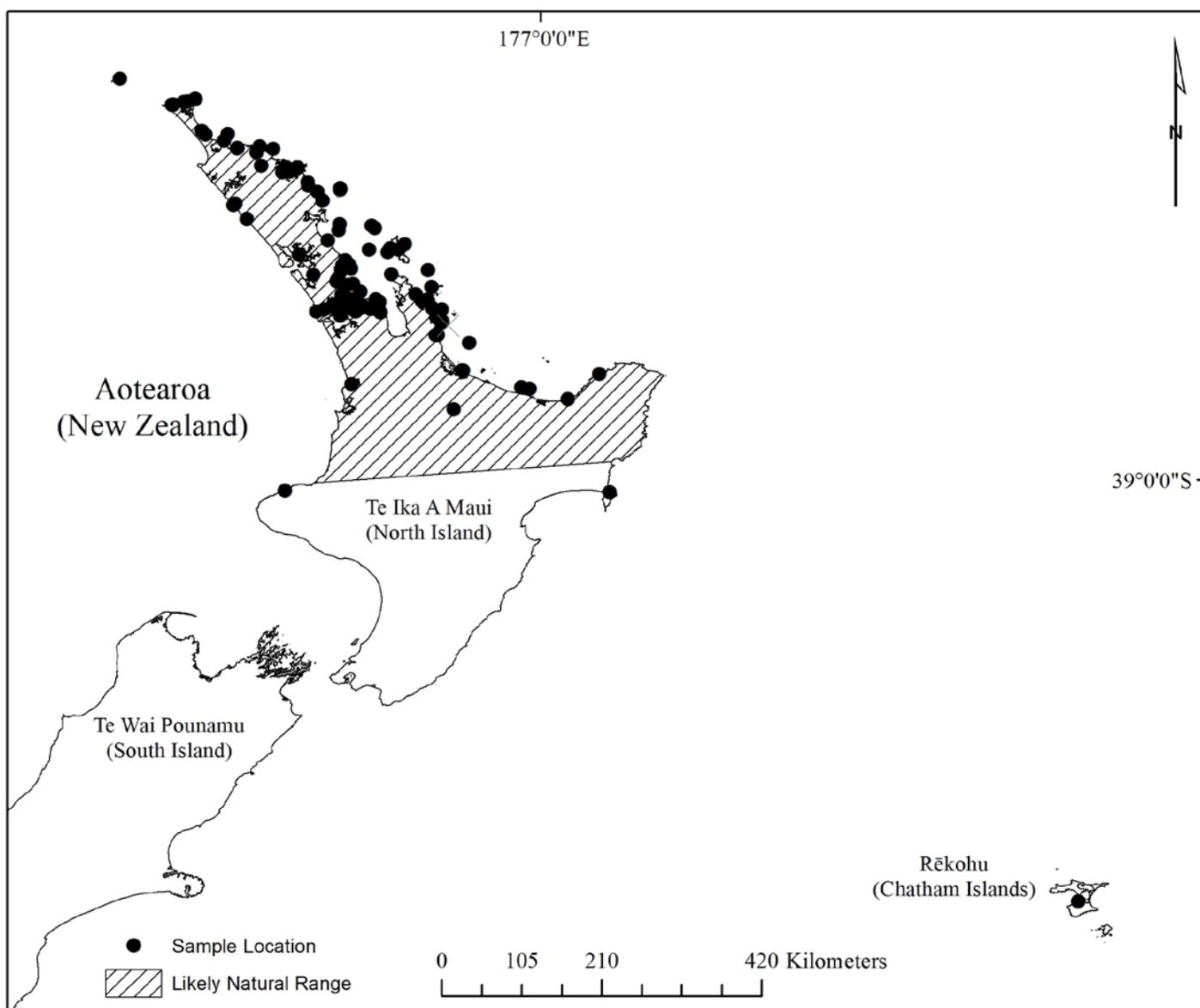


Figure 2. Locations from where lichen collections in AK and UNITEC have been made from pōhutukawa (including cultivated and natural occurrences of this phorophyte). The approximate natural southern limit of pōhutukawa as judged by Bylsma et al. (2014) is also shown. Image: Andrew Marshall.

Myrtle rust (*Austropuccinia psidii* (G. Winter) Beenken) was first reported from New Zealand in May 2017, after which it has spread rapidly throughout the North Island and northern South Island (Galbraith & Large 2017; Beresford et al. 2018). Although the full impact of myrtle rust on New Zealand Myrtaceae is still unknown, based on the Australian experience it may take a decade or more before this becomes evident (Carnegie et al. 2015; Carnegie & Pegg 2018; Fensham et al. 2020). Nevertheless, during the early stages of the establishment of that rust in New Zealand pōhutukawa (Figure 3) was one of the indigenous Myrtaceae that was found to be attacked (Toome-Heller et al. 2020). Due to concerns over the spread of myrtle rust and

its projected impacts on New Zealand Myrtaceae, as a precautionary measure, pōhutukawa was listed as 'Threatened – Nationally Vulnerable' by de Lange et al. (2018a).

The arrival of myrtle rust has prompted the need to better understand the ecological communities of our indigenous Myrtaceae. Currently there is some information available. Bylsma et al. (2014), for example, note that 16 fern and flowering plant taxa have been reported epiphytic on pōhutukawa. McKenzie et al. (1999) also published an annotated list of all of the fungi known from pōhutukawa that was part of a wider study of *Metrosideros*, although this excluded lichenised fungi. Two hundred and nine species were recorded, mainly



Figure 3. *Austropuccinia psidii* infection on epicormic growth of pōhutukawa (*Metrosideros excelsa*), Āwhitu Peninsula, vicinity of Manukau Lighthouse Station. Photograph: P. J. de Lange.

saprobies, but some endomycorrhizal fungi and primary or secondary pathogens were also included (McKenzie et al. 1999; Bylsma et al. 2014). Recently, Johnston and Park (2019) described a new species of leaf spot fungus *Blastocervulus metrosideri*, which is endemic, or nearly so, to pōhutukawa. The lichen mycobiota of pōhutukawa is less well-known. Pōhutukawa forest is thought to be important habitat for lichens (Blanchon 2013), particularly large foliose species such as *Pseudocyphellaria coriacea* and *Crocodia aurata* (Galloway 1988), and fruticose species such as *Ramalina australiensis* and *R. pacifica* (Blanchon et al. 1996), *Usnea nidifica* and *U. rubicunda* (Galloway 1985; Galloway 2007b). Useful but very local accounts are available of the lichens associated with pōhutukawa for Aotea Great Barrier Island (Hayward et al. 1986), Rangitoto Island (Blanchon et al. 2007), Motu Kaikoura (Blanchon et al. 2011) and Tuhua Mayor Island (de Lange et al. 2012), but there is a need for an in-depth survey of the lichens associated with pōhutukawa over

its full natural range.

To help rectify that apparent knowledge gap we provide a preliminary contribution to that need by listing the lichenised mycobiota that utilise pōhutukawa as a phorophyte. This contribution is not intended to be comprehensive, we have only examined herbarium holdings in two herbaria, AK and UNITEC (Thiers 2020–onwards) but nevertheless this list constitutes the first freely available compendium of lichenised mycobiota yet published for pōhutukawa.

Methods

The databases of AK and UNITEC were queried for lichen collections that specifically stated that pōhutukawa was the substrate. From that data we compiled a master list of lichenised and lichenicolous mycobiota. Any problematic taxa were then physically examined to resolve the names used for them in either herbarium.

Results and Discussion

From our sampling we report 187 lichen species (and lower ranks) from 76 genera and 32 families (Appendix 1), which include 25 of the lichen species currently believed to be endemic to New Zealand (Galloway 2007a, 2007b; authors' unpublished data). This represents 9% of the 2026 lichenised mycobiota and associated lichenicolous taxa reported for New Zealand by de Lange et al. (2018b). These figures, considering that our assessment is based on lichen holdings in just two of New Zealand's 14 herbaria (New Zealand National Herbarium Network n.d.) is almost certainly an underestimate of the full diversity associated with pōhutukawa. Galloway (2007a, 2007b) also recorded 44 of these species as being common or occasional associates of pōhutukawa forest.

The lichens associated with pōhutukawa held in AK and UNITEC came from c.109 locations, 12 of which were from cultivated trees. The locations mainly occur within the natural range of pōhutukawa with a bias toward the eastern extent of the species (Figure 2). Westerly locations with the exception of the Auckland isthmus are under-represented (Figure 2). Notably, offshore islands are well represented in the collections. These are patterns that reflect the field bias of the main lichen collectors, many of whom undertook field work on offshore islands or visited remote locations. The dominance of Auckland localities also reflects collector bias as the majority of collectors, J. Bartlett, D. Blanchon, E. Cameron, P. de Lange, G. Hayward, B. Hayward, A. Marshall and A. Wright, either reside

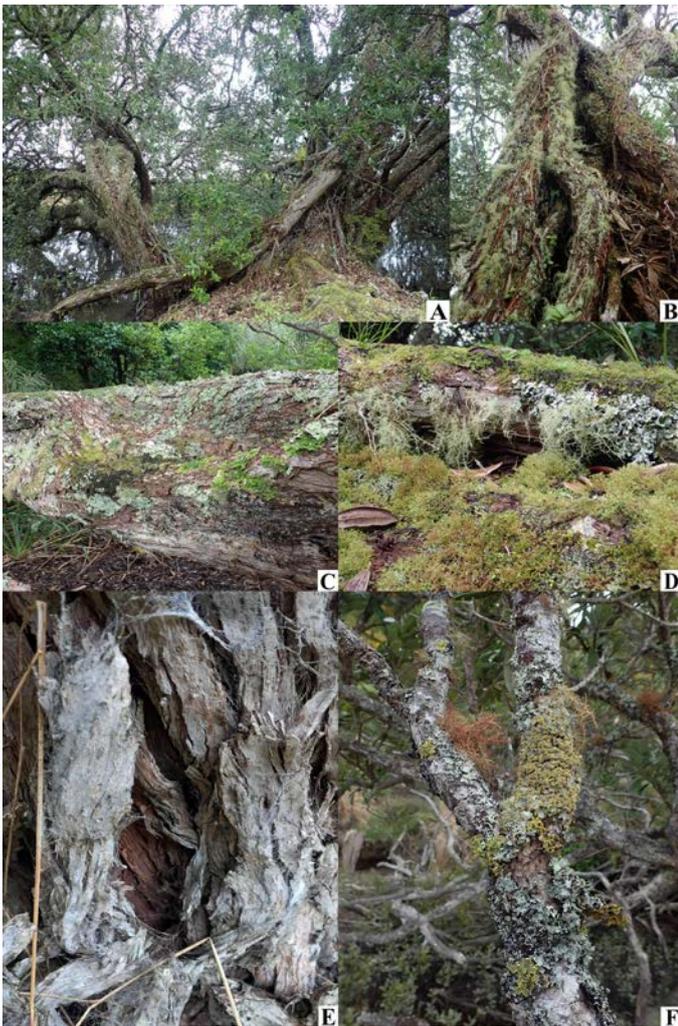


Figure 4. Examples of some pōhutukawa microhabitats. (A) Mature tree. (B) Trunk and aerial roots. (C) Horizontal branch. (D) Root mound and exposed roots. (E) Tree cavity. (F) Canopy branchlets. Photographs: Peter de Lange.

or once resided there. These general patterns are identical to those noted by de Lange et al. (2012) in the first nationwide assessment of the threat status of New Zealand lichenised and lichenicolous mycobiota. Further, despite the wide range of locations represented in AK and UNITEC herbaria, we could find no evidence of systematic lichen collection from pōhutukawa. Based on these herbarium records and field observations, a characteristic lichen assemblage can be identified as being associated with pōhutukawa, and some taxa may favour it as a substrate. Indeed, well-established pōhutukawa provide a diversity of habitats and micro-niches for lichens. These include root mounds, exposed roots (ground and aerial), trunks, tree cavities, vertical and horizontal branches, branchlets, and dead or dying branches and branchlets (Figure 4).

At humid, less-modified sites, photophilous

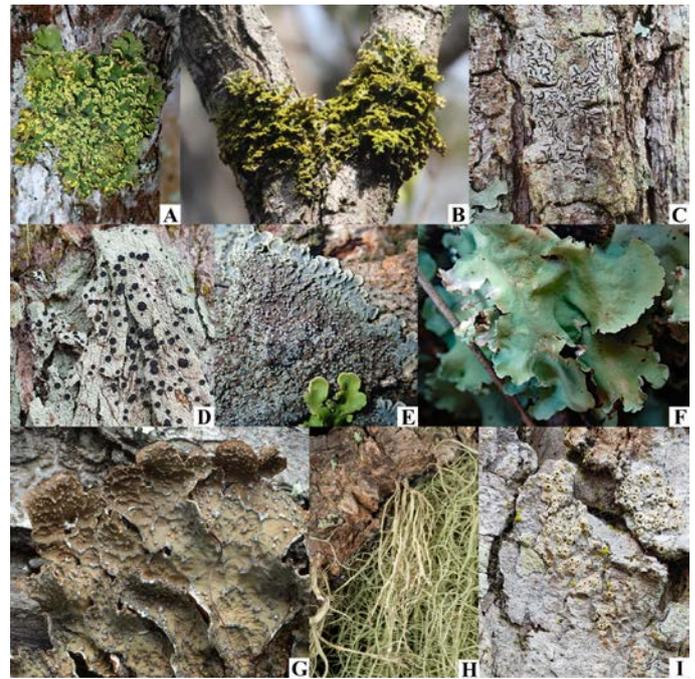


Figure 5. Examples of the diversity of lichens found on pōhutukawa. (A) *Crocodia aurata*. Photograph: M. Hutchison. (B) *Crocodia poculifera*. Photograph: K. A. Raharaha. (C) *Halegrapha mucronata*. Photograph: A. J. Marshall. (D) *Megalaria grossa*. Photograph: A. J. Marshall. (E) *Pannaria elixii*. Photograph: P. J. de Lange. (F) *Parmotrema robustum*. Photograph: P. J. de Lange. (G) *Pseudocyphellaria haywardiorum*. Photograph: R. Lücking. (H) *Ramalina pacifica*. Photograph: A. J. Townsend. (I) *Thelotrema lepadinum*. Photograph: A. J. Marshall.

foliose species of Parmeliaceae such as *Hypogymnia subphysodes*, *Menegazzia neozelandica*, *Parmotrema austrocetratum*, *Parmotrema crinitum*, *Parmotrema perlatum*, *Parmotrema reticulatum*, *Parmotrema subtinctorium*, *Parmotrema tinctorum*, and similarly members of the Peltigeraceae such as *Crocodia aurata* (Figure 5), *Crocodia poculifera* (Figure 5), *Podostictina pickeringii*, *Pseudocyphellaria carpoloma*, *Pseudocyphellaria coriacea*, *Pseudocyphellaria crocata*, *Pseudocyphellaria montagnei* and *Sticta squamata* are commonly encountered. Other foliose lichen species such as *Coccocarpia erythroxyli*, *Dirinaria applanata*, *Heterodermia speciosa*, *Pannaria allorhiza*, *Pannaria elixii* (Figure 5) and *Pannaria fulvescens* are also often present. The exposed trunks and canopy branches of pōhutukawa trees usually support a diverse range of fruticose lichens, including *Ramalina australiensis*, *Ramalina celastri*, *Ramalina pacifica* (Figure 5), *Ramalina peruviana*, *Teloschistes chrysophthalmus*, *Teloschistes flavicans*, *Usnea inermis* and *Usnea rubicunda*. Where

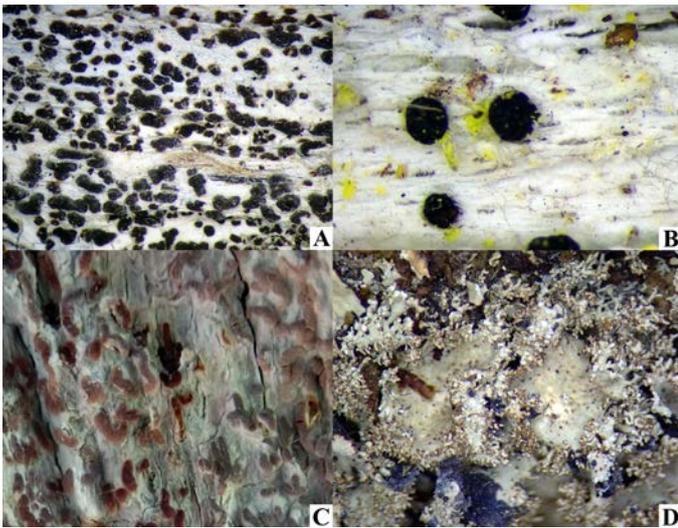


Figure 6. Examples of the diversity of lichens found on pōhutukawa. (A) *Arthonia nigrocincta* Photograph: P. J. de Lange. (B) *Bactrospora metabola* admixed with yellow granules of *Chrysothrix xanthina*. Photograph: P. J. de Lange. (C) *Enterographa pallidella* Photograph: P. J. de Lange. (D) *Hypotrachyna horrescens*. Photograph: P. J. de Lange.

more comprehensive field surveys have been carried out, crustose species such as *Calicium hyperelloides*, *Calicium lenticulare*, *Chaenotheca brunneola*, *Chrysothrix xanthina*, *Enterographa pallidella* (Figure 6) and *Opegrapha intertexta* have been collected, often in dry tree cavities, or on sheltered portions of necrotic wood. Several uncommon species, such as *Ramalina leiodea* (Blanchon et al. 2015) and *Sticta caperata* are so far known only from pōhutukawa in New Zealand.

Of the lichens recorded here on pōhutukawa, 57 have also been recorded on manawa (*Avicennia marina* subsp. *australasica*) (Reynolds et al. 2017), which is often found in association with pōhutukawa along an ecotone of northern New Zealand estuaries and coastal forest. This suggests that a common coastal forest lichen community exists in the northern North Island. Notably though, despite the lack of dedicated survey of lichen communities of pōhutukawa, our preliminary investigation shows that this phorophyte supports more species and lower ranks of lichens (187 taxa) than does manawa (106 taxa). Some of the differences between the mycobiotas of manawa and pōhutukawa could be explained by collecting biases and different reasons for specimen collection (e.g., the manawa study represents a targeted and detailed survey of all the lichens present on that phorophyte, sampling ten trees at each of 20 sites (Reynolds et al. 2017), while the pōhutukawa collections represent both opportunistic collecting

and, less commonly, detailed surveys of pōhutukawa forest for lichens. However, it is likely that many of the differences are indications of there being distinct lichen assemblages supported by pōhutukawa and manawa forests, reflecting their different bark characteristics, plant community composition, light levels and proximity to salt water (Reynolds et al. 2017).

Pōhutukawa trees are important substrates for a number of threatened lichens, with one species, *Ramalina pacifica* (Figure 5) currently assessed 'Threatened – Nationally Vulnerable,' and a further 31 collectively assessed as 'At Risk' (2 taxa listed as 'At Risk – Declining' and 29 as 'At Risk – Naturally Uncommon') (de Lange et al. 2018b). *Ramalina pacifica* was noted by Blanchon et al. (1996) and Galloway (2007b) as occurring mainly on manawa and pōhutukawa. While seemingly never common, this species does seem to be in decline (de Lange et al. 2012; Blanchon 2013). Of the two 'At Risk – Declining' species, there is little evidence that pōhutukawa is or was an important phorophyte for *Ramalina geniculata* (Blanchon et al. 1996). However, Galloway (2007b) noted that *Teloschistes flavicans* "is often a visually striking canopy epiphyte of coastal *Metrosideros excelsa*" (p. 1734), but this no longer seems to be the case for mainland sites, with an apparent decline in populations around Auckland and Northland (de Lange et al. 2012). Furthermore, although not confined to pōhutukawa other 'At Risk – Naturally Uncommon' species, including *Parmotrema robustum* and *Pseudocyphellaria haywardiorum*, particularly on Rangitoto Island, are commonly seen on this phorophyte (Figure 5). A further 21 taxa collected from pōhutukawa are listed as 'Data Deficient' by de Lange et al. (2018). Resolution of the conservation status of Data Deficient lichens is considered one of the Department of Conservation's highest priorities (J. R. Rolfe, personal communication). Targeted nationwide collecting of lichens from pōhutukawa has, as observed already, not been undertaken. The discovery of such species as the 'Data Deficient' *Soltaria chrysophthalma*, hitherto only known from New Zealand from a single collection made near Lake Lyndon, Canterbury, serves to illustrate the importance of phorophyte-based lichen surveys.

Conclusion

This contribution to our knowledge of the lichenised mycobiota of pōhutukawa, despite the limitations of the data and sampling, highlights the need for a more comprehensive study of pōhutukawa throughout its natural range. Although myrtle rust has yet to have

a serious impact on pōhutukawa, our ignorance of the microbiome of this iconic tree is yet another risk factor in its long-term management in the face of an increasing presence and potential impact of myrtle rust in New Zealand. Too often people value a tree species rather than the ecosystem it creates. Pōhutukawa not only forms an important vegetation association, and is a species that has immeasurable cultural value and significance to Māori and other New Zealand people and cultures (Simpson 2005), but each tree is also an ecosystem of interconnected associates that we so poorly understand. Our ignorance of that association is potentially an Achilles heel for the survival not only of pōhutukawa as a species but the many as yet unrecognised co-inhabitants. We recommend that more comprehensive sampling is done urgently before myrtle rust becomes more fully established on pōhutukawa in New Zealand.

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Appendix 1: List of lichens collected from pōhutukawa (*Metrosideros excelsa*) with specimens held in AK and UNITEC.

Species	Family	Threat status	Voucher	Endemic
<i>Amandinea punctata</i> (Hoffm.) Coppins et Scheid.	Caliciaceae	Not Threatened	AK 186260	
<i>Arthonia atra</i> (Pers.) A. Schneid.	Arthoniaceae	At Risk – Naturally Uncommon	UNITEC 9371	
<i>Arthonia nigrocincta</i> C.Knight et Mitt.	Arthoniaceae	Data Deficient	AK 359918	Yes
<i>Austroparmelina conlabrosa</i> (Hale) A.Crespo, Divakar et Elix	Parmeliaceae	Not Threatened	AK 177176	
<i>Austroparmelina labrosa</i> (Zahlbr.) A.Crespo, Divakar et Elix	Parmeliaceae	Not Threatened	AK 132940	
<i>Bacidia laurocerasi</i> (Delise ex Duby) Vain.	Bacidiaceae	Not Threatened	UNITEC 9357	
<i>Bacidia wellingtonii</i> (Stirt.) D.J.Galloway	Bacidiaceae	Not Threatened	UNITEC 9370	Yes
<i>Bactrospora arthonioides</i> Egea et Torrente	Roccellaceae	Data Deficient	UNITEC 12291	
<i>Bactrospora metabola</i> (Nyl.) Egea et Torrente	Roccellaceae	At Risk – Naturally Uncommon	UNITEC 3122	
<i>Biatora albopraetexta</i> (C.Knight) Hellb.	Ramalinaceae	Data Deficient	AK 18981	Yes
<i>Bunodophoron patagonicum</i> (C.W.Dodge) Wedin	Sphaerophoraceae	Not Threatened	AK 309317	
<i>Calicium hyperelloides</i> Nyl.	Caliciaceae	Not Threatened	AK 184962	
<i>Calicium lenticulare</i> Ach.	Caliciaceae	Not Threatened	AK 332731	
<i>Calicium tricolor</i> F.Wilson	Caliciaceae	Not Threatened	AK 203333	
<i>Chaenotheca brunneola</i> (Ach.) Müll.Arg.	Coniocybaceae	Not Threatened	AK 185242	

Species	Family	Threat status	Voucher	Endemic
<i>Chaenotheca citriocephala</i> (F.Wilson) Tibell	Coniocybaceae	Not Threatened	AK 194063	
<i>Chaenotheca stemonea</i> (Ach.) Müll.Arg.	Coniocybaceae	Not Threatened	AK 194100	
<i>Chaenothecopsis brevipes</i> Tibell	Mycocaliciaceae	Not Threatened	AK 194130	
<i>Chrysothrix xanthina</i> (Vain.) Kalb	Chrysotrichaceae	Data Deficient	AK 204257	
<i>Cladia inflata</i> (F.Wilson) D.J.Galloway	Cladoniaceae	Not Threatened	UNITEC 12294	
<i>Cladia schizopora</i> (Nyl.) Nyl.	Cladoniaceae	At Risk – Naturally Uncommon	AK 194808	
<i>Cladonia confusa</i> R.Sant.	Cladoniaceae	Not Threatened	AK 309266	
<i>Cladonia darwinii</i> S.Hammer	Cladoniaceae	Not Threatened	UNITEC 12288	
<i>Cladonia floerkeana</i> (Fr.) Flörke	Cladoniaceae	Not Threatened	AK 203852	
<i>Cladonia incerta</i> S.Hammer	Cladoniaceae	Not Threatened	AK 203854	Yes
<i>Cladonia scabriuscula</i> (Delise) Nyl.	Cladoniaceae	Not Threatened	AK 195050	
<i>Coccocarpia erythroxyli</i> (Spreng.) Swinscow et Krog	Coccocarpiaceae	Not Threatened	AK 161829	
<i>Coccotrema cucurbitula</i> (Mont.) Müll.Arg.	Coccotremataceae	Not Threatened	AK 332745	
<i>Coenogonium implexum</i> Nyl.	Coenogoniaceae	Not Threatened	AK 203885	
<i>Coenogonium luteum</i> (Dicks.) Kalb et Lücking	Coenogoniaceae	Not Threatened	UNITEC 9354	
<i>Collema laeve</i> Hook.f. et Taylor	Collemataceae	Not Threatened	AK 162373	
<i>Collema subflaccidum</i> Degel.	Collemataceae	At Risk – Naturally Uncommon	AK 209217	
<i>Crocodia aurata</i> (Ach.) Link	Peltigeraceae	Not Threatened	UNITEC 5516	

Species	Family	Threat status	Voucher	Endemic
<i>Crocodia poculifera</i> (Müll. Arg.) D.J.Galloway et Elix	Peltigeraceae	At Risk – Naturally Uncommon	UNITEC 7740	
<i>Dictyographa cinerea</i> (C.Knight et Mitt.) Müll.Arg.	Opegraphaceae	Not Threatened	AK 284437	
<i>Dictyonema cf sericeum</i>	Hygrophoraceae	Not Assessed	UNITEC 7734	Yes
<i>Dirinaria applanata</i> (Fée) Awasthi	Caliciaceae	Not Threatened	UNITEC 1425	
<i>Dirinaria picta</i> (Sw.) Clem. et Shear	Caliciaceae	At Risk – Naturally Uncommon	AK 169763	
<i>Enterographa pallidella</i> (Nyl.) Redinger	Roccellaceae	Not Threatened	UNITEC 7677	
<i>Erioderma solediatum</i> D.J.Galloway et P.M.Jørg.	Pannariaceae	At Risk – Naturally Uncommon	UNITEC 5237	
<i>Fissurina incrustans</i> Fée	Graphidaceae	At Risk – Naturally Uncommon	UNITEC 12290	
<i>Fissurina inquinata</i> C.Knight et Mitt.	Graphidaceae	At Risk – Naturally Uncommon	AK 169683	
<i>Flavoparmelia haywardiana</i> Elix et J.Johnst.	Parmeliaceae	Not Threatened	UNITEC 9361	
<i>Flavoparmelia soledians</i> (Nyl.) Hale	Parmeliaceae	Not Threatened	UNITEC 7060	
<i>Gabura fascicularis</i> (L.) P.M.Jørg.	Collemataceae	Data Deficient	UNITEC 5518	
<i>Graphis elegans</i> (Sm.) Arch.	Graphidaceae	At Risk – Naturally Uncommon	UNITEC 9352	
<i>Graphis librata</i> C.Knight	Graphidaceae	Not Threatened	AK 169608	
<i>Halegrapha mucronata</i> (Stirt.) Lücking	Graphidaceae	Not Threatened	UNITEC 1432	

Species	Family	Threat status	Voucher	Endemic
<i>Heterodermia obscurata</i> (Nyl.) Trevis.	Physciaceae	Not Threatened	AK 175160	
<i>Heterodermia pseudospeciosa</i> (kurok.) W.L.Culb.	Physciaceae	Data Deficient	UNITEC 7583	
<i>Heterodermia speciosa</i> (Wulfen) Trevis.	Physciaceae	Not Threatened	UNITEC 1434	
<i>Hypogymnia lugubris</i> var. <i>compactior</i> (Zahlbr.) Elix	Parmeliaceae	Not Threatened	AK 193762	
<i>Hypogymnia subphysodes</i> (Kremp.) Filson	Parmeliaceae	Not Threatened	UNITEC 4403	
<i>Hypotrachyna horrescens</i> (Taylor) Krog et Swinscow	Parmeliaceae	At Risk – Naturally Uncommon	AK 155101	
<i>Hypotrachyna imbricatula</i> (Zahlbr.) Hale	Parmeliaceae	Data Deficient	AK 332631	
<i>Hypotrachyna immaculata</i> (Kurok.) Hale	Parmeliaceae	Data Deficient	AK 177160	
<i>Hypotrachyna jamesii</i> (Hale) Divakar, A.Crespo, Sipman, Elix et Lumbsch	Parmeliaceae	Data Deficient	AK 193450	
<i>Hypotrachyna osseoalba</i> (Vain.) Y.S.Park	Parmeliaceae	At Risk – Naturally Uncommon	AK 175180	
<i>Hypotrachyna sinuosa</i> (Sm.) Hale	Parmeliaceae	Not Threatened	UNITEC 12292	
<i>Hypotrachyna spumosa</i> (Asahina) Krog et Swinscow	Parmeliaceae	Not Threatened	AK 193493	
<i>Hypotrachyna subfatiscens</i> ((Kurok.) Swinscow et Krog	Parmeliaceae	Not Threatened	AK 177154	
<i>Lecanactis neozelandica</i> Egea et Torrente	Roccellaceae	Not Threatened	UNITEC 12286	
<i>Lecanactis subfarinosa</i> (C.Knight) Hellb.	Roccellaceae	Not Threatened	AK 193088	Yes
<i>Lecania cyrtella</i> (Ach.) Th.Fr.	Ramalinaceae	Not Threatened	UNITEC 9369	

Species	Family	Threat status	Voucher	Endemic
<i>Lecanora elatinooides</i> Räsänen	Lecanoraceae	Data Deficient	UNITEC 9379	
<i>Lecanora flavopallida</i> Stirt.	Lecanoraceae	Not Threatened	AK 206681	
<i>Lecanora novaehollandiae</i> Lumbsch	Lecanoraceae	Data Deficient	AK 191278	
<i>Lecanora queenslandica</i> C.Knight	Lecanoraceae	At Risk – Naturally Uncommon	AK 191279	
<i>Lecanora subumbrina</i> Müll. Arg.	Lecanoraceae	Data Deficient	UNITEC 9378	
<i>Lecanora symmicta</i> (Ach.) Ach.	Lecanoraceae	Not Threatened	AK 206782	
<i>Lecanora xylophila</i> Hue	Lecanoraceae	Not Threatened	UNITEC 9420	
<i>Lecidea conisalea</i> C.Knight	Lecideaceae	Data Deficient	AK 194396	Yes
<i>Leioderma pycnophorum</i> Nyl.	Pannariaceae	Not Threatened	AK 201647	
<i>Lepra psoromica</i> (A.W.Archer et Elix) A.W.Archer et Elix	Ochrolechiaceae	Not Threatened	AK 161407	
<i>Lepraria finkii</i> (B. de Lesd.) R.C.Harris	Stereocaulaceae	Not Threatened	UNITEC 3410	
<i>Leptogium aucklandicum</i> Zahlbr.	Collembataceae	Not Threatened	UNITEC 1972	Yes
<i>Leptogium crispatellum</i> Nyl.	Collembataceae	Not Threatened	UNITEC 1975	
<i>Leptogium cyanescens</i> (Rabenh.) Körb.	Collembataceae	Not Threatened	UNITEC 2680	
<i>Leptogium denticulatum</i> Nyl.	Collembataceae	Not Threatened	AK 209313	
<i>Leptogium limbatum</i> F.Wilson	Collembataceae	Not Threatened	AK 176571	
<i>Leucodermia leucomela</i> (L.) Kalb.	Physciaceae	Not Threatened	UNITEC 5347	
<i>Megalaria grossa</i> (Pers. ex Nyl.) Hafellner	Ramalinaceae	Not Threatened	AK 172641	
<i>Megalaria melanotropa</i> (Nyl.) D.J.Galloway	Ramalinaceae	Not Threatened	AK 185178	Yes
<i>Megaloblastenia flavidoatra</i> (Nyl.) Sipman	Megalosporaceae	Data Deficient	AK 332807	

Species	Family	Threat status	Voucher	Endemic
<i>Megaloblastenia marginiflexa</i> (Hook.f. et Taylor) Sipman	Megalosporaceae	Not Threatened	AK 203169	
<i>Megalospora campylospora</i> (Stirt.) Sipman	Megalosporaceae	Not Threatened	AK 294182	
<i>Megalospora knightii</i> Sipman	Megalosporaceae	At Risk – Naturally Uncommon	UNITEC 5355	Yes
<i>Menegazzia neozelandica</i> (Zahlbr.) P.James	Parmeliaceae	Not Threatened	UNITEC 8231	
<i>Neophyllis melacarpa</i> (F.Wilson) F.Wilson	Cladoniaceae	Not Threatened	AK 193654	
<i>Notoparmelia cunninghamii</i> (Cromb.) A.Crespo, Ferencova et Divakar	Parmeliaceae	Not Threatened	AK 168582	
<i>Notoparmelia erumpens</i> (Kurok.) A.Crespo, Ferencova et Divakar	Parmeliaceae	Not Threatened	UNITEC 7618	
<i>Notoparmelia testacea</i> (Stirt.) A.Crespo, Ferencova et Divakar	Parmeliaceae	Not Threatened	AK 18988	
<i>Normandina pulchella</i> (Borrer) Nyl.	Verrucariaceae	Not Threatened	UNITEC 1973	
<i>Opegrapha agelaeoides</i> Nyl.	Opegraphaceae	Not Threatened	UNITEC 4466	
<i>Opegrapha intertexta</i> C.Knight	Opegraphaceae	Not Threatened	UNITEC 10918	Yes
<i>Pannaria allorhiza</i> (Nyl.) Elvebakk et D.J.Galloway	Opegraphaceae	Not Threatened	AK 154803	Yes
<i>Pannaria araneosa</i> (C.Bab.) Hue	Pannariaceae	Not Threatened	AK 203850	Yes
<i>Pannaria athroophylla</i> (Stirt.) Elvebakk et D.J.Galloway	Pannariaceae	Not Threatened	AK 201713	Yes
<i>Pannaria crenulata</i> P.M.Jørg.	Pannariaceae	Not Threatened	UNITEC 6860	
<i>Pannaria elatior</i> Stirt.	Pannariaceae	Data Deficient	AK 309878	
<i>Pannaria elixii</i> P.M.Jørg. et D.J.Galloway	Pannariaceae	Not Threatened	UNITEC 7619	

Species	Family	Threat status	Voucher	Endemic
<i>Pannaria fulvescens</i> (Mont.) Nyl.	Pannariaceae	Not Threatened	UNITEC 6862	
<i>Pannaria immixta</i> Nyl.	Pannariaceae	Not Threatened	AK 332816	
<i>Pannaria leproloma</i> (Nyl.) P.M.Jørg.	Pannariaceae	Not Threatened	AK 328032	
<i>Pannaria minutiphylla</i> Elvebakk	Pannariaceae	Not Threatened	AK 332648	
<i>Pannaria sphinctrina</i> (Mont.) Hue	Pannariaceae	Not Threatened	AK 253988	
<i>Pannaria</i> aff. <i>patagonica</i> (Malme) Elvebakk et D.J.Galloway	Pannariaceae	Not Threatened	AK 230391	
<i>Parmeliella nigrocincta</i> (Mont.) Müll.Arg.	Pannariaceae	Not Threatened	UNITEC 12293	
<i>Parmotrema austrocetratum</i> Elix et J.Johnst.	Parmeliaceae	Not Threatened	UNITEC 2686	
<i>Parmotrema cetratum</i> (Ach.) Hale	Parmeliaceae	Not Threatened	UNITEC 5448	
<i>Parmotrema crinitum</i> (Ach.) M.Choisy	Parmeliaceae	Not Threatened	UNITEC 6199	
<i>Parmotrema cristiferum</i> (Taylor) Hale	Parmeliaceae	Data Deficient	AK 196031	
<i>Parmotrema mellissii</i> (C.W.Dodge) Hale	Parmeliaceae	At Risk – Naturally Uncommon	AK 312438	
<i>Parmotrema perlatum</i> (Huds.) M.Choisy	Parmeliaceae	Not Threatened	UNITEC 7610	
<i>Parmotrema reticulatum</i> (Taylor) M.Choisy	Parmeliaceae	Not Threatened	UNITEC 9018	
<i>Parmotrema robustum</i> (Degel.) Hale	Parmeliaceae	At Risk – Naturally Uncommon	UNITEC 8049	
<i>Parmotrema subtinctorium</i> (Zahlbr.) Hale	Parmeliaceae	At Risk – Naturally Uncommon	UNITEC 3722	

Species	Family	Threat status	Voucher	Endemic
<i>Parmotrema tinctorum</i> (Despr. ex Nyl.) Hale	Parmeliaceae	Not Threatened	AK 196003	
<i>Pertusaria muricata</i> J.C.David	Pertusariaceae	Data Deficient	UNITEC 12289	
<i>Pertusaria puffina</i> A.W.Archer et Elix	Pertusariaceae	At Risk – Naturally Uncommon	UNITEC 6816	
<i>Pertusaria sorodes</i> Stirt.	Pertusariaceae	Not Threatened	AK 193492	Yes
<i>Pertusaria theochroa</i> Kremp	Pertusariaceae	Data Deficient	AK 206946	Yes
<i>Pertusaria thiospoda</i> C.Knight	Pertusariaceae	Not Threatened	UNITEC 9364	
<i>Physcia poncinsii</i> Hue	Physciaceae	Not Threatened	AK 181603	
<i>Podostictina pickeringii</i> (Tuck.) Moncada et Lücking	Peltigeraceae	Not Threatened	UNITEC 4514	Yes
<i>Polyblastidium casarettianum</i> (A.Massal.) Kalb	Physciaceae	At Risk – Naturally Uncommon	UNITEC 12274	
<i>Polyblastidium japonicum</i> (M.Sâto) Kalb	Physciaceae	Not Threatened	AK 157383	
<i>Pseudocyphellaria billardierei</i> (Delise) Räsänen	Peltigeraceae	Not Threatened	AK 190090	
<i>Pseudocyphellaria carpoloma</i> (Delise) Vain.	Peltigeraceae	Not Threatened	AK 311099	
<i>Pseudocyphellaria chloroleuca</i> (Hook.f. et Taylor) D.J.Galloway et P.James	Peltigeraceae	Not Threatened	AK 331932	
<i>Pseudocyphellaria coriacea</i> (Hook.f. et Taylor) D.J.Galloway et P.James	Peltigeraceae	Not Threatened	AK 331942	Yes
<i>Pseudocyphellaria crocata</i> (L.) Vain. agg.	Peltigeraceae	Not Threatened	AK 200714	
<i>Pseudocyphellaria episticta</i> (Nyl.) Vain.	Peltigeraceae	Not Threatened	AK 190315	Yes
<i>Pseudocyphellaria haywardiorum</i> D.J.Galloway	Peltigeraceae	At Risk – Naturally Uncommon	UNITEC 9628	

Species	Family	Threat status	Voucher	Endemic
<i>Pseudocyphellaria intricata</i> (Delise) Vain.	Peltigeraceae	At Risk – Naturally Uncommon	AK 308826	
<i>Pseudocyphellaria lividofusca</i> (Kremp.) D.J.Galloway et P.James	Peltigeraceae	At Risk – Naturally Uncommon	AK 310330	Yes
<i>Pseudocyphellaria montagnei</i> (C.Bab.) D.J.Galloway	Peltigeraceae	Not Threatened	AK 169072	Yes
<i>Pseudocyphellaria multifida</i> (Nyl.) D.J.Galloway et P.James	Peltigeraceae	Not Threatened	AK 331920	
<i>Pseudocyphellaria punctillaris</i> (Müll.Arg.) D.J.Galloway	Peltigeraceae	At Risk – Naturally Uncommon	AK 331930	
<i>Punctelia borrieri</i> (Sm.) Krog	Parmeliaceae	Not Threatened	AK 176088	
<i>Punctelia subrudecta</i> (Nyl.) Krog	Parmeliaceae	Not Threatened	UNITEC 9358	
<i>Pyxine subcinerea</i> Stirt.	Caliciaceae	Not Threatened	UNITEC 9367	
<i>Ramalina australiensis</i> Nyl.	Ramalinaceae	Not Threatened	UNITEC 554	
<i>Ramalina celastri</i> (Spreng.) Krog et Swinscow	Ramalinaceae	Not Threatened	UNITEC 4475	
<i>Ramalina exiguella</i> Stirt.	Ramalinaceae	At Risk – Naturally Uncommon	UNITEC 5403	
<i>Ramalina geniculata</i> Hook.f. et Taylor	Ramalinaceae	At Risk – Declining	UNITEC 1358	Yes
<i>Ramalina leiodea</i> (Nyl.) Nyl.	Ramalinaceae	At Risk – Naturally Uncommon	UNITEC 6919	
<i>Ramalina meridionalis</i> Blanchon et Bannister	Ramalinaceae	At Risk – Naturally Uncommon	AK 161637	
<i>Ramalina pacifica</i> Asahina	Ramalinaceae	Threatened – Nationally Vulnerable	UNITEC 6822	

Species	Family	Threat status	Voucher	Endemic
<i>Ramalina peruviana</i> Ach.	Ramalinaceae	Not Threatened	UNITEC 9629	
<i>Ramboldia laeta</i> (Stirt.) Kalb, Lumbsch et Elix	Lecanoraceae	Not Threatened	AK 193388	
<i>Remototrachyna costaricensis</i> Divakar et A.Crespo	Parmeliaceae	At Risk – Naturally Uncommon	AK 332629	
<i>Sarrameana albidoplumbea</i> (Hook.f. et Taylor) Farkas	Sarrameanaceae	Not Threatened	AK 328028	
<i>Scytinium subfragrans</i> (Degel.) Otálora, P.M.Jørg. et Wedin	Collembataceae	Data Deficient	UNITEC 5262	
<i>Scytinium kauaiense</i> (H.Magn.) Otálora, P.M.Jørg. et Wedin	Collembataceae	Not Threatened	AK 327675	
<i>Solitaria chrysophthalma</i> (Degel.) Arup, Søchting et Frödén	Teloschistaceae	Data Deficient	UNITEC 10704	
<i>Sphinctrina tubaeformis</i> A.Massal	Spintrinaceae	At Risk – Naturally Uncommon	AK 192496	
<i>Sticta caperata</i> (Nyl.) Nyl.	Peltigeraceae	Data Deficient	UNITEC 7431	
<i>Sticta cinereoglauca</i> Hook.f. et Taylor	Peltigeraceae	Not Threatened	AK 200710	Yes
<i>Sticta fuliginosa</i> (Hoffm.) Ach.	Peltigeraceae	Not Threatened	UNITEC 8050	
<i>Sticta latifrons</i> A.Rich.	Peltigeraceae	Not Threatened	AK 203847	
<i>Sticta martini</i> D.J.Galloway	Peltigeraceae	Not Threatened	UNITEC 12086	
<i>Sticta squamata</i> D.J.Galloway	Peltigeraceae	Not Threatened	UNITEC 7739	Yes
<i>Sticta subcaperata</i> (Nyl.) Nyl.	Peltigeraceae	Not Threatened	AK 224888	Yes
<i>Teloschistes chrysophthalmus</i> (L.) Th.Fr.	Teloschistaceae	Not Threatened	UNITEC 7845	
<i>Teloschistes flavicans</i> (Sw.) Norman	Teloschistaceae	At Risk – Declining	AK 201272	

Species	Family	Threat status	Voucher	Endemic
<i>Teloschistes sieberianus</i> (Laurer) Hillmann	Teloschistaceae	At Risk – Naturally Uncommon	AK 331967	
<i>Tephromela atra</i> (Huds.) Hafellner	Tephromelataceae	Not Threatened	AK 248722	
<i>Thallolooma subvelata</i> (Stirt.) D.J.Galloway	Graphidaceae	Not Threatened	AK 169617	
<i>Thelotrema lepadinum</i> (Ach.) Ach.	Graphidaceae	Not Threatened	AK 168994	
<i>Thysanothecium scutellatum</i> (Fr.) D.J.Galloway	Cladoniaceae	Not Threatened	AK 193453	
<i>Topeliopsis decorticans</i> (Müll. Arg.) A.Frisch et Kalb	Graphidaceae	Data Deficient	AK 155084	
<i>Topeliopsis novae-zelandiae</i> (Szatala) Lumbsch & Mangold	Graphidaceae	Data Deficient	UNITEC 12287	
<i>Usnea angulata</i> Ach.	Parmeliaceae	Not Threatened	AK 206914	
<i>Usnea cornuta</i> Körb.	Parmeliaceae	Not Threatened	UNITEC 6718	
<i>Usnea dasaea</i> Stirt.	Parmeliaceae	Not Assessed	UNITEC 5423	
<i>Usnea inermis</i> Motyka	Parmeliaceae	Not Threatened	AK 294254	
<i>Usnea molliuscula</i> Stirt.	Parmeliaceae	Not Threatened	AK 203853	
<i>Usnea nidifica</i> Taylor	Parmeliaceae	At Risk – Naturally Uncommon	UNITEC 3114	
<i>Usnea oncodes</i> Stirt.	Parmeliaceae	Not Threatened	AK 178291	
<i>Usnea rubicunda</i> Stirt.	Parmeliaceae	Not Threatened	UNITEC 1002	
<i>Usnea subciliata</i> (Motyka) Swinscow et Krog	Parmeliaceae	Data Deficient	AK 206926	
<i>Usnea xanthopoga</i> Nyl.	Parmeliaceae	Not Threatened	AK 247005	
<i>Xanthoparmelia mexicana</i> (Gyeln.)	Parmeliaceae	Not Threatened	AK 191017	
<i>Xanthoparmelia scabrosa</i> (Taylor) Hale	Parmeliaceae	Not Threatened	AK 191075	

Species	Family	Threat status	Voucher	Endemic
<i>Xanthoria parietina</i> (L.) Th.Fr.	Teloschistaceae	Not Threatened	UNITEC 9356	
<i>Yarrumia coronata</i> (Müll.Arg.) D.J.Galloway	Peltigeraceae	Not Threatened	AK 190196	

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Checklist of dicotyledons, gymnosperms and pteridophytes Naturalised or Casual in New Zealand: Additional records 2007–2019

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Checklist of dicotyledons, gymnosperms and pteridophytes Naturalised or Casual in New Zealand: Additional records 2007–2019

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Ewen K. Cameron, Barbara S. Parris, Paul D. Champion

Abstract

New records of Naturalised and Casual plants are summarised for the flora of New Zealand during the 13-year period 2007–2019. Seventeen species are reported as fully Naturalised and 209 species are considered to be new records of Casual plants.

Introduction

The *Flora of New Zealand Vol. IV* (Webb et al. 1988) and six checklists covering the period 1988–2006 (Webb et al. 1995; Heenan et al. 1998, 1999, 2002, 2004, 2008) provide a comprehensive account of naturalised pteridophytes, gymnosperms and dicotyledons in New Zealand. This checklist covers the period 2007–2019 by providing details of newly recorded Naturalised or Casual species. It comprises new records of Naturalised and Casual plants for the flora of New Zealand covering the 13-year period 2007–2019. Seventeen species are reported as fully Naturalised and 207 taxa are considered to be new records of Casual plants.

This paper follows the order in the *Flora of New Zealand Vol. IV* (Webb et al. 1988) for major groups: pteridophytes, followed by gymnosperms, then dicotyledons, and alphabetically by family within each of these. Families follow the recommendations of the Angiosperm Phylogeny Group (APG II 2003; APG III 2009; APG IV 2016). As per earlier listings, monocotyledonous plants are not included as they are the subject of another research study under way by Landcare Research.

Criteria for inclusion in the Naturalised Records list follow Webb et al. (1988, 1995) and Heenan et al. (1998, 1999, 2002, 2004, 2008). That is, populations are self-maintained by seed or vegetative reproduction, or they occur repeatedly in natural or semi-natural habitats or in urban environments. Criteria for inclusion in the Casual Records list follow the definition of Heenan et al. (1998, 1999, 2002, 2004, 2008). This category most frequently

refers to species that have become established in the urban environment from garden plants and typically includes, for example, plants that are considered garden escapes or garden discards.

The listing process undertaken here is in accord with the recommended and generally accepted international terminology for the classification of weed species (*sensu* Richardson et al. 2000; Pyšek et al. 2004). This includes the two major categories of Naturalised and Casual.

However, to improve understanding about the early stages of the invasion pathway we apply, to the Casual category, four subcategories, building on the concepts advocated by de Lange et al. (2005) and used by Heenan et al. (2008). The subcategories of Casual we formally use herein are: Cultivation Escape, Spontaneous Occurrence, Garden Discard and Intentional Release. We consider that these four subcategories encompass the majority of ways that we have observed new weed species establishing and spreading in New Zealand.

Definitions and plant examples from this paper of the Casual subcategories follow:

- **Cultivation Escape** – plants that have established themselves and are regenerating only in the immediate vicinity of the cultivated parent, e.g., *Thunbergia grandiflora* (Roxb. ex Rottler) Roxb.
- **Spontaneous Occurrence** – plants that have spontaneously established themselves well beyond the probable source of the parent plant but are not sufficiently common to be considered naturalized, e.g., *Eclipta prostrata* (L.) L.
- **Garden Discard** – plants that originate from the deliberate dumping of garden waste from which pieces of plant have vegetatively persisted or seed has germinated and, although persisting vegetatively, they are not spreading sexually, e.g., *Echinacea purpurea* (L.) Moench.

- **Intentional Release** – this includes species that have been intentionally planted or had seed sown with the purpose of them becoming naturalised species. Taxa are listed only where it is evident that plantings have then resulted in natural recruitment, e.g., *Hygrophila ringens* (L.) R.Br. ex Spreng.

In New Zealand (Esler 1987; Lee et al. 2000; Sullivan et al. 2005; Aikio et al. 2010), as elsewhere in the world, urban areas and cultivated plants are among the most important pathways for the introduction, establishment, naturalisation and spread of weed species. Therefore, we consider the classification scheme outlined above for new Casual records is a significant and useful addition to the classification of newly recognised weed species in New Zealand. In the Casual category, we provide only the plant name, herbarium voucher, collector, date and place of collection, and relevant notes such as the Casual subcategory.

The list presented herein does not include discussion of new records of *Cotoneaster* (Rosaceae) and *Salix* (Salicaceae) for the naturalised flora of New Zealand. Revised treatments of *Cotoneaster* and *Salix* have been prepared for the *eFlora* (<http://www.nzflora.info/Index.html>) that supersede the treatment in Webb et al. (1988). The *eFlora* treatment includes all *Cotoneaster* and *Salix* species Naturalised and Casual in New Zealand, an identification key, descriptions and synonymy (Glenny 2014, Glenny & Jones 2019). For the present paper, summaries are included, as Tables 1 and 2, respectively, of newly recorded adventive taxa and name changes in *Cotoneaster* (Glenny 2014); and *Salix* (Glenny & Jones 2019).

As with Webb et al. (1988) and associated checklists, all plant descriptions are taken from wild New Zealand herbarium material.

This checklist also includes 19 taxa which have become established (mostly temporarily) as ‘spontaneous occurrences,’ within plant nurseries as a result of using imported coir peat as a potting medium (James et al. 2012). The coir, or coco peat derived from coconut (*Cocos nucifera* L.) and sourced from Sri Lanka is increasingly being used as a sustainable alternative to New Zealand peat. However, it is evident that far from being a ‘sterile’ potting medium coir peat contains the seeds of a range of plants new to New Zealand, some of which have now successfully germinated within nursery conditions. Whilst most of these are unlikely to establish outside nurseries, the observation that some have, such as *Veronica javanica*, in our view justified their inclusion

in this listing. In this respect, their listing is no different to the acceptance by Webb et al. (1988) of other temporary New Zealand occurrences of other tropical / subtropical weeds such as *Alternanthera pungens* Kunth and *Tribulus terrestris* L.

FULLY NATURALISED

PTERIDOPHYTA PTERIDACEAE

Pteris vittata L.

ladder brake

DESCRIPTION (Figures 1A, 1B): Terrestrial or lithophytic ferns. Rhizome short-creeping; scales numerous, conspicuous, c.5 mm long, narrowly triangular, pale brown. Fronds monomorphic, arching, appearing to radiate from a crown. Stipe 20–250 mm long, pale brown, grooved, scaly towards base. Lamina 0.15–0.8 1 × 0.05–0.3 m, -pinnate, oblong-obovate. Pinnae to 250 mm long, closely spaced, decreasing in length from apex to base, narrowly oblong, ± falcate, and tapering above to an acute apex, base subcordate, ± overlying rachis; margins finely serrate in sterile zones; most pinnae attached by midrib only. Lowermost pinnae distinctly shorter, deltoid to cordate; terminal pinna longest, veins free set at ± 90 degrees to costa, simple or forked once. Paraphyses abundant.

FIRST RECORD: Cameron, E. K. & Parris, B. S., *New Zealand Botanical Society Newsletter* 51, 9–10 (1998).

VOUCHER: AK 223419–AK 223421, K. J. Bell s.n., 18 May 1995, Auckland, Auckland City, Epsom, Manukau Road.

ADDITIONAL RECORDS: AK 234690–AK 234692, E. K. Cameron 9264, 27 Feb 1997, Auckland, Epsom, 1/225A Manukau Road; AK 237258, E. K. Cameron 9555, 23 Mar 1999, Auckland, Epsom, 1/225A Manukau Road; AK 299467, B. S. Parris 12746, 17 Dec 2005, Auckland, St Stephens Ave, Neligan Court; AK 300375, E. K. Cameron 14548, 12 Aug 2007, Auckland, St Stephens Ave, Neligan House; WELT P027315, L. R. Perrie 6808 & L. D. Shepherd, 22 Nov 2012, Auckland, St Stephens Ave; AK 332805, P. J. de Lange 11048 & G. M. Crowcroft, 18 Aug 2012, Auckland, Okahu Bay; AK 313941, S. J. Crump s.n., P. B. Cashmore & P. N. Adams s.n., 9 Aug 2007, Bay of Plenty, Lake Rotomahana, near Steaming Cliffs; AK 224154, V. C. Wood s.n., 5 Oct 1995, Hawke’s Bay, Napier north side of Bluff Hill, 135 Thompson Road;



Figure 1. *Pteris vittata*: (A) young plant growing in mortar crack in painted-over concrete block/stucco external public toilet wall, Okahu Bay, Orakei Basin, Auckland, 14 June 2015; (B) mature plant growing amongst concrete slabs, Old Cemetery, Napier Botanic Gardens, Hospital Hill, Napier, 8 February 2016. Photographs © P. J. de Lange.

AK 237376, E. K. Cameron 9376, 5 Sep 1998, Hawke's Bay, Napier north side of Bluff Hill, 135 Thompson Road; WELT P020720, U. Asmus s.n., Sep 2003, Napier, Bluff Hill, Marine Parade; WELT P020721, U. Asmus s.n., Sep 2003, Napier, Bluff Hill, pedestrian walk between Clyde and Seaview Roads.

NOTES: The New Zealand biostatus of *Pteris vittata* has a confused history, with various authors arguing that current occurrences are naturalisations (Cameron & Parris 1998; Cameron 1999; Heenan et al. 1999; Brownsey & Perrie 2012) and others suggesting the wild occurrences may reflect indigenous as well as naturalised populations (de Lange et al. 2009; Ecroyd 2012). For detailed discussion on this debate, recourse to the articles by Brownsey and Perrie (2012) and Ecroyd (2012) is recommended. In the meantime, we treat *Pteris vittata* as fully naturalised to New Zealand. Resolution as to whether some populations are indigenous and others naturalised is a matter that modern molecular methodologies might resolve but until this is done, the more pragmatic view of Brownsey & Perrie (2012) is that this fern is naturalised.

ANTHOPHYTA
NYMPHAEALES
CABOMBACEAE

***Cabomba caroliniana* A.Gray**
 fanwort

DESCRIPTION (Figure 2): Perennial, rhizomatous, submerged aquatic with adventitious roots produced at stolon nodes and lower nodes of stems, stems up to 2 m long. Young vegetative parts often with rust-colored pubescence, with thin mucilaginous coat. Leaves submersed and floating. Submersed leaves opposite, blade 3–7 dichotomously to trichotomously branched, petiole to 4 cm; linear segments, blade 10–35 × 15–55 mm; terminal segments 3–200, linear to slightly spatulate, to 1.8 mm wide. Floating leaves alternate, blade 6–30 mm × 1–4 mm, margins entire or sagittate at base. Inflorescences axillary, solitary flowers. Flowers bisexual, protogynous, diurnal, borne at or above water surface or occasionally submersed; peduncle long; involucre absent. Flowers 3-merous, 6–15 mm diam.; calyx white to purplish or with purple-tinged margins, 5–12 × 2–7 mm; corolla similar but with proximal, yellow, nectar-pistils 2–4, mostly 3, divergent at maturity; ovules 3. Fruits 4–7 mm. Seeds 1–3, 1.5–

3.0 × 1.0–1.5 mm, tubercles in 4 longitudinal rows. Fruit and seed production not seen in New Zealand.

FIRST RECORD: Ford, K. A., Champion, P. D., *Flora of New Zealand: Seed plants. Fascicle 5, Nymphaeales* (2019).

ADDITIONAL RECORDS: AK 305927, AK 305930, P. J. de Lange 7940, & T. J. P. de Lange & F. J. T de Lange, 23 Aug 2009, Auckland, Western Springs, Meola Creek. AK 360306, G. Hoskins s.n., 17 Feb 2016, Auckland, Henderson, Paremuka Lakes.

NOTES: The two Meola Creek gatherings were made from a small spring flowing into Meola Creek and also from Meola Creek itself at the back of the Horticultural Society Buildings, Western Springs Park. Here they grew with *Hygrophila ringens*. It seems likely that these plants originated from a past deliberate planting of this commonly grown aquatic plant. *Cabomba caroliniana* was not observed as establishing outside of the springhead in the stream proper. The Meola Creek population was destroyed sometime in 2015 as the result of ongoing changes to the Western Motorway road. The population at the Paremuka Lakes (which are a series of three artificial ponds) site is much larger, with *Cabomba* present in all three ponds occupying an estimated 2.5 ha. At that site, *Cabomba caroliniana* dominated the ponds where it appears to be the only submerged species present along with emergent *Myriophyllum aquaticum* and *Persicaria decipiens*. It seems to have been a recent incursion at that location as there was no record of it from a 2013 ecological survey (Martin & Reeves 2013). This species is regarded as a Weed of National Significance (WoNS) in Australia and is likely to be targeted for eradication in New Zealand in the near future.

DICOTYLEDONAE APIACEAE

Anthriscus sylvestris (L.) Hoffm. cow-parsley

DESCRIPTION: Erect perennial herb up to 2 m tall. Stems stout, often deeply, longitudinally grooved, hollow; dark green, green to yellow-green, sometimes spotted maroon; finely hairy. Leaves alternately arranged, 3-pinnate, dark green, green to yellow-green, borne on stout, deeply channeled, finely pubescent to glabrescent petioles, these dark green to green often maroon-spotted adaxially and near base; lamina of basal leaves up to 0.8 × 0.8 m; lamina of cauline leaves up



Figure 2. *Cabomba caroliniana*, wild plants growing in Meola Creek, Western Springs, Auckland, 23 Aug 2009. Photograph © P. J. de Lange.

to 0.1 × 0.5 m; segments 15–50 mm, acute. Umbels compound, 200–600 mm diameter, rays 6–15, bearing numerous white flowers, these 3–6 mm diameter, petals 5, apices notched. Fruits, initially green, maturing brown, lanceolate, 6 mm long, glabrous and smooth, NEW RECORD: CHR 603154, W. R. Sykes 98/02, 21 Oct 2002, Canterbury, Christchurch, St Albans.

ADDITIONAL RECORDS: CHR 609331, R. Milne s.n. 11 Mar 2010, Southland, Te Anau, 3 Sinclair Road; CHR 621650, D. Glennly 11212, 17 Oct 2011, Canterbury, Christchurch, Heathcote River, opposite Princess Margaret Hospital; CHR 640092, L. Grueber s.n., 3 Mar 2016, Tasman, south of Motueka, Graham Valley; CHR 654865, J.C. Neal s.n., 21 Nov 2019, Canterbury, South West of Springston, Chamberlains Road; CHR 658614, J. Neal s.n., 22 Nov 2019, Canterbury, near Leeston.

NOTES: Initially rejected from the *Flora of New Zealand* by Webb et al. (1988: 1289) because it was unsupported by a voucher specimen. This species, which has been deliberately cultivated, especially in the South Island, is now rapidly spreading, mostly from gardens, but also along roadsides, drainage ditches and in urban wasteland. Despite the limited collections held in New Zealand herbaria it is evident from observations posted on iNaturalist NZ (see https://inaturalist.nz/observations?taxon_id=124544 [accessed: 18 November 2020]) that this species is now well established in the South Island, from the Nelson region east and south to Otago.

ASTERACEAE

Euryops chrysanthemoides (DC) B. Nord.

Paris daisy

DESCRIPTION (Figures 3A, 3B, 3C): Woody, usually much-branched shrub up to 2.0 × 1.8 m. Branches leafy. Leaves ± glabrous (sometimes bearing small tufts of hair within axils of young leaves), dark green, alternate, densely crowded toward branch apices, lamina 350–700 × 10–20 mm, narrow-elliptic to obovate, pinnatisect, with the lobes apiculate, curving outwards, usually becoming narrower and smaller towards the leaf base. Inflorescences usually solitary, borne on deeply striated peduncles, 80–150 mm. Capitula 30–50 mm diameter; involucre bracts 14–15, 5–6 mm long, ovate to ovate-acuminate, usually fused 1/3 of length, ± glabrous except for ciliate margins and apex, dark green to maroon-green. Ray- and disc-florets yellow; ligule 14–18 mm long. Achenes 5 × 2 mm, narrow-obvoid to fusiform, deeply ribbed, glabrous, black when mature. Pappus absent.

FIRST RECORD: Heenan, P. B., et al., *New Zealand Journal of Botany* 37, 635 (1999).

VOUCHER: AK 214518 P. J. de Lange 2574, 13 Jun 1994, Auckland, New Lynn, Lynn Mall.

ADDITIONAL RECORDS: UNITEC 11689, P. J. de Lange 147536 & C. Beard, Te Aupouri, Waiharara, near Camp Road turnoff; AK 236506, P. J. de Lange 3744 & P. B. Heenan, 3 Sept 1998, Auckland, Auckland City, Karangahape Road; AK 291064, P. J. de Lange 6540, T. J. P. de Lange & F. J. T. de Lange, 9 Jul 2005, Auckland, Mt Albert, St Lukes Road; AK 294550, P. J. de Lange 6588 & F. J. T. de Lange, 1 Nov 2005, Auckland, Mt Albert, Eastern side of Mt Albert Grammar, Upper reaches of Meola Creek; AK 297488, P. J. de Lange 6684, 16 Sep 2006, Auckland, New Lynn, Pleasant Road; AK 293613, P. J. de Lange 6576, 29 Sep 2005, Auckland, Mt Eden, Dominion Road shops; AK 290843, E. K. Cameron 13128, 2 Jul 2005, Auckland, Howick College grounds; AK 251812, P. J. de Lange 4727, 24 Nov 2000, South

Figure 3. *Euryops chrysanthemoides*: (A) plants growing along Tahuna Road, near Te Hoe, Hoe-o-Tainui, 8 October 2016, photograph © P. J. de Lange; (B) flowering specimen growing in drainage ditch, near Waimanu Place intersection with Point Wells Road, Point Wells, Omaha Bay, 7 October 2018, photograph © P. J. de Lange; (C) seedlings growing along footpath under a wall where planted shrubs of this species grow, 7 November 2011, photograph © C. C. Ogle.



Auckland, Papakura, Kirk's Bush; AK 236535, P. J. de Lange 3748, 30 Dec 1998, South Auckland, Hamilton City, Kahikatea Drive; AK 292765, P. J. de Lange 6556, T. J. P. de Lange & F. J. T. de Lange, 4 Sep 2005, South Auckland, Hamilton City, Hillcrest, Hillcrest Normal School; CHR 571876, C. C. Ogle 5220, 2 May 2007, Whanganui, Wicksteed Street; CHR 610010, C. C. Ogle 5766, 18 Jun 2010, Taranaki, Hawera, Albert Street; AK 320936, C. C. Ogle 5798, 2 Sep 2010, Whanganui, Grey Street, St George's School; AK 320933, C. C. Ogle 5797, 8 Oct 2010, Rangitikei, Feilding, 138 West Street; CHR 6215838, C. C. Ogle 6053, 23 Jun 2012, Rangitikei, Feilding, 138 West Street; AK 296920, J. R. Rolfe s.n., 21 May 2006, Wellington, Hutt River bed c. 100 m south of Stokes Valley Stream inlet; WELT SP087618/B, C. C. Ogle 5533b, 18 Jun 2009, Wellington, Kemp Street; WELT SP085694, J. R. Rolfe s.n., 8 Jan 2007, Wellington, Kaiwharawhara Stream; CHR 529177, P. B. Heenan s.n., 15 Apr 1999, Christchurch, Westmorland.

NOTES: This species is widely cultivated in private and public gardens throughout New Zealand. It remains a popular plant on account of its rapid growth, bushy form and large yellow capitula. Seedlings establish freely among and near planted shrubs, including edges of footpaths, gutters, banksides and in car parks. Although this species is most commonly seen naturalised in urban areas, increasingly it is being collected from rural areas, growing along roadsides, railway tracks and in wasteland. It has also been collected from coastal areas on sand dunes and within roadside indigenous shrubland. Further spread is anticipated.

BETULACEAE

Alnus rubra Bong.

red alder

DESCRIPTION (Figures 4A, 4B): Deciduous tree 26–30 m tall, 0.3–1.2 m diam. Trunk clean with a straight bole, usually devoid of branches for one third to half of length; crown narrowly pyramidal or dome-shaped and rounded; branches ± pendulous. Bark ash-grey to grey-brown, generally smooth, breaking with age into flat, irregular plates near the base; inner bark initially tan but turning red when exposed to air. Twigs olive to reddish brown, triangular in cross-section, lenticellate. Buds distinctly stalked. Leaves 76–152 × 25–38 mm, coriaceous, adaxially glabrous, dark green, abaxially pale covered in fine rust-red pubescence; lamina penniveined, obtuse



Figure 4. *Alnus rubra*, naturalised seedlings on side of cycle track on old railway: (A) sapling; (B) close-up of leaves, Spooners Tunnel, Wakefield, Nelson, 25 Nov 2018. Photographs © Chris Ecroyd.

to elliptic, base obtuse to rounded, apex acute, margins finely double-serrate, teeth gland-tipped. Inflorescences in preformed aments; ♂ aments in clusters of 2–5, initially 25–40 mm long, maturing 100–150 mm long, slender, pendent, orange; ♀ aments 8.3–12.5 mm long, ± ovoid to oblong, bases covered in dark red scales, styles bright red. Cone-like fruit persistent, semi-woody, 12.5–38.0 mm long, cylindrical to ovoid, borne on short orange peduncles (sometimes sessile); cone scales truncate, apices rugose. Nutlet c. 2.8–3.0 mm diam., ± obconic to subcircular, margins winged.

FIRST RECORD: Ecroyd, C. E., *Rotorua Botanical Society Newsletter* 52, 29–32 (2009).

VOUCHER: NZFRI 18845, D. Hayes s.n., 15 Feb 1990, South Auckland, Kaingaroa, Butchers Boundary Road.

ADDITIONAL RECORD: CHR 372609, A. H. Whitaker, s.n., 12 Nov 1981, Nelson, Motueka, Golden Downs Forest.

NOTES: Naturalised. At Golden Downs Forest, CHR 372609 was from a “‘veritable thicket’ of seedlings, saplings ... which had sprung up in profusion along a firebreak-cum-logging track close to a row of very large old alder trees.” At Kaingaroa, *A. rubra* was well established and aggressively spreading (occupying an estimated 1 km²) of plantation forestry in which it had been cultivated.

CAMPANULACEAE

Lobelia pedunculata R.Br.

DESCRIPTION (Figure 5): Perennial, turf-forming, rhizomatous, dioecious herb. Branches prostrate, rooting freely on contact with ground ± puberulent. Leaves subsessile or very shortly petiolate, ± puberulent, lamina 5–12 × 4–8 mm, pale green to yellow-green, orbicular to ovate, apex obtuse, base obtuse to subcordate, margins toothed. Flowers unisexual, solitary, peduncles variable 5–30(–38) mm long, ± puberulent. Calyx 1.5–2.5(–3.0) mm long. Corolla 6–10 mm long, initially pale blue to mauve, fading to white with age, tube pale blue; lobes linear-oblong, base often striped dark blue, spreading ± equal. Male flowers with purple anthers, upper pair each furnished with a slender bristle and shorter hairs below; ovary rudimentary. Fruits not formed in New Zealand.

FIRST RECORD: Webb, C. J., et al., *New Zealand Journal of Botany* 33, 170 (1995), as *Pratia pedunculata* (R.Br.) Benth.

VOUCHER: AK 277082 (originally AKU 20863), E. K.



Figure 5. *Lobelia pedunculata*, Edinburgh Street, Hillcrest, Hamilton, 23 October 2018. Photograph © P. J. de Lange.

Cameron 4786, 15 Feb 1988, Auckland, Mt Eden, Thames Street.

ADDITIONAL RECORDS: AK 306811, P. J. de Lange 8016 & J. R. Rolfe, 18 Oct 2009, Northland, Te Aupouri, Houhora, Pukenui, Lamb Road; AK 306300, P. J. de Lange 7993 & R. O. Gardner, 10 Oct 2009, Auckland, Birkenhead, Chatswood, Onetaunga Road; CHR 515305, C. C. Ogle 3315, 24 Dec 1997, Auckland, Hobsonville, 12 Oakpark Drive; AK 301046, P. J. de Lange 7058, 12 Nov 2007, Auckland, Mt Albert, Wairere Ave; UNITEC 12411, P. J. de Lange 14975, 4 Nov 2020, Waiheke Island, Oneroa, Tahatai Road; AK 312228, P. J. de Lange 9101, 17 Apr 2010, Hamilton, Hillcrest, Cranwell Place; AK 209224/CHR 478403, P. J. de Lange 1366, 13 May 1992, South Auckland, near Taharoa, Maungakohe; AK 301040, P. J. de Lange 7053 & P. B. Cashmore, 17 Mar 2006, Rotorua, Utuhina, 27 Clyde Street; CHR 606488, C. C. Ogle 5562, 2 Dec 2007, Taupō, Whareroa; CHR 541199, C. C. Ogle 3778 & R. C. Ogle, 18 Nov 2000, Whanganui, Bastia Hill, Shakespeare Road; CHR 649287, C. C. Ogle 6518, Whanganui, St Johns Hill, 10 Virginia Heights; CHR 568462, C. C. Ogle 4416, 19 Oct 2003, Manawatu, Feilding; AK 329802, P. J. de Lange 10327, 7 Jan 2012, Canterbury, Hanmer Plain, Hanmer Springs, Springs Road; CHR 466357; N. O'Brien s.n., 19 Dec 1989, Canterbury, Christchurch, Maidstone.

NOTES: So far, only male plants of *Lobelia pedunculata* have been seen and fruits are not formed. Nevertheless, this species is rapidly spreading, wild occurrences arising presumably from pieces of this plant present as a contaminant in nursery and lawn turf plantings, and also through the careless disposal of garden waste. In some parts of New Zealand, Auckland especially, *Lobelia pedunculata* is now a common roadside verge weed

and, in these habitats, it seems that further spread is being facilitated through the mowing of verges and also through the movement of mowers between suburbs.

CARYOPHYLLACEAE

Illecebrum verticillatum L.

coral-necklace

DESCRIPTION (Figure 6): Glabrous, much-branched, pink-red to reddish annual up to 150 mm tall. Branches (especially sterile ones) sprawling procumbent to decumbent, rooting on contact with ground, stems pink-red to red, ± fleshy, fertile stems floriferous from base, ± ascending. Interpetiolar stipules minute, membranous, apices often lacerate. Leaves ± succulent, subsessile or with very short petiole; lamina ovate to obovate, obtuse to subacute. Inflorescences verticillate, crowded in leaf axils, bracteolate; bracts membranous. Flowers sessile, densely packed, whorled, minute (1.8–)2.0(–2.5) mm long; calyx white to pinkish, divided into 5-segments, these almost free, ± succulent, apices acute terminated by a fine, often twisted, bristle-like apiculus; petals minute, pink to pinkish red; stamens 3(–5), minute borne on very short filaments; style minute. Capsules 2-locular. Seeds 1 per locule, ovoid, brown, glossy.

FIRST RECORD: Webb, C. J., et al., *Flora of New Zealand Vol. IV*, 476 (1988).

VOUCHER: CHR 227564, G. B. Rawlings s.n., Jan 1972, North Auckland, Waipoua Forest, Old Coach Road.

ADDITIONAL RECORDS: AK 313758, P. D. Champion s.n., 3 Nov 2004, North Auckland, Te Paki, Lake Austria, near Waitiki Landing; AK 308940, P. J. de Lange 8406 & C. Burke, 10 Jan 2010, North Auckland, Kai Iwi Lakes, Lake Taharoa; AK 339612, R. O. Gardner 10355, 5 Oct 2002, North Auckland, Kai Iwi Lakes, Lake Waikare; AK 320387, P. J. de Lange 9481, 2 Jan 2011, North Auckland, Kai Iwi Lakes, Lake Waikare; AK 309045, P. J. de Lange 8468, 15 Jan 2010, North Auckland, Kaipara, South Head Road, Lake Ototoa [Rototoa] Scenic Reserve, Lake Ototoa [Rototoa]; CHR 617063, P. B. Heenan s.n., 3 Jan 2007, Westland, Lake Brunner, Moana; CHR 617062, P. B. Heenan s.n., 12 Jan 2007, Westland, Lake Brunner, Moana.

NOTES: First treated as a 'zeta' record by Webb et al. (1988), *Illecebrum verticillatum* is, in New Zealand, found in open damp ground, especially inhabiting freshly exposed lake shorelines. As this species is a strict annual with a short growing season, vegetation surveys out of



Figure 6. *Illecebrum verticillatum*, Lake Waikare, Kai Iwi Lakes, 2 January 2011. Photograph © P. J. de Lange.

season are unlikely to record it. Therefore, we suspect that the increase in specimen collections and apparent range extension more likely reflects a renewed interest by botanists in investigating the flora of New Zealand lake margins throughout the seasons rather than evidence that this species is now actively spreading. Irrespective, *Illecebrum* has now been collected from a range of sites spanning the northern portion of the north-western North Island, and from one site in Westland, South Island. At these sites, though it is still generally uncommon, it can on occasion be locally abundant. For these reasons, we now treat this species as fully naturalised.

CRASSULACEAE

Crassula alata (Viv.) A. Berger var. *alata*

three-part crassula

DESCRIPTION (Figures 7A, 7B): Late winter to spring annual with bright green to dark red erect stems to 80 mm long, sparingly, and then basally, branched or at times heavily branched; leaves bright green, red-green to crimson, linear-lanceolate to linear, 1.5–3.0 × 0.5–0.8 mm, acute and often with a colourless point, flat or almost so above, but usually strongly convex below. Inflorescence 1, rarely a few, thyrse with sessile dichasia in the axils of leaf-like bracts; pedicels absent or almost so; flowers (2–)3(–4)-merous; calyx lobes oblong-lanceolate, 1.5–2.0 mm long, acuminate to cuspidate with a colourless point, fleshy, green to red; corolla cup-shaped, off-white often tinged red; lobes triangular, 0.7–1.0 mm long, usually cuspidate, erect; nectary scales oblong-cuneate to almost square, rounded, slightly broadened at the apex, membranous, pale-yellow; ovaries almost conical, at first gradually later abruptly constricted into short styles, with 2 ovules.



Figure 7. *Crassula alata*: **(A)** plants growing in gravel beside Henley Lake Park, Masterton, 29 Sept 2012, photograph © John Barkla; **(B)** *Crassula alata* showing trimerous flower, naturalised in Canterbury Agricultural Park near State Highway 75, Hillmorton, Christchurch, 18 Sep 2020, photograph © W. Reinder.

Follicles erect, smooth, splitting along the whole suture but opening only in the upper half and breaking off at the base by a circumscissal split.

FIRST RECORD: Heenan, P. B., et al., *New Zealand Journal of Botany* 42, 797–814 (2004).

VOUCHER: AK 284862, C. C. Ogle 4388, 3 Nov 2003, Rangitikei, Bulls, Santoft, Santoft Road.

ADDITIONAL RECORDS: AK 354652/CHR 597380, P. J. de Lange 12328 & J. R. Rolfe, 24 Sep 2014, North Auckland, Kaitaia; AK 355481, P. J. de Lange 12377, 7 Nov 2014, Dargaville, Victoria Street, Hobson's Choice Motel grounds; AK 332590, P. J. de Lange 11008, 10 Aug 2012, North Auckland, Waiwera, Waiwera Motor Camp (derelict camp ground); AK 303756, P. J. de Lange 7521 & T. J. de Lange, 1 Nov 2008, Auckland, Western Springs Park, near Motions Road; AK 354958, P. J. de Lange 12335 & T. J. P. de Lange, 12 Oct 2014, Auckland, Carrington, Unitec campus grounds; UNITEC 11693, P. J. de Lange 14757, 12 Aug 2016, Auckland, Auckland City, Beach Road, Te Taou Reserve; AK 354658, P. J. de Lange 12333 & T. J. P. de Lange, 28 Sep 2014, South Auckland, Kingseat; AK 334921, P. J. de Lange 11149, T. J. P. de Lange & F. J. T. de Lange, 3 Nov 2012, South Auckland, Rangiriri, Rangiriri Road; AK 236618, P. J. de Lange 3592 & P. D. Champion, 10 Oct 1998, South Auckland, Burbush / Te Kowhai Road intersection; AK 345268, P. J. de Lange 11706, 6 Oct 2013, Hamilton, St Andrews, Beerescourt Road; AK 353956, P. J. de Lange 12325 & J. R. Rolfe, 20 Aug 2014, Hamilton, Angelsea Street; UNITEC 11694, P. J. de Lange 14758, South Auckland, Hauraki, Paeroa, State Highway 2; AK 289819, P. J. de Lange 6474 & P. B. Cashmore, 15 Apr 2005, Bay of Plenty, Whakatane, Whakatane River; UNITEC 11695, P. J. de Lange 14759, 27 Sep 2016, Bay of Plenty, Maketu, Little Waihi Road; AK 254666, R. O. Gardner 10214A, 17 Oct 2000, Taupo, south end of town; AK 320924, C. C. Ogle 5796, 16 Oct 2010, Taranaki, Hawera, State Highway 3; AK 303589, C. C. Ogle 5433, 22 Sep 2008, Palmerston North, Massey University grounds; AK 303659, C. C. Ogle 5435, 4 Oct 2008, Himatangi–Palmerston North Highway 56; AK 303748, R. C. Ogle & C. C. Ogle 5437, 23 Oct 2008, Whanganui, Hatrick Street West; AK 303752, C. C. Ogle 5438, 27 Oct 2008, Manawatu, Feilding, 138 West Street; AK 303769, C. C. Ogle 5439, 4 Nov 2008, Rangitikei, Bulls, Dalziel Street; AK 355133, P. J. de Lange 12347, 24 Oct 2014, Christchurch, Addington, corner of Twigger Street and Lincoln Road, Addington Court Motel; CHR 641231, P. B. Heenan s.n., 5 Oct 2015, Christchurch, Halswell, Cashmere Road; CHR 641232, P. B. Heenan

s.n., 2 Oct 2015, Canterbury, Prebbleton, Leadleys Road; CHR 641230, P. B. Heenan s.n., 8 Oct 2015, Canterbury, Prebbleton, Birches Road; CHR 641233, P. B. Heenan s.n., 30 Sep 2015, Canterbury, Taitapu, Old Taitapu Road; CHR 626006, J. Barkla s.n., 17 Oct 2012, Otago, Lake Wanaka, Roy's Bay; CHR 610191, J. Barkla s.n., 13 Aug 2010, Otago, Kingston; CHR 619264, J. Barkla s.n., 9 Oct 2011, Otago Peninsula, Harrington Point; CHR 626007, J. Barkla s.n., 6 Nov 2012, Otago, Bannockburn, Bannockburn Inlet.

NOTES: Probably because of its diminutive size, strict late winter to spring growth habit and superficial similarity to *C. colligata* Toelken and *C. sieberiana* (Schult. et Schult.f.) Druce, the naturalised presence of *C. alata* var. *alata* in New Zealand has almost certainly gone unrecognised for much longer than the official recognition date of 2003. Irrespective, as noted by Ogle (2008), this species is now fully naturalised in New Zealand and, based on the herbarium evidence, is widespread throughout the country.

***Crassula natans* var. *minus* (Eckl. et Zeyh.)
G.D.Rowley**

DESCRIPTION (Figures 8A, 8B): Glabrous herb of semiaquatic habitats. Branches decumbent, filiform up to 100 mm long, sparingly to much-branched. Leaves connate at base, succulent, patent and usually widely spaced, on internodes 3.3–8.0 mm long, lamina 3.3–7.4 × 0.5–1.2 mm, 0.5–0.8 mm thick, pinkish-green, pale green or red, linear to oblanceolate, dorsiventrally flattened to terete, with 2–3 pairs of minute dark-pink hydathodes, apex obtuse or rounded, minutely apiculate, apiculus 0.1–0.3 mm long, caducous; sheath 0.3–0.5 mm long, hyaline. Flowers 4-merous, 1–2(–3) per leaf axil at successive nodes; pedicels 1.4–5.2 mm long, filiform, calyx lobes broadly triangular, 0.2–0.4 mm long, green to yellow-green, distally streaked dark crimson-red, subacute, obtuse or rounded; corolla shortly tubular, 0.3–0.6 × 0.4–0.6 mm, white tinged pink, petals weakly connate, erect to erectopatient, 0.5–1.1 mm long, mostly white (sometimes distally tinged pink), base prominently streaked magenta, oblanceolate, obtuse or rounded (rarely apiculate); nectary scales 0.4–0.5 × 0.15–0.25 mm, oblong-cuneate, truncate; stamens 4, filaments 0.1–0.25 mm long, yellow, anthers initially magenta fading to pink at anthesis; ovaries 4, initially obovoid becoming cylindrical with age, each with 1 ovule. Follicles 0.49–0.82 × 0.32–0.60 mm, pale pink when ripe, ovoid, ± weakly trigonous, smooth, spreading

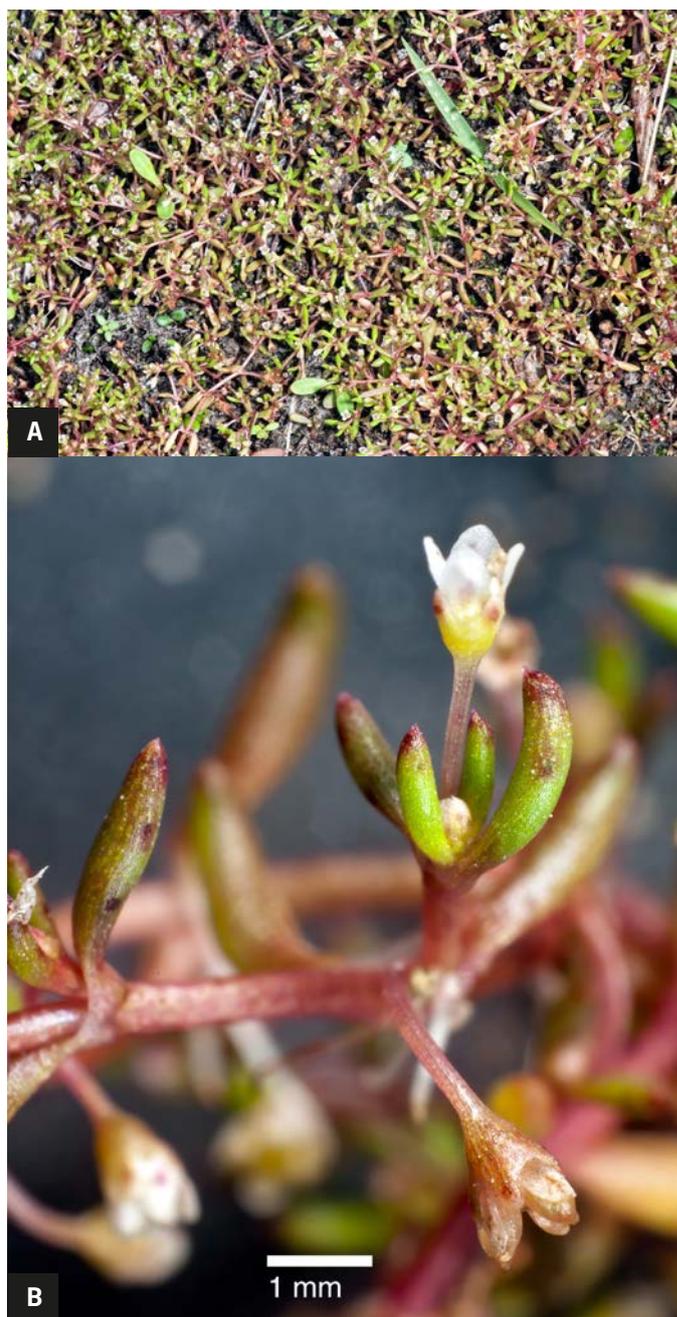


Figure 8. *Crassula natans* var. *minus*: (A) growing in marginal lake turf; (B) close-up of its flower and leaves, at the edge of Lake Waiporohita, Karikari Peninsula, 19 November 2010. Photographs © Jeremy Rolfe.

to strongly recurved, opening along the entire suture; fruiting pedicel elongating at fruit maturation (up to 10 mm long), usually decurved toward soil; seeds 0.6–0.7 mm long, dark brown, glossy, smooth (sometimes faintly longitudinally ridged)

FIRST RECORD: de Lange, P. J., et al., *New Zealand Journal of Botany* 49, 361–366 (2011A).

VOUCHER: AK 318964, P. J. de Lange 9341, A. J. Townsend & J. R. Rolfe, 19 Nov 2010, Karikari Peninsula,

Lake Waiporohita.

ADDITIONAL RECORDS: AK 318965, *P. J. de Lange* 9342, *A. J. Townsend & J. R. Rolfe*, 19 Nov 2010, North Auckland, Karikari Peninsula, Lake Waiporohita.

NOTES: *Crassula natans* var. *minus* is treated here as fully naturalised because, although currently known from one localised site (Lake Waiporohita), it is seasonally common there. Furthermore, as it is highly invasive, bird dispersed and easily overlooked, it seems rather unlikely that this species will be confined to the one Northland lake.

FABACEAE

Lathyrus japonicus Willd.

sea pea

DESCRIPTION: Lianoid, long-creeping, rhizomatous, glabrescent (sometimes sparingly puberulent at leaf bases, stem axils and on pods), glaucescent, perennial, herb. Stems 0.2–0.6(–0.8) m long, angular, decumbent to ascending, arising from long-creeping, slender rhizomes. Leaves shortly petiolate; stipulate, stipules ovate to semi-sagittate, 15–25 mm long, acute; leaflets 8–12, ovate, oblong to elliptic, 15–45(–50) × 10–30 mm, acute to obtuse, ± penninerved, tendrils simple, 2- or 3-branched. Inflorescences racemose, borne on peduncles 40–60 mm long; flowers 25–30 mm long, dark purple with darker lines on standard; calyx-teeth lanceolate, the lower as long as or greater than tube length. Fruiting pods 300–400(–500) × 10 mm, glabrous, 1–3(–6)-seeded.

FIRST RECORD: Hammett, K. W., *National Sweet Pea Society Annual 2009*, 97–99 (2009).

VOUCHER: AK 304570/CHR 546915, *R. Gold s.n.*, 22 Feb 2009, Otago, Catlins, Lathyrus Bay.

NOTES: Naturalised over c. 70 m of the back of the beach. It seems that plants may have germinated from seeds associated with the wreckage of a sailing ship at Lathyrus Bay in 1859. Irrespective, this species was first recorded from the vicinity of the ship wreck in 1871, and it seems that this remote bay has been named after the presence of this plant. The wild status and circumstances of this species' spread is discussed in detail by Cameron (2014).

LAURACEAE

Cinnamomum camphora (L.) J.Presl

camphor laurel

DESCRIPTION (Figures 9A, 9B): Trees 15–30 m tall, with stout trunk and broad spreading crown. Bark light brown or greyish-brown, rugose, tessellated, finely fissured strongly aromatic bark. Young branches glabrous, maroon, reddish or green, rounded. Leaf buds prominent, enclosed by caducous scales. Leaves alternatively arranged or in pseudo-whorls; petioles 15–40 mm long, glabrous; lamina 45–110 × 24–60 mm, elliptic, ovate-lanceolate, ovate to broadly ovate, glabrous, adaxially glossy green to yellow-green (young growth usually flushed pink), abaxially glaucous or dull green, adaxial midrib yellowish to cream prominent, side-veins three, prominent, apex apiculate, base attenuate to narrowly cuneate. Domatia pouched, domatium located within axils of midrib and basal secondary veins, and sometimes between secondary and tertiary veins. Inflorescence a terminal to sub-terminal 8–16–20 or more-flowered panicle 70–80(–120) mm long. Flowers 5–8 mm diameter, petals 1.5–2.5(–3.2) mm long, ovate to truncate, greenish-white, white to pale yellow. Fruit a globular glossy black drupe 8–10 mm diameter, held embedded in a cupular green to glaucous-green receptacle, 5–6 mm diameter.

FIRST RECORD: Heenan, P. B., et al., *New Zealand Journal of Botany* 40(4), 163 (2002).

VOUCHER: AK 239643, *B. H. Cumber s.n.*, 16 Jul 1999, Auckland, North Glenfield, Adah Reserve end of Odette Street

ADDITIONAL RECORDS: AK 307622, *P. J. de Lange* 8205 & *J. R. Rolfe*, 23 Oct 2009, Northland, west of Kaitaia, Lake Ngatu, Sweetwater Road; AK 359749, *P. J. de Lange* 12876 & *J. R. Rolfe*, 13 Nov 2015, Northland, Kaitaia, 25 Matthews Ave; UNITEC 11364, *P. J. de Lange* 14574 & *T. J. P. de Lange*, 6 Jan 2020, Northland, Kaitaia, Matthews Ave; AK 301761, *A. P. McCluggage s.n.*, 18 Apr 2007, Northland, Whangārei City, Apirana Ave; AK 297607, *P. J. de Lange* 6700, *F. J. T. de Lange* & *T. J. de Lange*, 29 Sep 2006, Auckland, Puhoi, Puhoi Domain, above Puhoi River (north side); AK 321504, *M. N. Lee s.n.*, 13 Dec 2010, Auckland, Henderson, behind 8 Woodside Road; AK 239649, *E. K. Cameron* 9747, 24 Jul 1999, Auckland, North Glenfield, Adah Reserve end of Odette Street; AK 287866, *B. H. Cumber s.n.*, Apr 2004, Auckland, North Glenfield, Adah Reserve end of Odette Street; UNITEC 11690, *P. J. de Lange* 14754, 3

Apr 2019, Auckland, Auckland City, Mt Albert, Mt Albert War Memorial Park, Selcourt Street; UNITEC 11194, P. J. de Lange 14510, 8 Nov 2019, Auckland, Mt Albert, Woodward Road;. 2019AK 242847, P. J. de Lange 4030, 5 Dec 1999, Auckland, Glen Eden, Waikumete Cemetery; UNITEC 11365, P. J. de Lange 14575, 17 Jan 2020, Auckland, Mt Albert, Mt Albert War Memorial Park; AK 257491, T. J. Martin 97, 11 Jul 2002, Auckland, Three Kings Domain; AK 286340, E. K. Cameron 12417, 28 Apr 2004, Auckland, St Heliers, Dingle Dell Reserve; AK 256157, P. J. de Lange 5321 & G. M Crowcroft, 29 Sep 2001, Bay of Plenty, Tauranga, Maungatapu, Taipari Road; AK 305950, P. J. de Lange 7950, 21 Dec 2008, Tauranga, Maungatapu, near Maungatapu Primary School; AK 304632, W. M. Kent s.n., 16 Mar 2009, Bay of Plenty, Te Puke Cemetery.

NOTES: Camphor laurel is a commonly planted ornamental tree grown throughout the warmer parts of New Zealand. Since the first observations of self-sown plants, there has been a steady increase in wild collections notably from Northland (Kaitia especially), Auckland and Tauranga. As the fruit is bird dispersed the species is probably even more widespread than current collections and observations posted on iNaturalist NZ (<https://inaturalist.nz/home> [accessed: 16 Sept 2020]) suggest. Camphor laurel, as a fast-growing sun and shade tolerant tree, potentially poses a serious threat to indigenous coastal and lowland forests of the northern part of New Zealand at least. It is recognised as a seriously invasive plant in Australia, e.g., <https://weeds.dpi.nsw.gov.au/Weeds/Details/28> (accessed: 16 Sept 2020).

MYRTACEAE

Agonis flexuosa* (Willd.) Sweet var. *flexuosa
peppermint tree

DESCRIPTION (Figures 10A, 10B, 10C): Small, aromatic, multi-trunked trees up to 10 m high with a broad crown. Bark firm, deeply furrowed, brown-grey to grey. Branchlets pendulous, often flexuose, initially finely, softly pilose hairy, with hairs shedding at maturation. Leaves 30–135 × 15–30 mm, narrowly elliptic or narrowly ovate, sometimes falcate, often weakly twisted, initially pink-tinged and sericeous, maturing light to dark green, glabrous, apex acute, margins ± entire. Flowers in glomerules, 8–14 mm diameter; hypanthium 1.5–2.0 mm long, sericeous near apex; sepals ovate-triangular,



Figure 9. *Cinnamomum camphora*: (A) sapling growing on margin of tree privet (*Ligustrum lucidum* W.T.Aiton) forest. Unitec Institute of Technology campus, Woodward Road, Mount Albert, Auckland, 8 November 2019; (B) close-up of foliage showing abaxial and adaxial leaf surfaces. Specimen wild in unkempt verge garden of car park; outside Department of Conservation office, Matthews Ave, Kaitia, 13 November 2015. Photographs © P. J. de Lange.



Figure 10. *Agonis flexuosa* var. *flexuosa*: (A) seedling growing on side of railway track, Mt Albert War Memorial Park, near Asquith Ave Railway crossing, Auckland, 16 January 2020; (B) sapling growing on Pleistocene sand dunes, Rimmers Road, Woodhill Forest, 7 June 2006, photographs © P. J. de Lange; (C) flowers on cultivated tree, Queens Park/Pukenamu, Whanganui, 10 Aug 2012, photograph © C. C. Ogle.

1–2 mm long, greyish-sericeous; petals 3–6 mm long, white, margins usually crimped and apices notched; style 1.0–2.5 mm long; ovary summit glabrous; ovules 5–6 per locule. Fruit broadly turbinate to broadly cup-shaped, 2.5–4.2 mm diameter, glabrous or sparsely hairy near apex.

FIRST RECORD: Heenan, P. B., et al., *New Zealand Journal of Botany* 40(2), 164 (2002).

VOUCHER: AK 179144, R. O. Gardner 5335, 22 Sep 1987, Taranaki, New Plymouth.

ADDITIONAL RECORDS: AK 357259, P. J. de Lange 12636, 13 Apr 2015, Te Pahi, Te Pahi Farm House grounds; AK 322620, P. J. de Lange 9766, 26 Feb 2011, Te Pahi, Waitiki Landing, Kanuka Café tearooms; AK 321220, P. J. de Lange 9539, 28 Jan 2011, Bream Bay, Waipu Cove, 'Waipu Beach'; AK 253619, W. G. Worsfold s.n., 2 Jul 2001, Auckland, Rodney, Mangawhai; AK 292590 / 292591, P. J. de Lange 6551 & J. Salter, 30 Aug 2005, Kaipara, Woodhill Forest, Rimmer Road; AK 353087, P. J. de Lange 12307 & F. J. T. de Lange, 23 May 2014, Auckland, Auckland City, Avondale, Glendon Ave; AK 251844, P. J. de Lange 4733, 30 Nov 2000, Auckland,

Auckland City, Mt Albert, Mt Albert Research Centre; AK 254921, *P. J. de Lange* 5307 & *G. M. Crowcroft*, 24 Aug 2001, Auckland, Auckland City, Western Springs; AK 284972, *E. K. Cameron* 12287, 14 Feb 2004, Auckland, Auckland City, Mt Albert, Kitenui Avenue; UNITEC 11247, *P. J. de Lange* 14543, 16 Jan 2020, Auckland, Mt Albert, Mt Albert War Memorial Park near Asquith Ave Railway Crossing; AK 295622, *E. K. Cameron* 13752, 1 Apr 2006, Auckland, Auckland City, Balmoral, Grange Road, Bank Direct car park; AK 319685, *T. Martin*, 13 Nov 2010, Auckland, Auckland City, Orakei, Orakei Baptist Church; AK 359950, *P. J. de Lange* 12889, 11 Dec 2015, Rotorua, Sala Street, Alpin Motel grounds; UNITEC 11697, *P. J. de Lange* 14761, 8 Feb 2016, Hawkes Bay, Napier, Hospital Hill, Chaucer Road; CHR 532095, *C. C. Ogle* 3593, 15 Sep 1999, Whanganui, Whanganui City, Victoria Ave; UNITEC 11698, *P. J. de Lange* 14762 & *T. J. P. de Lange*, 1 Dec 2019, Golden Bay, Collingwood, Beach Road.

NOTES: *Agonis flexuosa* is a common and widely cultivated ornamental tree, especially in the warmer parts of the North and South Islands. New Zealand plants are fairly uniform with respect to leaf shape and size and match var. *flexuosa*. In places where it has been planted, such as in sand country, in coastal areas, sites abutting railway tracks and along roadsides, or on impoverished soils, it readily self-establishes from seed. Seedlings grow quickly, reaching maturity with 5–10 years. Although still uncommon in the wild since it was first reported establishing in 1987, there has been a rapid increase in occurrences throughout a sufficient area of New Zealand for this species to warrant fully naturalised status.

Melaleuca armillaris* Sm. subsp. *armillaris

bracelet honey myrtle

DESCRIPTION (Figures 11A, 11B): Small tree, up to 6 m high; bark hard, shallowly fissured, occasionally corky. Leaves alternate, 12–25 × 1 mm, dark green to yellow-green, linear, adaxially concave, abaxially gland-dotted, apex narrowly acute, recurved; petiole 1–2 mm long. Inflorescence a dense spike, 30–70 × 20–30 mm, arising from short side branches; axis glabrous to hairy, apex surmounted by a dormant vegetative bud, this initiating growth as a leafy shoot as flowering nears completion. Flowers subtended by a caducous linear pherophyll; stamens 13–18 per bundle, white, claw 5–6 mm long, free part of filaments c. 3–7 mm long. Capsules 3–5 mm wide, sepals persistent, pointed to undulate on the

capsule rim.

FIRST RECORD: Heenan et al., *New Zealand Journal of Botany* 40(2), 164 (2002).

VOUCHER: AK 251144, *P. J. de Lange* 4333, 30 Jul 2000, Auckland, New Lynn, Waikumete Cemetery.

ADDITIONAL RECORDS: AK 189992, *A. E. Wright* 9505, 30 Nov 1989, Northland, Te Pahi, Te Hapua Road, between Waitiki Landing and Spirits Bay turnoff; AK 353315, *J. M. Fox* 90/224 & *W. A. Nelson*, 6 Nov 1990, Te Pahi, Te Hapua Rd. 3.2 km NE by road of junction of Cape Reinga Rd and Te Hapua Rd; Te Aupouri, Waipapakauri beach, Ninety Mile Beach, near Motor Camp; AK 294778, *R. J. Pierce* s.n., 13 Dec 2005, Ahipara, just above Foreshore Road; AK 350858, *M. D. Wilcox* s.n., 29 Mar 2014, AK 333342, *L. Shaft* s.n., 4 Sep 2012, Northland, Ahipara, just north of Kaka Street; AK 34358, *M. D. Wilcox* s.n., 22 Sep 2013, Northland, Ahipara dunes, SW of Kaka Street; AK 359989, *M. Aslund* & *B. S. Parris* 12947, 17 Nov 2015, Bay of Islands, Kerikeri, 967 Inlet Road; AK 308920, *P. J. de Lange* 8381, 8 Jan 2010, Northland, Bream Bay, Marsden, Marsden Point Road, near Oil Refinery Visitor Centre; AK 297610, *P. J. de Lange* 6703, *F. J. T. de Lange* & *T. J. P. de Lange*, 29 Sep 2006, Kaipara Harbour, Makarau River, Waitangi Bridge.

NOTES: Commonly planted throughout the warmer parts of New Zealand, *Melaleuca armillaris* readily establishes in the vicinity of planted specimens. Since it was discovered naturalising, this species has started to expand its range, particularly in the sand country of the far north and in coastal scrub and regenerating forest. As such, it has now past the point of being a 'casual' as described by Heenan et al. (2002) and warrants fully naturalised status.

***Tristaniopsis laurina* (Sm.) Peter G. Wilson et J.T. Waterh.**

water gum

DESCRIPTION (Figures 12A, 12B, 12C): Multi-trunked shrubs or small trees up to 8 m tall with a broad spreading crown. Bark pale pinkish grey, shedding in long ± tabular strips with inrolled margins. Branchlets initially angular to subangular, finely pubescent, hairs shedding as stem matures. Leaves 60–120 × 15–30 mm, oblanceolate to narrow-oblanceolate, apex obtuse to acute, bases attenuate, young growth often pinkish to red-tinged with margins and leaf base pubescent, maturing with adaxial surface dark green glabrous (except near base), abaxially pale green, grey-green to grey-white, pilose, with scattered oil glands; petiole



Figure 11. *Melaleuca armillaris* subsp. *Armillaris*: (A) wild adults; (B) close-up of inflorescences specimens naturalised on margin of tidal inlet, Milnthorpe Quay, Parapara Inlet, Golden Bay, Nelson, 1 Dec 2019. Photographs © P. J. de Lange.

3–8 mm long. Inflorescences in 7–15-flowered dichasia, axis finely pubescent, hairs caducous. Sepals deltoid, greenish, initially ± finely pubescent, hairs caducous. Petals 4–5 × 3–4 mm, orbicular to suborbicular, yellow, margins crimped, apex often notched. Stamens c. 12–20 per fascicle, shorter than the petal. Capsules 6–10 × 4–6 mm, dark red-brown; seeds 5–6 mm long, winged. FIRST RECORD: Heenan, P. B., et al., *New Zealand Journal of Botany* 40(2), 164 (2004).

VOUCHER: AK 280434, CHR 565531, W. Stahel s.n., 18 Mar 2003, South Auckland, Bay of Plenty, c. 3 km south of Katikati.

ADDITIONAL RECORDS: AK 360519, P. J. de Lange 13031, 18 Mar 2016, North Auckland, Kaitaia, North Road, Orana Motel grounds (Pukepoto Road side of Motel); AK 370653 / 370654, A. J. Townsend 227, 31 Jul 2013, North Auckland, south of Mangonui, Black River Road; UNITEC 11222, P. J. de Lange 14416, 6 Oct 2018, Omaha Bay, Point Wells, Point Wells Road; AK 289722 / AK 290497, P. J. de Lange 6428 & T. J. P. de Lange, 7 Apr 2005; Auckland, Auckland City, Glen Eden, Waikumete Cemetery; AK 289723, P. J. de Lange 6429 & T. J. P. de Lange, 7 Apr 2007, Auckland, Auckland City, Glen Eden, Waikumete Cemetery; UNITEC 11271, P. J. de Lange 11217 & T. J. P. de Lange, 31 Jul 2018, Auckland, Auckland City, Point Chevalier, Walford Street; AK 286104, P. J. de Lange 5995, 13 Apr 2004, Auckland, Auckland City, Mt Albert, Selcourt Street; AK 284814, E. K. Cameron 12278, 26 Jan 2004, Auckland, Auckland City, Epsom, Manukau Road; AK 285107, E. K. Cameron 12289, 20 Feb 2004, Auckland, Auckland City, Remuera; AK 288211, P. J. de Lange 6110 & T. J. P. de Lange, 10 Sep 2004, South Auckland, Hamilton, Te Rapa Straight; CHR 610018, R. C. Ogle & C. C. Ogle 5775, 18 Aug 2010, Taranaki, New Plymouth, Gover St (between Leach and Courtney Streets), garden of Burger King restaurant.

NOTES: *Tristaniopsis* is commonly planted, often as a street verge tree, throughout the warmer parts of New Zealand. Establishment was first reported by Heenan et al. (2004) on the basis of plants that had appeared in roadside scrub near Katikati, Bay of Plenty. Since then, *Tristaniopsis* has been collected from a range of situations over a large part of the northern North Island. Whilst most occurrences are of seedlings and saplings in the vicinity of established plantings in urban areas, sporadic occurrences of this species along rural roadsides and in gumland scrub suggest it has the propensity to spread readily beyond urban plantings. Particularly worrisome is that this species flourishes in



Figure 12. *Tristaniopsis laurina*: (A) seedling; (B) planted tree showing flowers; (C) fruiting wild adult, one of many specimens noted growing in shrubbery, Pukepoto Road, Kaitiāia, Northland, 19 March 2016, photographs © P. J. de Lange.

impoverished soils, often in indigenous shrubland and, once mature, specimens can produce masses of wind-dispersed seed. In its indigenous range of Australia *Tristaniopsis laurina* can form trees up to 30 m tall (Wilson & Waterhouse 1982), dimensions thus far not seen in New Zealand.

ONAGRACEAE

Epilobium hirsutum L.

great willowherb

DESCRIPTION (Figures 13A, 13B): Semi-aquatic, softly hairy, rhizomatous, much-branched herb up to 2 m tall. Stems and branches erect, woody near base, densely, softly pubescent; hairs in admixtures of non-glandular and glandular. Leaves opposite to subopposite, 30–60 × 10–26 mm, light green, green to grey-green, surfaces finely pubescent (hairs eglandular), adaxially less than abaxially, lanceolate to narrowly oblong, bases clasping stem and slightly decurrent with stem, apices acute, margins coarsely to finely toothed in upper $\frac{2}{3}$ – $\frac{1}{2}$. Inflorescences borne in upper third of stem, with one flower per leaf axil. Flowers erect up to 10 mm diameter;

ovaries erect or outwardly falcate, 30–50 mm long, densely strigulose, dull grey-green or maroon, borne on a pedicel 4–20 mm long. Hypanthium 1.8–2.8 × 1.6–3.2 mm, bearing a conspicuous rim of white hairs near apex. Sepals 5–7.0 × 2.3–2.8 mm, grey-green to green, broadly lanceolate to obtuse, keeled, both surfaces softly pubescent. Petals 6–18.0 × 5.0–10.0 mm, dark pink to rose-purple, ovate, apically weakly to prominently notched. Styles white, exerted. Fruits 25–100 mm long, pubescent, hairs glandular. Seeds c. 1 mm long, surface coarsely papillose, comose.

NEW RECORD: CHR 646066, *J. Butt s.n.*, Mar 2018, Canterbury, Kaiapoi, Lake Pegasus.

ADDITIONAL RECORDS: CHR 649338, *P. Bradbury s.n.*, 19 Apr 2018, Canterbury, Waipara, Kate Valley Landfill; CHR 646089, *P. Bradbury s.n.*, 1 May 2018, Canterbury, Leithfield, Hursley Terrace Road; CHR 646090, *P.*

Bradbury s.n., 3 May 2018, Canterbury, Kaiapoi Lakes Reserve; CHR 654811, *T. Ryder s.n.*, 5 Feb 2019, Christchurch, New Brighton, Travis Wetland.

NOTES: Possible Cultivation Escape or trans-Tasman establishment from Australia, where it is now well established. First found growing on limestone blocks at the outlet of a small lake at Kaiapoi, North Canterbury. All records since are from wetland edges, drains and road sides in the same region and it appears that it was well established before it was discovered. It is a widespread species in Europe and North America (where it is considered naturalised – see <https://gobotany.nativeplanttrust.org/species/epilobium/hirsutum/> [accessed: 17 November 2020]) in such sites and, with wind seed dispersal, perennial habit and an ability to establish in damp, disturbed sites out of sight, we consider this species to already be fully naturalised. It is almost certain to establish beyond the range known in early 2019. The discovery of *E. hirsutum* in New Zealand was noted in a news release on 20 May 2019 (<https://www.mpi.govt.nz/news-and-resources/media-releases/mpi-confirms-discovery-of-invasive-weed-great-willowherb-in-canterbury/> [accessed: 16 Sept 2020]). In Victoria, Australia, it was first collected in 1996, and has since been recorded as a weed at a range of sites, commonly growing at margins of wetlands and other damp situations (<https://vicflora.rbg.vic.gov.au/flora/taxon/3f305290-410b-434e-8cb9-e64b0b7bd7f3> [accessed: 16 Sept 2020]).

PLANTAGINACEAE

Veronica javanica Blume

Javan speedwell

DESCRIPTION (Figure 14): Annual, decumbent or ascending herb to about 150 mm tall, much branched; branches up to 250 mm long, usually densely greyish-white pilose. Leaves opposite; lamina 5.5–25 × 5–16 mm, broadly ovate, apex obtuse, truncate, subcuneate to subcordate, obtuse at base, coarsely crenate-serrate up to 10×, densely pilose above, subglabrescent; petiole 1.5–2(–3.5) mm long. Racemes axillary, 1.5–2.5 mm long, few-flowered; flowers blue to whitish, bracteate. Bracts 2.0–2.3 × 0.4–0.5 mm, narrowly oblong, obtuse, shortly ciliate. Pedicels 0.5–1 mm long, stout. Calyx 1.8–2.5 mm long at flowering, up to 3.4 mm long in fruit; lobes 0.5–1 mm wide, oblong to obovate-oblong, obtuse, glabrous to sparsely pilose, ciliate. Corolla up to



Figure 13. *Epilobium hirsutum* showing growth habit (A) and flowers (B), from specimens naturalised at Travis Wetland, Christchurch, 2 Feb 2019. Photographs © Colin Meurk.

2 mm long. Capsule 1.25–2.6 × 2.25–2.8 mm, broadly obcordate in outline, compressed, glabrous, ciliate on suture.

FIRST RECORD: Anon., *Branch Out* 24, 2–3 (2007).

VOUCHER: WELT SP086054, *P. J. Garnock-Jones* 2621, 7 Mar 2007, Wellington City, Otari-Wilton's Bush.

ADDITIONAL RECORDS: AK 306867, *P. J. de Lange* 8085 & *J. R. Rolfe*, 21 Oct 2009, North Auckland, Te Pahi, Waitiki Landing; AK 316328, *P. J. de Lange* 9242, 2 Sep 2010, North Auckland, State Highway 12, near Katui, Native Forest Restoration Trust Nursery; AK 309046, *P. J. de Lange* 8469, *T. J. de Lange* & *F. J. T. de Lange*, 2 Jan 2010, North Auckland, Dargaville, Victoria Street; AK 316419, *P. J. de Lange* 9264, 3 Sep 2010, North Auckland, Kaipara, State Highway 12, Ruawai; AK 316403, *P. J. de Lange* 9260, 3 Sep 2010, North Auckland, Kaipara, State Highway 12, Paparoa; UNITEC 11371, *P. J. de*

Lange 14428, 5 Oct 2018, North Auckland, Omaha Bay, Omaha, Ida Way; UNITEC 11372, P. J. de Lange 14429, 2 Oct 2018, North Auckland, Omaha Bay, Point Wells, Point Wells Road; UNITEC 11373, P. J. de Lange 14430, 1 Oct 2018, North Auckland, Omaha Bay, Point Wells; AK 298378, A. E. Esler s.n., 5 Dec 2006, Auckland, Mt Albert, 5 Stilwell Street; AK 301976/CHR 552776, P. J. de Lange 7292, T. J. de Lange & L. Levis, 8 Mar 2008, West Auckland, Oratia, Oratia Valley, Oratia Native Plant Nurseries; WELT SP103450, P. J. Garnock-Jones 2895, 19 Apr 2013, Auckland, Oratia Nursery; AK 302241, E. K. Cameron 15046, 19 Apr 2008, Auckland, Balmoral, Thames Street; AK 303415, P. J. de Lange 7410 & F. J. T de Lange, 27 Aug 2008, Auckland, Three Kings, Jansen's Pet Shop; AK 303727, P. J. de Lange 7516, 9 Apr 2008, Auckland, Mt Albert, Asquith Ave; UNITEC 11370, P. J. de Lange 14427 & T. J. P. de Lange, 1 Jan 2019, Auckland, Mt Albert, corner of Alberton and Lloyd Aves; AK 305671, P. J. de Lange 7889 & T. J. de Lange, 7 Jul 2009, Auckland, Mt Albert, Monaghan Street; AK 334393, P. J. de Lange 11121 & G. M. Crowcroft, 7 Oct 2012, Auckland, Western Springs, Auckland Zoo; AK 306193, P. J. de Lange 7972, 2 Oct 2009, Auckland, Newmarket, George Street; AK 328960, P. J. de Lange 10276, 15 Nov 2011, Auckland, Newmarket, Remuera Road; AK 344958, P. J. de Lange 11684, 1 Oct 2013, Auckland, University of Auckland, Thomas Building (grounds); UNITEC 11692, P. J. de Lange 14756, 7 Sep 2016, Auckland, University of Auckland, Symonds Street campus, courtyard near recreation centre; AK 344957, P. J. de Lange 11683, 29 Sep 2013, South Auckland, Manurewa, Auckland Botanical Gardens; AK 305806, G. M. Crowcroft s.n. & F. J. T. de Lange, 15 Aug 2008, Hamilton, Te Rapa Straight; AK 308763, P. J. de Lange 8233, 19 Dec 2009, Coromandel Peninsula, Whangamata, Port Road; AK 347634, P. J. de Lange 11877, 7 Dec 2013, Bay of Plenty, Tauranga, Mt Maunganui; AK 347636, P. J. de Lange 11883, 16 Dec 2013, Rotorua, corner of Pukaki and Hinemoa Streets; UNITEC 11369, P. J. de Lange 14426, 26 Mar 2019, Taranaki, Lake Mangamahoe; WELT SP101305, P. J. Garnock-Jones 2620, 24 Feb 2007, Wellington, Otari-Wilton's Bush.

NOTES: The first wild collection of *Veronica javanica* in New Zealand was in Auckland in 2006, and it was first recorded as naturalising in 2007, when it was recorded as a weed along track sides within planted areas from Otari-Wilton's Bush, Wellington. It was subsequently treated as a 'Spontaneous Occurrence' by Heenan et al. (2008). Since then this species has been much more



Figure 14. *Veronica javanica*, flowering plants naturalised amongst *Lepidium didymum*, in raised concrete planter box within paved courtyard between buildings, University of Auckland, Auckland, 7 September 2016. Photograph © P. J. de Lange.

widely collected throughout the northern North Island and has extended its range to Taranaki and the Chatham Islands (<https://inaturalist.nz/observations/17238577>, accessed 1 February 2021). Despite the range increase, this species is nearly always found as a nursery weed, or in association with nursery-derived plantings. On available evidence, it seems likely that *Veronica javanica* was one of the first of the 'coir peat' weeds to become established. Indications are that whilst widespread, this species is still confined, possibly by climate to more sheltered sites, and so far, has yet to be found outside urban and/or nursery settings.

POLYGONACEAE

Persicaria chinensis (L.) H.Gross

Chinese knotweed

DESCRIPTION (Figure 15): Perennial rhizomatous plants, 1.0–1.8(–2.6) m tall. Stems erect, ascending often scandent, glabrous or retrorsely hispid; ochrea cylindrical, 15–25(–50) mm long, tan to brown, base inflated, margins oblique, without cilia, base leathery otherwise papery, surface glabrescent to minutely puberulent. Leaf petiole 10–25 mm, winged at least distally; lamina 40–180 × 15–100 mm, lanceolate to ovate or elliptic, base truncate to broadly cordate, apex acuminate, lamina margins glabrous or antrorsely scabrous with

whitish hairs, otherwise glabrous or hispid abaxially and adaxially, sometimes with abaxial veins puberulent, otherwise abaxial surface often minutely reddish-punctate. Inflorescences terminal or terminal and axillary, 3–6 × 3–6 mm; peduncle 10–30 mm, stipitate-glandular for entire length; ochreolae overlapping, margins eciliate. Pedicels mostly ascending, 2–3 mm. Flowers 1–3 per ochreate fascicle; perianth white to pink, campanulate, glabrous, accrescent; tepals 5, ovate, 3–4 mm, apex acute to obtuse; stamens 8, filaments distinct, free; anthers red or purple, elliptic; styles 3, connate proximally. Achenes included in fleshy, bluish black perianth, black, trigonous, 2.8–4.0 × 2.0–3.0 mm, dull, minutely punctate.

NEW RECORD: AK 299431–AK 299432, *R. G. Smart s.n.*, 31 May 2007, Auckland City, Glenfield.

ADDITIONAL RECORDS: AK 304966, *R. J. Hursthouse s.n.*, 13 May 2009, Auckland City, Glenfield; AK 305177, *V. E. Lepper s.n.*, 16 Jun 2009, Auckland City, Glenfield; CHR 605366, *V. E. Lepper s.n.*, July 2009, Auckland City, Glenfield; AK 335293, *A. M. Rule s.n.*, 20 Nov 2012, Auckland City, Massey, Glen Road; AK 335831, *A. M. Rule s.n.*, 14 Dec 2012, Auckland City, Glendowie, Roberta Reserve; AK 335972, *N. P. Goldwater s.n.*, 3 Oct 2012, Auckland City, Bucklands Beach, Hutchinsons Road by Angelo Stream; AK 339472, *A. M. Rule s.n.*, 23 May 2013, Auckland City, Bucklands Beach, Hutchinsons Road by Angelo Stream; AK 341172, *M. F. Stewart s.n.*, 17 Jul 2013, Auckland City, Mt Roskill, Big King Reserve; AK 350213, *K. A. Leggett s.n. & M. F. Stewart*, 21 Jan 2014, Auckland City, Waterview, Oakley Creek stream. AK 361089, *S. L. Happy s.n.*, 18 Feb 2016, Auckland City, Te Atatu South, Roberts Road; AK 356273, *D. Embling s.n.*, 21 Jun 2011, Hamilton, Comries Road / Belmont Ave intersection.

NOTES: *Persicaria chinensis* has so far been recorded at some 19 Auckland suburban and streambank sites, and also one in Hamilton, because it is an aggressively spreading species. The Ministry of Primary Industries has classified this species as an Unwanted Organism in New Zealand and it is currently being managed for eradication at all sites.



Figure 15. *Persicaria chinensis* scrambling out of unmaintained garden over fences, hedges and exotic vegetation, Frost Road, Mt Roskill, 10 July 2019. Photograph © Jack Warden.

CASUAL RECORDS

PTERIDOPHYTA ANEMIACEAE

Anemia phyllitidis Sw.

NEW RECORD: AK 327905, *B. S. Parris 12849*, 22 Sep 2008, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. Two sporelings, on steep S-facing bank, under canopy of recently dead *Cyathea medullaris* (G.Forst.) Sw. Parent plant established on same site in 1996, but died a year or so later. Sporelings were apparently from soil spore bank and appeared when light levels increased.

ATHYRIACEAE

Diplazium esculentum (Retz.) Sw.

vegetable fern

FIRST RECORD: Brownsey, P. J. & Perrie, L. R., *Flora of New Zealand: Ferns and lycophytes. Fascicle 24, Athyriaceae* (2018).

VOUCHER: AK 259023-24 (duplicates CHR, WELT), *B. S. Parris 12572*, 25 Mar 2002, North Auckland, Bay of Islands, Kerikeri.

ADDITIONAL RECORDS: AK 360894, *P. J. de Lange 13148 & F. J. T. de Lange*, 5 Jul 2015, Auckland, Manurewa, Puhinui Creek near Botanic Gardens; AK

360895, P. J. de Lange 13149 & F. J. T. de Lange, 5 Jul 2015, Auckland, Glendowie, Churchill Park near Kinsale Ave.

NOTES: Cultivation Escape. Initially collected from a garden in Kerikeri where this species had spread rapidly and aggressively. Subsequent collections may have arisen from flood-deposited material washed downstream from plantings (Puhinui Creek), and at Glendowie possibly from a past deliberate planting. In New Zealand, this species has yet to be seen fertile, though it spreads very quickly vegetatively via an extensive underground network of black, wiry, easily detached rhizomes which produce numerous young plants.

DRYOPTERIDACEAE

Dryopteris formosana (Christ) C.Chr.

NEW RECORD: AK 374687, B. S. Parris 12960, 10 Oct 2018, North Auckland, Bay of Islands, Kerikeri.

NOTES. Cultivation Escape. Two self-sown plants, c. 3 m away from parent plant.

Dryopteris wallichiana (Spreng.) Hyl.

NEW RECORD: AK 374688, B. S. Parris 12957, 12 Nov 2017, North Auckland, Bay of Islands, Kerikeri.

NOTES. Cultivation Escape. Sporadically self-sowing up to 25 m away from parent plant.

POLYPODIACEAE

Phlebodium aureum (L.) J.Sm.

NEW RECORD: AK 380640, E. Middleton s.n., 19 Jan 1983, Auckland City, Remuera, appeared in flowerpot.

ADDITIONAL RECORDS: AK 351756, B. J. Gill s.n., Feb 2014, Auckland City, Grey Lynn, outside hanging pot; AK 352151, B. J. Gill s.n., 1 Jun 2014, Auckland City, Grey Lynn (from same plant as above); AK 353079, B. S. Parris 12930, 2 Jun 2014, North Auckland, Kerikeri.

NOTES: Spontaneous Occurrence. All three records derive from a pot contaminant; and with at least two of them it was in association with a cultivated plant purchased from a nursery.



Figure 16. *Pteris multifida* naturalising on about 2 m of retaining wall, Kari Street nursery, Grafton, Auckland, 13 Aug 2009. Photograph © E. K. Cameron.

PTERIDACEAE

Pteris multifida Poir.

NEW RECORD: AK 305834, E. K. Cameron 15197, 13 Aug 2009, Auckland City, Grafton.

ADDITIONAL RECORDS: AK 306049, P. J. de Lange 7963, 5 Sep 2009, Hamilton, St Andrews; AK 306050, P. J. de Lange 7964, 5 Sep 2009, Hamilton, Hillcrest.

NOTES (Figure 16): Cultivation Escape. The three gatherings were all made from places adjacent to where the species had been cultivated in the recent past.

Pteris parkeri J.J.Parker

FIRST RECORD: Parris, B. S., *New Zealand Botanical Society Newsletter* 131, 8–9 (2018).

VOUCHER: AK 330571, D. Shaw, 28 Mar 2012, North Auckland, Matakoho, 12 Horniblow Road.

NOTES. Spontaneous Occurrence. “Spontaneously appeared in a grassy ditch where the edge of a small

bridge was covering it. Not seen elsewhere in the district." Recorded as cv *Albolineata*.

THELYPTERIDACEAE

Pseudophegopteris aurita (Hook.) Ching

NEW RECORD: AK 327895, B. S. Parris 12850, 22 Sep 2008, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. One sporeling growing in shade on south-facing slope. Parent plant 40 m away on other side of house.

GNETOPSIDA

EPHEDRACEAE

Ephedra foeminea Forssk.

NEW RECORD: AK 303482, P. J. de Lange 7450, 14 Jul 2007, Auckland, University of Auckland campus grounds.

NOTES: Cultivation Escape. Formerly well established in cracked asphalt of driveway between buildings. *Ephedra foeminea* has an extensively creeping, suckering growth habit, and this gathering appears to have established as a result of routine road maintenance that severed root suckers and stolons that had extended from a planted specimen (AK 232230, C. D. McCullough s.n., 27 Nov 1995) growing in a walled garden above drive. Following a verbal recommendation, this wild plant was destroyed by university grounds staff in January 2009.

PINOPSIDA

ARAUCARIACEAE

Araucaria cunninghamii Mudie var. *cunninghamii* hoop pine

NEW RECORD: AK 250902, P. J. de Lange s.n. & G. M. Crowcroft, Feb 1994, Auckland, Hauraki Gulf, Motuihe Island, Isthmus, Ocean Bay.

NOTES: Cultivation Escape. Occasional saplings present in the vicinity of a planted adult tree. About a decade after this collection was made, the seedlings, saplings and adult tree (and, indeed, many associated *A. heterophylla* – which is more common on this island) were removed as part of the ongoing programme of removing alien species from Motuihe Island by staff of the Department

of Conservation.

CUPRESSACEAE

Hesperocyparis arizonica (Greene) Bartel

Arizona cypress

NEW RECORD: CHR 400732, W. R. Sykes 456/81, 4 Dec 1981, North Auckland, Waitangi State Forest.

ADDITIONAL RECORD: NZFRI 27827, C. C. Ogle 5638 & R. C. Ogle, 2 Sep 2009, Whanganui, Westmere, Bason Botanic Reserve.

NOTES: Cultivation Escape. The two collections comprise seedlings up to 400 mm tall. Howell (2019) published Arizona cypress (as *Cupressus arizonica* Greene) as a casual for two New Zealand Ecological Districts but included no vouchers. We follow Adams et al. (2009) in accepting the segregate genus *Hesperocyparis* Bartel et R.A.Price for those western cypresses previously treated as *Cupressus* L.

Juniperus communis L.

common juniper

NEW RECORD: CHR 603224, H. Webb s.n., 19 Nov 2008, Rangitikei, Te Namu.

NOTES: Cultivation Escape. Seedlings and saplings growing near cultivated adult plants. Howell (2019) published common juniper as a casual for one New Zealand ecological district but included no vouchers.

Taxodium distichum (L.) Rich.

bald cypress

FIRST RECORD: Perrie, L. & Perrie, R., *Auckland Botanical Society Journal* 63, 24–25 (2008).

VOUCHER: AK 301850, L. R. Perrie 5417, 29 Dec 2007, Te Kauwhata.

ADDITIONAL RECORDS: WELT SP103262, L. R. Perrie s.n., 31 Dec 2011, Te Kauwhata; AK 335987, T. J. Martin s.n., 14 Dec 2012, Auckland, Mt Wellington; WELT SP102828, M. Needham s.n., Jan 2014, Te Aroha; AK 332368, C. Ashton s.n., 17 Apr 2010, Auckland, Auckland Domain.

NOTES: Cultivation Escape. Seedlings observed in the vicinity of cultivated adults.

PINACEAE

***Abies pinsapo* Boiss.**

Spanish fir

NEW RECORD: NZFRI 28186, *C. C. Ogle 5757 & R. C. Ogle*, 20 May 2010, Whanganui, Pukenamu-Queen's Park.

ADDITIONAL RECORD: CHR 616009, *C. C. Ogle 5919*, 10 Sept 2011, Wairarapa, Eketahuna; CHR 616011, *C. C. Ogle 5920*, 19 Sep 2011, Whanganui, Pukenamu-Queen's Park.

NOTES: Cultivation Escape. Seedlings established from nearby cultivated trees. Howell (2019) published Spanish fir as a casual for two New Zealand ecological districts but included no vouchers.

Pinus elliotii* Engelm. var. *elliotii

slash pine

FIRST RECORD: Wilcox, M. D., *Auckland Botanical Society Bulletin* 31, 34 (2014).

VOUCHER: AK 349019, *M. D. Wilcox s.n.*, 13 Oct 2013, North Auckland, Lake Ohia.

NOTES: Cultivation Escape. Locally well established in the vicinity of planted trees and spreading into adjacent gumland. Howell (2019) published slash pine as a casual for one New Zealand ecological district but included no vouchers.

PODOCARPACEAE

***Afrocarpus falcatus* (Thunb.) C.N.Page**

yellowwood

FIRST RECORD: Perrie, L. R., *Tuhinga* 22, 157–160 (2011).

VOUCHER: WELT SP088056, *L. R. Perrie 6202b & L. D. Shepherd*, 4 Jan 2010, Palmerston North.

ADDITIONAL RECORD: AK 360897, *P. J. de Lange 13151 & F. J. T. de Lange*, 5 Jul 2015, Auckland, Manurewa, Totara Park, Puhinui Creek.

NOTES: Cultivation Escape. Noted growing under or close to planted fruiting specimens or in sites close to planted fruiting trees. This species is widely cultivated in New Zealand, and it is likely that there will be other wild occurrences. For example, NZFRI 26519 (*T. R. Pellett s.n.*, 6 May 2007, Napier) is a collection of a planted adult under which seedlings are said to have

been observed, though, in this case, only adult material was collected. Howell (2019) published yellowwood as a casual for one New Zealand ecological district but included no vouchers.

***Podocarpus elatus* R.Br. ex Endl.**

brown pine

NEW RECORD: AK 300197, *P. J. de Lange 6987, T. J. P. de Lange & F. J. T. de Lange*, 21 Jul 2007, Auckland, Ellerslie, Ellerslie Race Grounds.

ADDITIONAL RECORDS: AK 300330, *E. K. Cameron 14545*, 5 Aug 2007, Auckland, Remuera; AK 360896, *P. J. de Lange 13150 & F. J. T. de Lange*, 5 July 2015, Auckland, Manurewa, Totara Park, Puhinui Creek.

NOTES: Cultivation Escape. The collections were made from places where male and female trees grow together. As the fruits of this species are readily eaten by birds, this species is also very likely to establish away from planted specimens. The naturalisation of this species was noted by Gardner (2010) but no substantiating specimens were cited. Howell (2019) published brown pine as a casual for two New Zealand ecological districts but included no vouchers.

***Podocarpus elongatus* (Aiton) L'Herit. ex Pers.**

Breede River yellowwood

NEW RECORD: AK 317063, *C. C. Ogle 5781*, 5 Sep 2010, Whanganui, Westmere, Bason Botanic Reserve.

NOTES (Figures 17A, 17B, 17C): Cultivation Escape. About fifteen seedlings self-established within 0.5 m of two planted shrubs. Howell (2019) published Breede River yellowwood as a casual for two New Zealand ecological districts but included no vouchers.

Podocarpus macrophyllus* (Thunb.) Sweet var. *macrophyllus

Japanese yew pine

NEW RECORD: AK 303824, *P. J. de Lange 7567, T. J. P. de Lange & F. J. T. de Lange*, 16 Nov 2008, Auckland, Mt Eden, Eden Terrace, New North Road.

ADDITIONAL RECORDS: AK 311276, *P. J. de Lange 9026*, 12 Mar 2010, Bay of Plenty, Whakatane, Valley Road.

NOTES: Cultivation Escape. Sparingly established near planted fruiting female trees. The fruits of this species are larger than those of *P. elatus* and are avidly eaten by blackbirds (*Turdus merula*). Consequently, this species is likely to establish well away from planted specimens.



Figure 17. *Podocarpus elongatus*: (A) self-established seedlings (arrowed) of *Podocarpus elongatus* below a planted shrub; (B, C) planted parent source for seedlings, Bason Botanic Gardens, Rapanui Road, Whanganui, 4 July 2012. Photographs © Colin Ogle.

The naturalisation of this species was noted by Gardner (2010) but no substantiating specimens were cited. Howell (2019) published yew pine as a casual for one New Zealand ecological district but included no vouchers.

**ANTHOPHYTA
DICOTYLEDONAE
ACANTHACEAE**

***Aphelandra sinclairiana* Nees**

NEW RECORD: AK 379872, C. Hutching s.n., 26 Sep 2018, Auckland, Papakura, Butterworth Block, Great South Road
NOTES: Cultivation Escape. A group of 8–10 plants in a patch no bigger than 4–6 square metres under a forest canopy; seedlings 30 cm to plants c. 2 m tall.

Hygrophila ringens* (L.) R.Br. ex Spreng. var. *ringens
willow hygro

NEW RECORD: AK 305910, P. J. de Lange 7931 & R. O. Gardner, 23 Dec 2007, Auckland, Western Springs, Meola Creek.

ADDITIONAL RECORDS: AK 305924/CHR 553121, P. J. de Lange 7939, 23 Aug 2009, Auckland, Western Springs, Meola Creek; AK 305931, P. J. de Lange 7944, T. J. P. de Lange & F. J. T. de Lange, 23 Aug 2009, Auckland, Western Springs, Meola Creek; AK 370957, C. D. Kilgour 2994 & R. Morton, 17 May 2016, Auckland, Waiheke Island, Awaawaroa.

NOTES (Figures 18A, 18B): Intentional Release and Cultivated Escape. The three Meola Creek gatherings were made from an associated small spring and tributary stream at the back of the Horticultural Society Buildings, Western Springs that were destroyed by roadworks in 2015. It seems likely that they had stemmed from a

past deliberate planting of this commonly grown aquatic plant. Although flowering and fruiting was not observed in the wild plants, they had spread asexually through detachment of stems and rooted pieces, probably during flooding. Plants are easily overlooked because, when vegetative, they have a superficial similarity to *Persicaria hydropiper* (L.) Spach, common in this area. The Waiheke Island specimen was in a roadside drain and was suspected to have spread from planted material.

***Strobilanthes gossypina* T.Anderson**

NEW RECORD: AK 374689, B. S. Parris 12958, 12 Nov 2017, North Auckland, Bay of Islands, Kerikeri.
 NOTES: Seven seedlings less than 1 m from parent plant that died after flowering.

***Ruellia makoyana* Closon**

NEW RECORD: AK 300489, B. S. Parris 12828, 23 Aug 2007, North Auckland, Bay of Islands, Kerikeri.
 NOTES: Cultivation Escape. Single self-sown plant in deep shade close to parent plant; the seedling has survived a winter at this site.

***Thunbergia grandiflora* (Roxb. ex Rottler) Roxb.**
 Bengal clock vine

NEW RECORD: AK 302136, P. J. de Lange 7344, 13 Apr 2008, Auckland City, Mount Albert, near Baldwin Avenue Railway Station.
 NOTES: Cultivation Escape. Single plant collected from vegetation along railway tracks. Cultivated in a nearby garden.

***Odontonema tubaeforme* (Bertol.) Kuntze**
 firespike

NEW RECORD: AK 254263, R. Renwick s.n., 5 Aug 2001, North Auckland, between Mangonui and Coopers Beach, Rangikapiti Road.
 ADDITIONAL RECORDS: AK 359300, T. J. Martin s.n., Jul 2010, North Auckland, inland from Mangonui, by Oruaiti River; AK 360446, P. J. de Lange 13003, 10 Mar 2016, North Auckland, Kaitaia, North Road, grounds of The Northerner Hotel; AK 360518, P. J. de Lange 13003, 18 Mar 2016, North Auckland, Kaitaia, North Road, grounds of Orana Motel; UNITEC 11738, P.J. de Lange 14773 & F.J.T. de Lange, Auckland, Mt Albert, Fifth Ave.
 NOTES: Garden Discard. Most collections are from plants



Figure 18. *Hygrophila ringens*: (A) plants established in a tributary spring and stream draining into Meola Creek (this site has since been destroyed through widening of the North Western Motorway), Western Springs, Auckland, 23 August 2009, photograph © P. J. de Lange; (B) close-up of foliage, from plants naturalised in creek near Hillcrest, North Shore, Auckland, 24 April 2020, photograph © R. Y. Vesie.

spreading by layering from garden discards, but at least one collection (AK 359300) also contains seedlings.

ACTINIDIACEAE

***Actinidia eriantha* Benth.**
 kiwifruit

NEW RECORD: CHR 605353, B. Kent s.n., 28 May 2009, Bay of Plenty, Te Puke, Bennetts Gully.
 NOTES: Cultivation Escape. A few vines found growing wild in a gully in the vicinity of planted specimens.

AIZOACEAE

***Trianthema portulacastrum* L.**

giant pig weed

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302100, E. K. Cameron 15024, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-Waikato, Waipa, Kihikihi, Growing Spectrum Ltd. NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date, there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

AMARANTHACEAE

***Iresine diffusa* f. *herbstii* (Hook.) Pedersen.**

NEW RECORD: AK 300494, B. S. Parris 12825, 23 Aug 2007, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. Single self-sown plant in deep shade, 30 m from parent plant.

ANACARDIACEAE

***Harpephyllum caffrum* Bernh. ex Krauss**

kaffir plum

NEW RECORD: AK 304199, P. J. de Lange 7601 & G. M. Crowcroft, 27 Jan 2009, Coromandel Peninsula, Tairua.

ADDITIONAL RECORDS: AK 305410, T. Martin s.n., 7 Jul 2009, North Auckland, Takou Bay, Takou Bay Road; AK 359165, T. J. Martin s.n., 13 Nov 2014.

NOTES: Cultivation Escape. The three gatherings come from the vicinity of planted, fruiting adult trees. Kaffir plum is very widely, though not commonly, cultivated in northern New Zealand and trees fruit freely, so further incidences of wild plants are to be expected.

APIACEAE

***Ammi visnaga* (L.) Lam.**

NEW RECORD: AK 373181/AK 373182, C. D. Kilgour s.n., 2 Nov 2018, North Auckland, Whangarei Heads, Tamaterau.

NOTES: Cultivation Escape. About 50 plants, adults and seedlings to 1.2 m tall, on roadside verge, possibly spread from neighbour's property.

***Anthriscus cerefolium* (L.) Hoffm.**

garden chervil

NEW RECORD: AK 379271-AK 379272, C. C. Ogle 6667, 12 Oct 2019, Whanganui, St John's Hill, 16 Virginia Heights.

NOTES: Cultivation Escape. First grown in March 2017 as a culinary herb, from where seedlings self-established through the garden.

***Bupleurum rotundifolium* L.**

Thorow-wax

NEW RECORD: CHR 582316, M. Visch s.n., 24 Jan 2007, Canterbury, Oxford, Ashley Gorge Road.

NOTES: Spontaneous Occurrence. Appeared in a garden where it had not been cultivated.

***Eryngium planum* L.**

blue eryngo

NEW RECORD: CHR 603249, H. Phillips s.n., 9 Jan 2009, Wairarapa, Te Whiti Settlement Road.

NOTES: Spontaneous Occurrence. Growing on roadside gravels.

***Oenanthe javanica* (Blume) DC.**

NEW RECORD: AK 358120, P. D. Champion s. n., 12 Nov 2014, Horowhenua, Levin, State Highway 1, near Kawi Road

NOTES: Cultivation Escape. Growing in a roadside ditch, the plants having spread from a nearby garden. The wild collection corresponds to the pink/green variegated cultivar 'Flamingo.' Also reported growing wild along a creek at Richmond (<https://inaturalist.nz/observations/40341294> [accessed: 17 November 2020]).

***Smyrniololus* L.**

alexanders

FIRST RECORD: Martin, T. J., *Auckland Botanical Society Journal* 67, 179–180 (2012).

VOUCHERS: AK 313519-AK 313521, T. J. Martin s.n., 11 Jun 2010, North Auckland Land District, Takou Bay; AK 333750, T. J. Martin s.n., 19 Sep 2012, Auckland City, Kelston, Archibald Park.

ADDITIONAL RECORDS: AK 335007, AK 335008/CHR 599121, T. J. Martin s.n., 28 Oct 2012, North Auckland Land District, Takou Bay; AK 380183, E. K. Cameron 17536, 8 Sep 2020, Auckland City, Meola Reef Reserve.

NOTES: Cultivation Escape and Spontaneous Occurrence. Locally established in the vicinity of deliberate plantings (Takou Bay); and local occurrences not associated with any plantings (Auckland City records). Alexanders is an aggressive, fast growing rampant species that is sometimes cultivated as a medicinal herb. Notably, Martin (2012) records The Herb Farm in the Manawatu listing alexanders as their Plant of the Week for August 2006 on their website and noting it having “established itself beautifully under trees in our woodland areas.”

APOCYNACEAE

Alyxia ruscifolia* R.Br. var. *ruscifolia

prickly alyxia

NEW RECORD: AK 361405, P. J. de Lange 13158, 9 Jul 2016, Auckland, Symonds Street, University of Auckland campus grounds.

NOTES: Cultivation Escape. Numerous saplings and seedlings established along c. 5 m of the top of a basalt block wall. Associated with a single, planted, fruiting adult.

***Beaumontia grandiflora* Wall.**

Easter lily vine

NEW RECORD: AK 300230, P. J. de Lange 6971 & T. J. P. de Lange, 15 Jul 2007, Auckland, Mt Albert.

NOTES: Cultivation Escape. Seedlings established in brick wall some 4 m distant from a massive adult vine planted within the Mt Albert Research Centre. The brick wall, seedlings and plant vine were destroyed in August 2009 following redevelopment of this part of the research centre grounds. *Beaumontia* is occasionally cultivated in New Zealand, so further wild occurrences are to be expected.

AQUIFOLIACEAE

***Ilex opaca* Aiton**

American holly

NEW RECORD: AK 312632, E. K. Cameron 15456 & C. Ashton, 26 Apr 2010, Auckland City, Auckland Domain.

NOTES (Figure 19A, 19B): Cultivation Escape. A few seedlings established in a bark garden about 250 m distant from three cultivated adult trees of *Ilex opaca* which fruit prolifically.

ASTERACEAE

***Ajanthia pacifica* (Nakai) K.Bremer et Humphries**

pink ice daisy

NEW RECORD: CHR 526592 C. C. Ogle 6583 & R. C. Ogle, 13 May 2018, Taranaki, New Plymouth sea front near Huatoki Stream mouth.

NOTES: Cultivation Escape. Planted on rock wall but seedlings establishing on spoil at foot of the wall. Inflorescences on most of the planted specimens lacked ray florets but some had pink ray florets and may be the cultivar ‘Pink Ice.’ Also known as *Dendranthema pacificum* (Nakai) Kitam. and *Chrysanthemum pacificum* Nakai.

***Artemisia lactiflora* Wall. ex DC.**

white mugwort

NEW RECORD: AK 335368, T. J. Martin s.n., 21 Aug 2012, South Auckland, Hunua District, Mill Road.

NOTES: Cultivation Escape. Scattered plants along c.12 m of roadside under shade of trees.

***Bidens ferulifolia* (Jacq.) DC.**

Apache beggarticks

NEW RECORD: AK 359857, P. J. de Lange 12904, 19 Dec 2015, Hamilton Basin, Tamahere Straight, Tamahere Eventide Retirement Home grounds.

ADDITIONAL RECORDS: AK 360705, P. J. de Lange 13108, 21 May 2016, North Auckland, Glorit, Mataia, Mataia Homestead; CHR 644226, C. C. Ogle 6477 & R. C. Ogle, 9 July 2016, Whanganui, Bastia Hill, 115 Mount View Road, AK 381760, E. K. Cameron 17585, 28 Jan 2021, Taranaki, New Plymouth, Te Henui Cemetery.

NOTES (Figures 20A, 20B): Cultivation Escape. At



Figure 19. *Ilex opaca*: (A) seedling noted in vicinity of planted tree; (B) adult foliage and flowers from planted tree (seed source for seedlings), Auckland Domain, Auckland, 26 April 2010. Photographs © E. K. Cameron.

Tamahere, *Bidens ferulifolia* has spread from deliberate plantings and is now a serious weed at that location, where many hundreds of seedlings and mature flowering and seeding plants were noted growing within freshly bark-mulched gardens, around established shrubs and in wasteland nearby. In New Plymouth freely spreading over graves where it was most likely originally planted. At the Glorit site, *Bidens* was noted as sporadic weed growing in gravel of car park. These plants most likely arose from a nearby garden, though, at the time of collection, this species did not appear to be in cultivation there. *Bidens ferulifolia* is now a popular garden plant in New Zealand and it is being increasingly grown, so further naturalisations are likely.

***Chrysocoma coma-aurea* L.**

golden bitterbush

NEW RECORD: CHR 625856, C. C. Ogle 6149, 7 Apr 2013, Whanganui, Bason Botanic Gardens.

NOTES (Figures 21A, 21B): Cultivation Escape. Hundreds of seedlings growing amongst planted adult shrubs.

***Coleostephus multicaulis* (Desf.) Durieu**

moonlight

NEW RECORD: CHR 640824, C. C. Ogle 6442 & R. C. Ogle, 10 Oct 2016, Whanganui, 22 Maria Place.

NOTES: Spontaneous Occurrence. Two plants seen; a possible cultivation escape but there were no gardens nearby and no plantings of this species had been seen in the district up to 2016; seedlings were found for sale in a Whanganui garden centre in October 2017. The site was a flat waste area where a building was demolished c. 2010 and left partly as temporary car parking, on gravel.

***Cotula discolor* (DC.) J.C. Manning et Mucina**

NEW RECORD: CHR 565385, C. C. Ogle 4096 & J. Clarkson, 24 Apr 2002, Taranaki, Opunake, Mangahume Stream mouth.

NOTES: Cultivation Escape. One patch 3–4 m diameter, noted growing amongst rocks within a rough pasture of *Elytrigia repens* (L.) Nevski, and *Cenchrus clandestinus* (Hochst. ex Chiov.) Morrone, c. 100 m from coast. The collection had been recorded earlier as *C. lineariloba* (DC.) Hilliard in, e.g., <https://www.nzpcn.org.nz/flora/species/cotula-dicolor/> (accessed: 16 Sept 2020), but this has been shown to be a different species (Manning et al. 2013).

***Echinacea purpurea* (L.) Moench**

purple cone flower

NEW RECORD: AK 321233, P. J. de Lange 9548 & G. M. Crowcroft, 30 Jan 2011, Hamilton Basin, Horotiu, Horotiu Road.

NOTES: Garden Discard. Growing in patches in rough grass and beneath a hedge above a road. Probably derived from nearby residential houses either from garden waste or past deliberate plantings, although purple cone flower was not now evident in the more obvious cultivations seen from roadside. Also, Ogle (pers. obs.) has observed seedlings next to a planted



Figure 20. *Bidens ferulifera*: (A) wild plants growing in freshly laid bark in garden, deliberate plantings common in the vicinity; (B) close-up of flowering wild plants, Hamilton Basin, Tamahere Straight, Tamahere Eventide Retirement Home grounds, 19 Dec 2015. Photographs © P. J. de Lange.

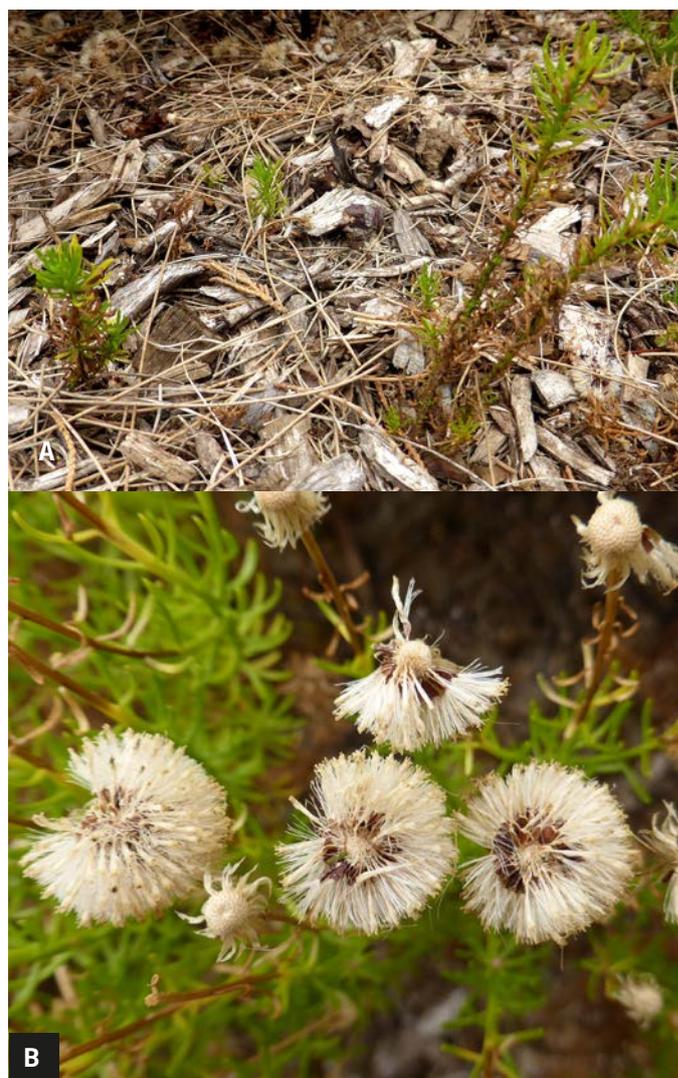


Figure 21. *Chrysocoma coma-aurea*: (A) seedlings and (B) seeding plant, self-established from planted specimens nearby, Bason Botanic Reserve, Rapanui Road, Whanganui, 31 Dec 2017. Photographs © C. C. Ogle.

specimen in his Whanganui garden for the past two years.

***Eclipta prostrata* (L.) L.**
false daisy

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302089, E. K. Cameron 15013, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-North Auckland, Kaiwaka, Kauri Park Nurseries. NOTES: Spontaneous Occurrence. A new weed record for New Zealand that derives from the importation



Figure 22. *Olearia phlogopappa*, Ward Street, National Park, Volcanic Plateau, 27 Nov 2013. Photograph © P. J. de Lange.

of coir peat contaminated with weed seeds from Sri Lanka. To date there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

***Eleutheranthera ruderalis* (Sw.) Sch.Bip.**

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302088, E. K. Cameron 15012, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-North Auckland, Kaiwaka, Kauri Park Nurseries.

NOTES: Spontaneous Occurrence. A new weed record for New Zealand that derives from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from

the contaminated coir peat imported to New Zealand. Recorded by Anon. (2008) as “Unknown shrub 3.”

Olearia phlogopappa* (Labill.) DC. var. *phlogopappa
asthma bush

NEW RECORD: AK 301047/CHR 552369, P. J. de Lange 7059 & F. J. T. de Lange, 5 Oct 2007, Auckland, Auckland Zoo.

ADDITIONAL RECORD: AK 347052, P. J. de Lange 11823, 27 Nov 2013, Volcanic Plateau, National Park, Ward Street.

NOTES (Figure 22): Cultivation Escape. Scattered shrubs and saplings locally established under privet (*Ligustrum lucidum*) scrub on margins of old zoo access road, and also within a derelict hedgerow. This species was previously reported as a garden escape from Oban, Stewart Island, by Wilson (1982) but we have seen no substantiating voucher specimens.

Santolina rosmarinifolia* L. subsp. *rosmarinifolia
green lavender cotton

NEW RECORD: AK 306306, P. J. de Lange 7999 & R. O. Gardner, 10 Oct 2009, Auckland, Birkenhead, Chatswood.

NOTES: Cultivation Escape. Numerous seedlings, saplings and flowering shrubs growing along the margin of an ill-kept street verge. Planted specimens in nearby garden.

***Stevia rebaudiana* (Bertoni) Bertoni**
stevia

NEW RECORD: AK 329799, P. J. de Lange 10324, 1 Jan 2012, Bay of Plenty, Mt Maunganui, Tauranga, industrial area near port.

ADDITIONAL RECORDS: AK 353069, P. J. de Lange 12305 & T. J. P. de Lange, 17 Oct 2012, Auckland, Western Springs, Meola Creek, near North Western Motorway.

NOTES: Garden Discard. Collected twice, once in a wasteland near railway yard within an industrial area, and also from a site used as an illegal rubbish dump by locals near a major urban park. It has been present in New Zealand for some time, because it was grown in a pot by Alan Esler in 1981, presumably to identify it: AK 219259, A. E. Esler s.n. & P. Fry, 4 Jun 1981, Auckland, Mount Albert, D.S.I.R.

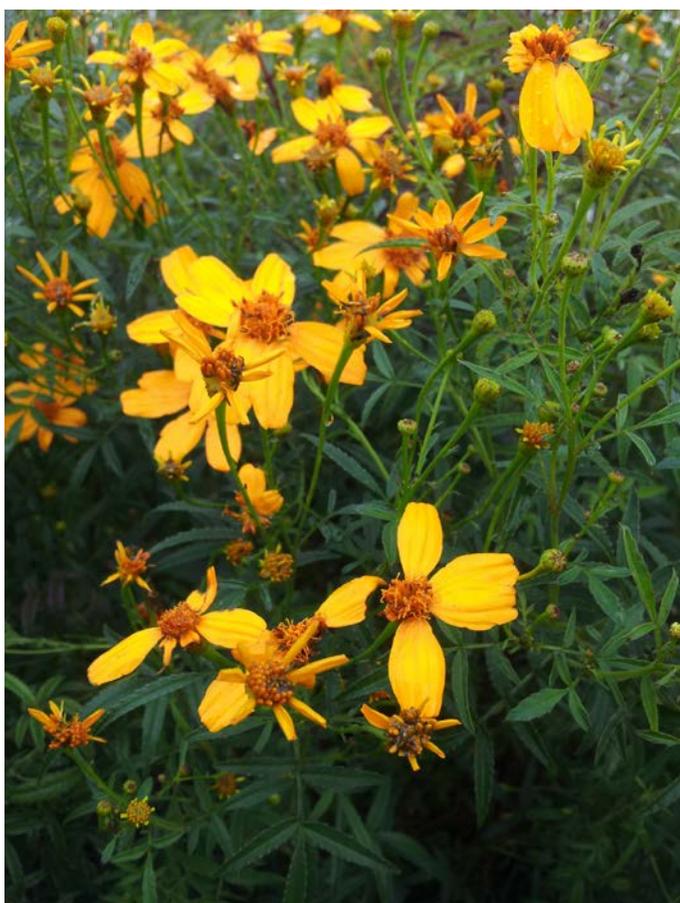


Figure 23. *Tagetes lemmonii* plant showing flowering capitula, specimen one of several naturalised on margin of kahikatea (*Dacrycarpus dacrydioides*) forest remnant, from cultivation in nearby cottage gardens, Mataia Homestead, Mataia, near Glorit, Kaipara, North Auckland, 21 May 2016. Photograph © P. J. de Lange.

***Tagetes lemmonii* A.Gray**

Mexican marigold

NEW RECORD: AK 360707, *P. J. de Lange* 13109, 21 May 2016, North Auckland, Glorit, Mataia, near Mataia Homestead.

NOTES (Figure 23): Cultivation Escape. Sparingly naturalised on margin of kahikatea (*Dacrycarpus dacrydioides* (A.Rich.) de Laub.) forest remnant near homestead. This species was cultivated in the nearby homestead gardens and so presumably arose from seed dispersed from there. Although still uncommonly cultivated, this species is being increasingly grown in the warmer parts of New Zealand, and so further naturalisations are likely.

***Taraxacum hamatum* Raunk.**

dandelion

FIRST RECORD: de Lange, P. J., et al., *Checklist of Vascular Plants Recorded from Chatham Islands*. Wellington Hawke's Bay Conservancy, Department of Conservation (2011).

NEW RECORD: CHR 156630, *B. Bell s.n.*, Dec 1961, Chatham Islands, South East Island.

NOTES: Spontaneous Occurrence. Probably arose as a seed contaminant in grass seed sown on Rangatira (South East Island) for pasture.

***Taraxacum insigne* Ekman ex Wiinst. et K.Jess.**

remarkable dandelion

NEW RECORD: CHR 199517, *P. H. Raven* 25016 & *T. Engelhorn*, 19 Sep 1969, Marlborough Sounds, Stephens Island.

NOTES: Spontaneous Occurrence. Collected from grassland around lighthouse.

***Zinnia elegans* Jacq.**

zinnia

NEW RECORD: AK 310813, *E. K. Cameron* 15433, 7 Mar 2010, Auckland, Balmoral, Thames Street.

ADDITIONAL RECORDS: AK 347666, *P. J. de Lange* 11894, 21 Dec 2013, Hamilton, St Andrews, 9 Dover Road; AK 351067, *P. J. de Lange* 12146 & *G. M. Crowcroft*, 12 Apr 2014, Hamilton, St Andrews, 9 Dover Road.

NOTES: Cultivation Escape. Locally established in garden and persisted for years (Auckland) and a derelict property (Hamilton). In both sites, this species was being, or had been recently, cultivated.

BALSAMINACEAE

***Impatiens textorii* Miq.**

touch-me-not

NEW RECORD: CHR 586897A, *G. La Cock* & *C. C. Ogle* 5169, 26 Feb 2007, Taranaki, Carrington Road, some 300–400 m from Pukeiti Gardens visitors' centre.

ADDITIONAL RECORDS: CHR 586898A, *C. C. Ogle* 5170 & *G. La Cock*, 26 Feb 2007, Taranaki, Carrington Road, Pukeiti Gardens; CHR 603314A, *C. C. Ogle*, 22 Mar 2009, Whanganui, Durie Hill, Forres Street, Purua Stream; CHR 605415, *C. C. Ogle* 5644, 16 Oct 2009,

Whanganui, Durie Hill, Forres Street, Purua Stream; AK 309856, *C. C. Ogle* 5666, 7 Nov 2009, Whanganui, Durie Hill, Forres Street, Purua Stream.

NOTES: Cultivation Escape. This species spread rapidly from garden plantings and, by 2007, was locally abundant in Pukeiti Gardens where staff attempted to control or eradicate the species. In February 2007, seedlings from Pukeiti Gardens were transplanted to a garden near Purua Stream in Whanganui until they flowered, to get a specific identification. These plantings then self-established and dozens of seedlings were removed; no further plants were found after Nov 2009.

BEGONIACEAE

***Begonia angularis* Raddi**

NEW RECORD: AK 344163, *B. S. Parris* 12907, 10 May 2011, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. One seedling, in root mass of a fern in shaded garden bed.

***Begonia foliosa* var. *miniata* (Planch. et Linden) L.B.Sm. et B.G.Schub**

Fuchsia begonia

NEW RECORD: CHR 608115, *G. La Cock* s.n., 12 Feb 2010, Whanganui, Kai Iwi, Bushy Park.

NOTES: Spontaneous Occurrence. A single plant occurring within an area of indigenous forest where it was unlikely to have been planted.

***Begonia luxurians* Scheidw.**

NEW RECORD: AK 300491, *B. S. Parris* 12823, 23 Aug 2007, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. A few self-sown plants in deep shade; the first seedlings to survive the winter. Most seedlings near parent plant, but this was one from 30 m away.

BERBERIDACEAE

***Vancouveria hexandra* (Hook.) C.Morren et Decne.**

American barrenwort

NEW RECORD: CHR 609973, *W. R. Sykes* 137/07, 31 Oct

2007, Canterbury, Christchurch, St Albans.

NOTES: Cultivation Escape. Spreading extensively within a garden.

BERBERIDOPSISACEAE

***Berberidopsis corallina* Hook.f.**

coral plant

NEW RECORD: CHR 592830/AK364957, *W. R. Sykes* 84/05, 4 Dec 2005, Stewart Island, Halfmoon Bay, Oban.

NOTES: Cultivation Escape. A single plant occurring in a semi-modified forest gully.

BORAGINACEAE

***Heliotropium amplexicaule* Vahl**

blue heliotrope

NEW RECORD: CHR 615369, *W. R. Sykes* 4/11, 20 Jan 2011, Canterbury, Christchurch, St Albans.

NOTES: Cultivation Escape. Single plant established on waste ground.

***Nemophila menziesii* Hook. et Arn.**

baby blue eyes

FIRST RECORD: de Lange, P. J., et al., *Checklist of Vascular Plants Recorded from Chatham Islands*. Wellington Hawke's Bay Conservancy, Department of Conservation (2011).

VOUCHER: CHR 594846, *P. B. Heenan & P. J. de Lange*, 15 Sep 2007, Chatham Islands, Chatham Island, Cloughs Creek, near Owenga.

ADDITIONAL RECORDS: CHR 509125/AK 358523, *W. R. Sykes* 514/95, 4 Dec 1995, Canterbury Land District, Prebbleton, Springs Road; CHR 532493, *W. R. Sykes* 376/98, 5 Nov 1998, Canterbury Land District, Prebbleton, Springs Road; AK 306637, *B. S. Parris* 12712, 24 Sep 2005, North Auckland, Bay of Islands, Kerikeri; CHR 616239, *C. C. Ogle* 5941, *I. & J. Bell*, 23 Oct 2011, Whanganui, Bastia Hill, Mount View Road.

NOTES: Cultivation Escape. A cultivated annual in gardens, and sometimes spreading from gardens or occasionally persisting after road-verge sowing of seed onto lowland road verges. There are named cultivars that have self-established: cv. Baby Blue Eyes (CHR 509125

and CHR 532493) were described as having “corolla 1.8–2.4 cm across, deep or medium blue in distal 2/3; lower part white”; cv. Penny Black (CHR 616239) had “corolla lobe spread = 15 mm, lobes deep maroon with white tips”; var. *atomaria* (Fisch. et E.Mey.) Voss, cv. Snowstorm (AK 306637) had a white corolla with deep purple, almost black, markings.

***Symphytum grandiflorum* A.DC.**

dwarf comfrey

NEW RECORD: CHR 688638, C. C. Ogle 6306, 26 Nov 2014, Manawatu River, Palmerston North, Victoria Esplanade.

ADDITIONAL RECORD: CHR 689100, W. R. Sykes 26/14, 28 Nov 2014, Christchurch, St Albans, 115 Packer Street.

NOTES: Cultivation Escape. Forming the entire ground-cover of a formal garden, under planted shrubs and perennials; spreading by runners from original ‘spot plantings’ (CHR 688638) and “spreading slightly... forming a loose mat” (CHR 689100).

BRASSICACEAE

***Aubrieta deltoidea* (L.) DC.**

lilac bush, purple rock cress

NEW RECORD: AK 218249, A. E. & L. Esler s.n., 23 Dec 1985, Dunedin waterfront.

ADDITIONAL RECORD: CHR 654847, W. Reinder s.n., 28 Sep 2019, Christchurch, Beckenham.

NOTES: Cultivation Escape. CHR 654847 is a collection of two seedlings that had been growing in gutter; with more noted in garden nearby where plants of nursery origin had been planted a year earlier.

***Brassica oleracea* var. *botrytis* L.**

cauliflower

FIRST RECORD: de Lange, P. J., et al., *Checklist of Vascular Plants Recorded from Chatham Islands*. Wellington Hawke’s Bay Conservancy, Department of Conservation (2011B).

NEW RECORD: AK 304038/CHR 553774, P. J. de Lange CH2012 & B. Horne, 1 Dec 2008, Chatham Islands, Rekohu (Chatham Island), Waitangi, Point Ellice.

ADDITIONAL RECORD: UNITEC 11193, P. J. de Lange 14509, 23 Dec 2019, Auckland, Mt Albert, Unitec Institute of Technology campus ground.



Figure 24. *Brassica oleracea* var. *botrytis*, one of several plants naturalised in seepage overlooking cliff face, Ellice Point, Rēkohu (Chatham Island), Chatham Islands, 2 December 2008. Photograph © P. J. de Lange.

NOTES (Figure 24): Cultivation Escape. The Chatham Island occurrence comprised scattered wild plants growing amongst rank grasses in steep ravine leading down to cliff face. Cauliflower was noted in cultivation in a vegetable garden on private land above the ravine so it seems likely this occurrence arose from garden waste or seed dispersed from that source. The second find from the Unitec Institute of Technology was of an isolated specimen growing in building rubble and spoil.

***Brassica oleracea* var. *palmifolia* DC.**

walking stick cabbage

FIRST RECORD: Cameron, E. K., *Auckland Botanical Society Journal* 72, 68–70 (2017)

NEW RECORD: AK 364441 A, B, S. P. Benham s.n. & J. Kitto-Verhoef, 20 Mar 2017, Auckland, Hauraki Gulf, Motukorea/Browns Island.

NOTES: Spontaneous Occurrence. A single 1.7 m tall plant at base of cliff; because of the site it was unlikely

to be planted. Possibly seed-dispersed by rock pigeons.

***Lepidium peregrinum* Thell.**

FIRST RECORD: Heenan, P. B., & de Lange, P. J. *New Zealand Journal of Botany* 49, 489–496 (2011).

VOUCHER: AK 316005, P. J. de Lange 9225, 13 Jan 2010, South Auckland, Kawhia Harbour, O Wiwi Ku (Meurant Island).

ADDITIONAL RECORDS: AK 347716, P. J. de Lange 11924, 4 Jan 2014, Auckland, West Auckland, Oratia Valley, Parker Road; AK 329785, P. J. de Lange 10308, 27 Dec 2011, South Auckland, Kawhia Harbour, Rakaunui Peninsula, Mangakara Bay, Cemetery Cave.

NOTES: Spontaneous Occurrence. The biostatus of *Lepidium peregrinum* was discussed in detail by Heenan and de Lange (2011) who concluded it was accidentally introduced into New Zealand during the 1800s, probably via goods traded between Sydney, Australia, and the Kawhia Harbour, North Island, New Zealand. The presence of this species in the Oratia Valley (P. J. de Lange 11924, AK 347716) probably relates to its subsequent spread from a nearby nursery where plants of the Kawhia provenance were temporarily cultivated (see Heenan & de Lange 2011).

BUXACEAE

***Sarcococca ruscifolia* Stapf**

NEW RECORD: CHR 644230, M. Brooke & C. C. Ogle 6481, 10 Apr 2017, Whanganui, Kai Iwi, Rangitatau East Road, Bushy Park.

ADDITIONAL RECORDS: CHR 644231, C. C. Ogle 6481a & R. C. Ogle, 2 May 2017, Whanganui, Kai Iwi, Rangitatau East Road, Bushy Park; AK 367527, Ogle C. C. 6496b, 2 Jul 2017, Kai Iwi, Rangitatau East Road, Bushy Park; AK 379270, C. C. Ogle 6670b, 22 May 2019, Whanganui, Rapanui Road, Bason Botanic Gardens.

NOTES (Figures 25A, 25B, 25C): Cultivation Escape. Many hundreds of seedlings within 1 m of planted shrub. The parent shrub was removed in Oct 2018 because it was believed that bird-carried fleshy fruits of *S. ruscifolia* could lead to its invasion of the adjoining indigenous forest. AK 375834 was collected earlier than any of the records above and is from a planted shrub at Eastwoodhill Arboretum near Gisborne (*S. G. Dodgshun s.n.*, 6 Jun 1996). The label states “plant layering and self-seeding in profusion underneath its own canopy”



Figure 25. *Sarcococca ruscifolia*: (A, B) planted fruiting plant and part of the sward of self-established seedlings around it, 2 May 2017; (C) flowering specimen, 3 July 2017, Bushy Park, Kai Iwi, Whanganui. Photographs © C. C. Ogle.

but the herbarium specimen does not demonstrate this. Photographs and notes on <https://inaturalist.nz/observations/52229291> (accessed: 16 Sept 2020), taken in June 2020 at Eastwoodhill Arboretum, note the presence of “thousands of seedlings, young plants and wild adults.” This last record is outside the scope of the present paper, but it does demonstrate that *S. ruscifolia* is a likely candidate for future classification as Fully Naturalised.

CACTACEAE

***Austrocyllindropuntia subulata* (Muehlenpf.) Backeb.**

Eve’s-pin cactus

NEW RECORD: CHR 615107, C. C. Ogle 5904, C. R. Higgle & R. C. Ogle, 20 May 2011, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES (Figures 26A, 26B): Garden Discard. Established from garden waste dumped in grazed pasture.

***Cylindropuntia fulgida* var. *mammillata* (Schott ex Engelm.) Backeb.**

NEW RECORD: CHR 615108, C. C. Ogle 5905, C. R. Higgle & R. C. Ogle, 20 May 2011, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES: Garden Discard. Established from garden waste dumped in grazed pasture.

CAMPANULACEAE

***Lobelia giberroa* Hemsl.**

giant lobelia

NEW RECORD: CHR 614090, C. C. Ogle 5789 & C. R. Higgle, 6 Nov 2010, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES: Cultivation Escape. Numerous seedlings derived from nearby adult cultivated plants.

***Lobelia laxiflora* subsp. *angustifolia* (A.DC.) Eakes et Lammers**

Mexican cardinal flower

NEW RECORD: AK 356074, P. J. de Lange 12480, 24 Jan 2015, Auckland, Point Chevalier, Point Chevalier Road.

NOTES: Cultivation Escape. A large patch growing up through cracked block wall and asphalt pavement (footpath). Plants spreading by suckering from adjacent wasteland (a derelict garden) where this species had probably once been cultivated. Despite periodic roadside spraying, plants reappear at this site – further vegetative spread is prevented only by the physical barrier created by the footpath and sporadic footpath and roadside maintenance.

CAPRIFOLIACEAE

***Lonicera hildebrandiana* Collet et Hemsl.**

Burmese honeysuckle

NEW RECORD: AK 222121, P. D. Champion s.n., 14 Mar 1995, Hamilton, Hamilton Parade.

ADDITIONAL RECORD: AK 291472, B. Myer s.n., 22 Jul 2005, Auckland, Papatoetoe, Redoubt Road.

NOTES: Cultivation Escape. A large vigorous vine that can layer for over 10 m, with stems to 250 mm diameter. The Hamilton record (AK 222121) near the Waikato River bank appeared to be wild; the Papatoetoe record (AK 291472) was layering down a steep bank covering over 6 × 10 m. There are other records where the vine has layered less distance and is clearly still connected to the original planting (e.g. AK 307033, J. M. Linehan s.n., 11 Oct 2007, North Auckland, Kaiwaka; AK 353060, B. S. Parris 12927, 5 Mar 2014, North Auckland, Bay of Islands, Urupukapuka Island, Lowndes Cottage).

CARYOPHYLLACEAE

***Stellaria apetala* Ucria**

lesser chickweed

NEW RECORD: CHR 91500, A. J. Healy 54/332, 18 Oct 1954, Domain, Ashburton.

ADDITIONAL RECORDS: CHR 92172, A. J. Healy 56/294, 31 Oct 1956, Ashburton; CHR 118312, A. J. Healy 59/291, 24 Mar 1959, Islington, Christchurch; CHR 122468, A. J. Healy 54/280, 4 Oct 1959, Riccarton Bush; CHR 509560, A. J. Healy 97/77, 7 Oct 1995, Halswell, Christchurch; AK 368563, E. K. Cameron 15553, 6 Oct 2010, Coromandel, Waikawau Bay; CHR 655045, C. C. Ogle 6603, 2 Oct 2018, Whanganui, St John’s Hill, outside 8 Virginia Heights.

NOTES: A short-lived annual, growing in dry, sparsely

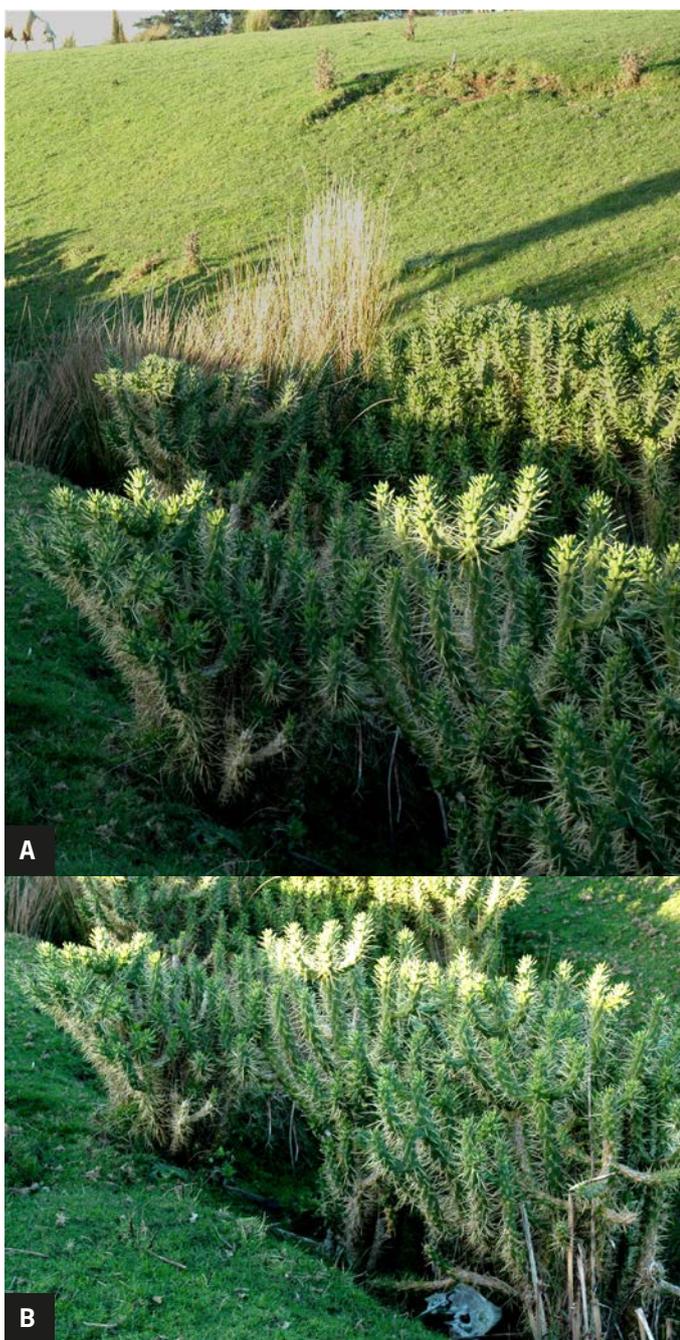


Figure 26. *Austrocyliodropuntia subulata*: (A, B) growing as a garden discard, in grazed paddock near Paloma Gardens, Fordell, Whanganui, on 20 May 2011. Photographs © C. C. Ogle.

vegetated places such as disturbed dunes and street-side berms. Probably because of its diminutive size, its late winter to spring growth habit and superficial similarity to *S. media*, the naturalised presence of *S. apetala* in New Zealand was not recognised until 2018 (CHR 655045), though it had previously been collected and mostly attributed to *S. media*, since at least 1956. Since 2018 in New Zealand this *Stellaria* has been treated as *Stellaria pallida* (Dumort.) Crép. (Schönberger et al. 2020), however as Hūgin (2012) and Hūgin et al. (2015) point out, *S. apetala*, as the older name, has priority, and this is followed here.

CASUARINACEAE

Allocasuarina verticillata (Lam.) L.A.S. Johnson

drooping she-oak

NEW RECORD: CHR 586780, C. C. Ogle 5031, 5 Jul 2006, Whanganui, Gonville, Purnell Street, Purnell House.

NOTES: Cultivation Escape. Suckering within unmown lawn overlying consolidated dunes. The plants derive from a row of planted *A. verticillata* trees, of both sexes. At the time of collection about 10 suckers were recorded spread along 50 m of dunes.

CLEOMACEAE

Cleome rutidosperma DC.

fringed spiderflower

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 299212, T. K. James s.n., 6 Apr 2007, cultivated ex-Bulls in potting mix containing composted coir peat.

ADDITIONAL RECORDS: AK 302076, T. K. James s.n., 7 Mar 2008, cultivated ex-Ruakura Research Centre, in potting mix containing composted coir peat; AK 302075, E. K. Cameron 15000, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-Kihikihi nursery, in potting mix containing composted coir peat.

NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more

details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

***Cleome viscosa* L.**

Asian spiderflower

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302073, E. K. Cameron 14999, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-Waikato, Waipa, Kihikihi, Growing Spectrum Ltd. NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

CONVOLVULACEAE

***Evolvulus nummularius* (L.) L.**

roundleaf bindweed

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302087, E. K. Cameron 15011, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-North Auckland, Kaiwaka, Kauri Park Nurseries. NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date, there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand. Recorded by Anon. (2008) as 'Unknown shrub 7.'

CRASSULACEAE

***Aeonium canariense* (L.) Webb et Berthel.**

giant velvet rose aeonium

NEW RECORD: CHR 603675, W. R. Sykes 62/04, 4 Jul 2004, Banks Peninsula, Charteris Bay, Orton Bradley Estate.

NOTES: Cultivation Escape. Numerous seedlings establishing near adult plant.

***Sedum cepaea* L.**

pink sunray

NEW RECORD: AK 360228, M. Lusk s.n., 2 Feb 2016, Hawke's Bay, Havelock North, Te Mata Peak Road, above Te Kahika Stream.

NOTES: Cultivation Escape. Spreading aggressively from seed within a garden where it had once been cultivated.

***Sedum oreganum* Nutt.**

Oregon stonecrop

NEW RECORD: CHR 603141/AK 367370, W. R. Sykes 20/02, 16 Jan 2002, Nelson Land District, near Kawatiri Junction, Hope River.

NOTES: Cultivation Escape. Growing in understory of *Lophozonia menziesii* (Hook.f.) Heenan et Smissen forest.

***Sempervivum tectorum* L.**

hen and chicks

NEW RECORD: CHR 606062, W. R. Sykes 5/06, 30 Jan 2006, Dunedin, Saddle Hill.

NOTES: Cultivation Escape. Plants scattered over a roadside bank.

EBENACEAE

***Diospyros kaki* Thunb.**

persimmon

NEW RECORD: AK 327933, B. S. Parris 12843, 8 Apr 2008, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. One self-sown plant c. 0.5 m high in deep shade under parent tree (cv. 'Fuji'). The only seedling seen in over 13 years.

ERICACEAE

Epacris microphylla R.Br. var. *microphylla*

coral heath

FIRST RECORD: Urquhart, A. T., *Transactions of the New Zealand Institute* 14, 364–365 (1882).

VOUCHERS: AK 77437, A. T. Urquhart s.n., undated, Auckland, Karaka, near Drury (Duplicate: AK77441).

ADDITIONAL RECORD: WELT SP044368, T. Kirk s.n., 11 Jul 1887, Te Karaka.

NOTES: Cultivation Escape. The published record was rejected from the *New Zealand Flora* by Webb et al. (1988, p. 1289) because at the time it was thought to be unsupported by a voucher specimen. The substantiating specimens have now been found. Aside from the Kirk record, we are unaware of any additional collections and it seems that this *Epacris* is now extirpated from the wild in New Zealand.

Erica sparsa Lodd.

pink smoke, ker ker

NEW RECORD: CHR 624913, C. C. Ogle 6112, 15 Jul 2012, Whanganui, Bastia Hill, Mount View Road.

NOTES (Figures 27A, 27B): Cultivation Escape. Scattered seedlings on clay bank above road; a planted flowering shrub was in garden above. The wild New Zealand material is inadequate to determine which of the two subspecies is present.

Leucothoe fontanesiana (Steud.) Sleumer

NEW RECORD: AK 305231, T. J. Martin s.n., 11 Jun 2009, South Auckland, Hunua, McMurray Road.

NOTES: Cultivation Escape. Sprawling ground cover over c. 25 m², under exotic trees; spreading by layering, no fertility present. Leaves variegated with splotches of green and cream.

Rhododendron arboreum Sm.

tree rhododendron

NEW RECORD: CHR 591730, C. C. Ogle 5180, G. La Cock & D. Worthy, 26 Feb 2007, Taranaki, Carrington Road, Pukeiti Gardens.

NOTES: Cultivation Escape. Six seedlings noted on clay roadside bank opposite the Pukeiti Gardens' visitors centre. The seedlings grew under *Weinmannia racemosa* L.f. on the margin of indigenous forest. Associates included sparse *Lotus pedunculatus* Cav. and *Holcus*



Figure 27. *Erica sparsa*: (A) Seedlings of *Erica sparsa*, on a clay roadside bank and (B) flowers of self-established shrub, Mount View Road, Whanganui, 2 Aug 2012. Photographs © C. C. Ogle.

lanatus L.; and seedlings of *R. decorum* Franch. and *R. maddenii* Hook.f. Many shrubs of this species and its cultivars inside Pukeiti Gardens.

Rhododendron maddenii Hook.f.

NEW RECORD: CHR 591731, C. C. Ogle 5180, G. La Cock & D. Worthy, 26 Feb 2007, Taranaki, Carrington Rd, Pukeiti Gardens.

NOTES: Cultivation Escape. One seedling on clay roadside bank opposite the Pukeiti Gardens' visitors centre. The seedling grew under *Weinmannia racemosa* on the margin of indigenous forest. Associates included sparse *Lotus pedunculatus* and *Holcus lanatus*; and seedlings of *R. arboreum* and *R. decorum*. Many shrubs of this species and its cultivars are grown in the Pukeiti Gardens.

EUPHORBIACEAE

Acalypha wilkesiana Muell.Arg.

copper plant

NEW RECORD: AK 305629, P. J. de Lange K450, 8 May 2009, Kermadec Islands, Raoul Island, Raoul Island Accommodation House Grounds

NOTES (Figure 28): Cultivation Escape. Six saplings present in rank grassland near the Accommodation House, with a further sapling present in tall grass near swimming pool. Previously, this species was known from a single very large, old planted individual which was all that remained of the few plants observed by Sykes (1977). Sykes (1977) treated the species as a cultivation relict. However, the plants observed in 2009, and others removed by staff on the island in 2007, arose from seed. Occasional plants are still found in some cases up to 200 m distant from where the species had been deliberately planted. Raoul Island plants match the cultivar 'Marginata' that is widely grown throughout the tropical Pacific.

Euphorbia bourgaeana J.Gay ex Boiss.

tree spurge

NEW RECORD: CHR 615113, C. C. Ogle 5910, C. R. Higgie & R. C. Ogle, 20 May 2011, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

ADDITIONAL RECORDS: AK 375527, C. D. Kilgour s.n., 28 Sep 2017, Auckland City, Mt Albert, corner Richardson and Range View Roads; AK 374977, C. D. Kilgour 3409b, 11 Oct 2017, Auckland City, St Lukes, by 'Kings Plant Barn'; AK 379121, E. K. Cameron 17387, 17 Nov 2019, Auckland University central city grounds.

NOTES: Cultivation Escape. Freely seeding and establishing in the vicinity of four separate garden plantings. At the Whanganui site, the adult plants were obtained under the name *Euphorbia stygiana* H.Schaef. which appears to be an error. At the Auckland St Lukes



Figure 28. *Acalypha wilkesiana*, one of several self-sown saplings growing in rough pasture near the Accommodation House, Raoul Island, Kermadec Islands group, 10 May 2009. Photograph © P. J. de Lange.

site, similar plants were being sold as '*E. lambii*' in the adjacent nursery. The garden at the Richardson Road site is now a construction site. The floral bracts of the cultivated specimens at St Lukes (AK 374976) are fused for 2/3 their length and the floral glands are dentate – these features match *E. lambiorum* Svent. However, we have followed the *Catalogue of Life*, which treats this taxon as a synonym of *E. bourgaeana*.

Euphorbia myrsinites L.

myrtle spurge

NEW RECORD: CHR 604461, C. C. Ogle 5502 & C. R. Higgie, 30 Dec 2008, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES: Cultivation Escape. Occasional seedlings as much as 5 m down-slope from planted clumps of *E. myrsinites*.



***Euphorbia paralias* L.**

sea spurge

FIRST RECORD: Beadel, S., *Trilepidea* 102, 3–5 (2012).
VOUCHER: AK 330642, S. M. Beadel s.n., 9 Feb 2012, South Auckland, north of Aotea Harbour Entrance.

ADDITIONAL RECORDS: AK 380948, H. A. Cox s.n., 7 Oct 2020, Waitakere Coast, south of Karekare, just out from Tunnel Point; AK 380954, M. Gemmell s.n. & T. Greenwood, 8 Oct 2020, Waitakere Coast, south of Karekare Beach; AK 330792–AK 330795, S. M. Beadel s.n., 23 Apr 2012, South Auckland, north of Aotea Harbour Entrance; CHR 618159, S. Beadel s.n., 23 Apr 2012, South Auckland Land District, Aotea heads, Waihi Stream; CHR 656918, E. Graeme s.n. 3 May 2019, Taranaki, mouth of Mokau River; CHR 654881, A. Wightman s.n., Dec 2019, Manawatu, south of Himatangi Beach; CHR 665502, B. Fagan s.n., 13 Aug 2020, North Westland, Kahurangi National Park, Heaphy Track, Scotts Beach.

NOTES (Figures 29A, 29B, 29C, 29D, 29E): Spontaneous Occurrence. This aggressive and highly invasive species of coastal beach and sand dune habitats was first reported for New Zealand by Beadel (2012). Plants almost certainly established at this remote location from seed dispersed across the Tasman Sea from Australia where this species is now well established. Because of the serious risk this species poses to New Zealand's coastal vegetation and ecosystems, the population discovered by Beadel was eliminated by the Ministry of Primary Industries (MPI) and the site is now subjected to routine surveillance, as are the three sites found since 2012, viz. Mokau, Himatangi and South Karekare. At these last three sites, single plants were found at two of them and near Karekare, one adult, three juveniles and about 100 seedlings. All are exposed beaches on the west coast of the North Island. Another infestation, occupying 5 × 5 m, was found by J. Barkla on 30 July 2020 on the South Island's West Coast, between Karamea and Scotts

Figure 29. *Euphorbia paralias*: (A) Adult flowering plant growing amongst *Spinifex sericeus*, Waitakere, south of Karekare Beach, 14 October 2020, photograph © A. J. Marshall; (B, C) mature plant and young plants, Scotts Beach, Karamea, North Westland, 30 July 2020, photographs © John Barkla; (D) seedling, Waitakere, south of Karekare Beach, 14 October 2020, photograph © A. J. Marshall; (E) mature plant showing taproot, collected Scotts Beach, Karamea, North Westland, by Brent Fagan and photographed 20 Aug 2020. Photograph © Carol Elliott (MPI).

Beach Campsite, close to the Heaphy Track (<https://inaturalist.nz/observations/54812688> [accessed: 16 September 2020]). B. Fagan of MPI collected all visible plants from the site on 13 August 2020, vouchered one specimen, CHR 665502, and removed the rest for later destruction. The largest plant had a substantial taproot and a woody crown with multiple erect shoots, some with flowers. Since then a further location on dunes south of Karekare Beach, Waitakere Coast has been reported (October 2020 – see <https://inaturalist.nz/observations/62986222> [accessed: 17 November 2020]) and is now in the process of being eradicated. Despite these efforts, further occurrences of this species along New Zealand's coastline are anticipated.

***Euphorbia pinea* L.**

pine spurge

NEW RECORD: AK 306307, P. J. de Lange 8000 & R. O. Gardner, 10 Oct 2009, Auckland, North Shore, Birkenhead, Chatswood, Chelsea View Drive.

ADDITIONAL VOUCHER: CHR 619075, R. O. Gardner 11174, 17 Mar 2012, Auckland, North Shore, Birkenhead. NOTES (Figure 30): Cultivation Escape. Established from seed that had washed down slope from a street-side bark garden. Locally common and spreading.

***Manihot grahamii* Hook.**

hardy tapioca

NEW RECORD: NZFRI 30437, R. Booth, E. M. Miller M06/156 & N. C. Miller, 6 Nov 2006, North Auckland, Kerikeri, Main Road, Wharepuke Subtropical Gardens.

ADDITIONAL RECORDS: AK 330169, H. Taylor s.n., 31 Jan 2012, North Auckland, Kerikeri, Edkins Road; CHR 526653, C. R. Higgie & C. C. Ogle 6557, 4 March 2018, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens; CHR 526586, C. R. Higgie (Ogle 6580), 30 April 2018, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens. NOTES: Cultivation Escape. At Kerikeri, seedlings were locally present in a garden where a mature flowering and fruiting specimen was being grown; and also, a 3 m-tall roadside plant amongst weeds and *Ensete Bruce* ex Horan. bananas, perhaps from roadside dumping. In the extensive Paloma Gardens there were scattered seedlings in open ground near planted specimens. The species is sometimes, and incorrectly, being sold in specialist nurseries in New Zealand as *Jatropha multifida* L.



Figure 30. *Euphorbia pinea*, naturalising in a suburban garden: (A) inflorescence and (B) young plants, Birkenhead, Auckland, 20 April 2012. Photographs © Jeremy Rolfe.

FABACEAE

Acacia longissima H.L.Wendl.

FIRST RECORD: Wilcox, M. *Auckland Botanical Society Journal* 66, 45 (2011).

VOUCHER: AK 321066-67, M. D. Wilcox s.n., 10 Jan 2011, Auckland, Green Bay, Crestwood Retirement Village.

ADDITIONAL RECORD: AK 234638, S. Prouse s.n., 16 Feb 1998, Auckland, Mangere Bridge, Sealand Place.

NOTES: Cultivation escape. Abundantly naturalised (seedlings and saplings) at Green Bay in pine (*Pinus* L.) and black wattle (*Acacia mearnsii* De Willd.) woods over an area of about 0.5 ha as an understorey tree to 5 m tall; the Mangere Bridge record was a single seedling, 1.1 m tall, which appeared spontaneously in a garden.

Acacia retinodes Schldt.

NEW RECORD: AK 254436, R. O. Gardner 10267, 10 Apr 2001, Auckland, North Titirangi, Crum Park.

ADDITIONAL RECORD: AK 353578 (dupl. CHR), R. O. Gardner 10332, 14 Aug 2002, Auckland, North Titirangi, Crum Park (same tree as ROG 10267).

Arachis hypogaea L.

peanut

NEW RECORD: AK 302012, P. J. de Lange 7300, T. J. P. de Lange & F. J. T de Lange, 15 Mar 2008, Auckland, Auckland Zoo.

ADDITIONAL RECORD: AK 353578, T. J. Martin s.n., 29 Mar 2014, Auckland City, Mt Wellington.

NOTES: Spontaneous Occurrence and Cultivation Escape. A single flowering plant in the Zoo with immature fruits found growing within the rotted base of an old fence post hole in a concrete pathway within the zoo grounds – presumably it arose from discarded viable seed; AK 353578 was a plant in overgrown garden where it had been cultivated the previous summer.

Crotalaria lunata Bedd. ex Polhill

NEW RECORD: AK 300433/CHR 547175, P. J. de Lange 7013, 26 Aug 2007, Auckland, Westhaven.

ADDITIONAL RECORD: UNITEC 11691, P. J. de Lange 14755 & C. Beard, 22 Sep 2016, Te Aupouri, Waharara, near Camp Road turnoff; AK 332931, R. S. Elliot s.n., 19 Aug 2012, North Auckland, Kerikeri, Riverview Road.

NOTES (Figures 31A, 31B): Cultivation Escape. Numerous seedlings, saplings and adult flowering and fruiting shrubs were noted growing in the general vicinity of planted specimens at the Auckland site and in a similar situation on Te Aupouri Peninsula near Waiharara. The Auckland population was thriving and rapidly expanding until December 2009 when the widening of State Highway One eliminated it. The population near Waiharara also grows along a roadside, in this case for a distance of about 15 m. At Kerikeri, a single tall shrub, “just appeared” in garden.

Erythrina falcata Benth.

evergreen coral tree

NEW RECORD: AK 302049, P. J. de Lange 7322, 12 Mar 2008, Auckland, Mt Albert, Ferndale House.

NOTES: Cultivation Escape. Seedling collected within a bark garden of a kindergarten close to a well-established adult tree. The adult tree fruits heavily and children routinely pick the fruit and plant the seeds, many of which germinate. Most of these seedlings are



Figure 31. *Crotalaria lunata*: (A) Flowers of naturalised plant of *Crotalaria lunata* on the side of State Highway 1, Westhaven Drive, Auckland, a site now destroyed by road widening, 27 August 2007, photograph © P. J. de Lange; (B) immature fruits on a naturalised *Crotalaria lunata* shrub, in a roadside ditch near Waiharara, near Camp Road turnoff, Te Aupouri, 22 September 2016, photograph © C. Beard.

then removed through routine maintenance. *Erythrina falcata* is occasionally cultivated in the warmer parts of the North Island and, as it fruits regularly, further occurrences are likely.

***Hippocrepis emerus* (L.) Lassen**
scorpion senna

NEW RECORD: CHR 356072, H. D. Wilson 789-238 & C. J. Webb, 14 Apr 1971, Stewart Island, Halfmoon Bay.
ADDITIONAL RECORDS: CHR 592818, W. R. Sykes 107/05, 9 Dec 2005, Stewart Island, Oban; CHR 592806, P. B. Heenan s.n., 1 Jan 2008, Stewart Island, Halfmoon Bay.
NOTES: Cultivation Escape. Heenan et al. (2009) suggested *H. emerus* (e.g., CHR 592818, CHR 592806) may be naturalised or a garden relict. It is here

considered a casual naturalisation with plants having been recorded as “spreading over an unkempt roadside bank” (CHR 592806) and “semi-adventive on steep bank below garden” (CHR 592818).

***Inga edulis* Mart.**
ice cream bean

NEW RECORD: AK368411, L. J. Forester s.n., 22 Mar 2006, Northland, Taiharuru Estuary.
ADDITIONAL RECORDS: AK 299453/CHR 552283, P. J. de Lange 6971 & T. J. P. de Lange, 25 May 2007, Auckland, Mt Albert; AK 327563, T. J. Martin s.n., 25 Feb 2011, North Auckland, Takou Bay; AK 359988, M. Aslund s.n., 17 Nov 2015, North Auckland, Kerikeri.
NOTES: Cultivation Escape. “Numerous small plants under large adult (5 m tall) and adult fruiting prolifically” (AK 368411). Numerous seedlings and saplings growing under and in the general vicinity of mature fruiting tree planted within the Mt Albert Research Centre, and numerous seedlings at two sites in Northland within 20 m of mature trees.

***Lessertia frutescens* (L.) Goldblatt et J.C.Manning**

NEW RECORD: CHR 92180, A. J. Healy 56/325, 2 Dec 1956, Canterbury, Christchurch, Riccarton.

NOTES: Cultivation Escape. Several seedlings established near parent plant.

***Leucaena leucocephala* (Lam.) de Wit**

ipil ipil

NEW RECORD: AK 360486, P. J. de Lange 13017 & T. J. P. de Lange, 24 Dec 2015, Auckland, St Lukes, St Lukes Road.

ADDITIONAL RECORDS: AK 360847, S. L. Happy s.n., 27 May 2016, Auckland, St Lukes, St Lukes Road; UNITEC 11696, P. J. de Lange 14760, 14 Dec 2019, Auckland, Auckland City, Mt Albert, New North Road; UNITEC 11551A-C; P. J. de Lange 14689, 29 Feb 2020, Auckland, Auckland City, Mt Albert, Unitec Institute of Technology campus.

NOTES (Figures 32A, 32B, 32C): Cultivation Escape. Noted initially in 2015 as a few wild plants growing in an overgrown garden used for parking cars near a rented bungalow. That site has subsequently expanded to many hundreds of mature, flowering and fruiting shrubs and thousands of seedlings. Subsequently noted elsewhere in Mt Albert, in wasteland and on basalt stone walls. Further naturalisations are likely as the leaves and immature seed pods of *Leucaena* are eaten as a delicacy by Asian peoples, known to Laotians as 'kan thin,' Cambodians as 'kratin,' Vietnamese 'schemu' and Thais as 'phak krathin'. The ongoing naturalisation of this species is unfortunate, especially as it is regarded as one of "100 worst invasive species" by the Invasive Species Specialist Group of the IUCN Species Survival Commission (see <http://www.iucngisd.org/gisd/speciesname/Leucaena+leucocephala> [accessed: 11 June 2020]) and its Auckland naturalisations had been reported to the relevant authorities (see, <https://inaturalist.nz/observations/4044724>, <https://inaturalist.nz/observations/7771334> and <https://inaturalist.nz/observations/43550066> – all accessed: 26 November 2020).

***Ornithopus compressus* L.**

yellow serradella

NEW RECORD: AK 373180, C. D. Kilgour 3455, 10 Oct 2017, South Auckland, Kariotahi Beach, c. 500 m south of carpark. <https://inaturalist.nz/observations/2413608>

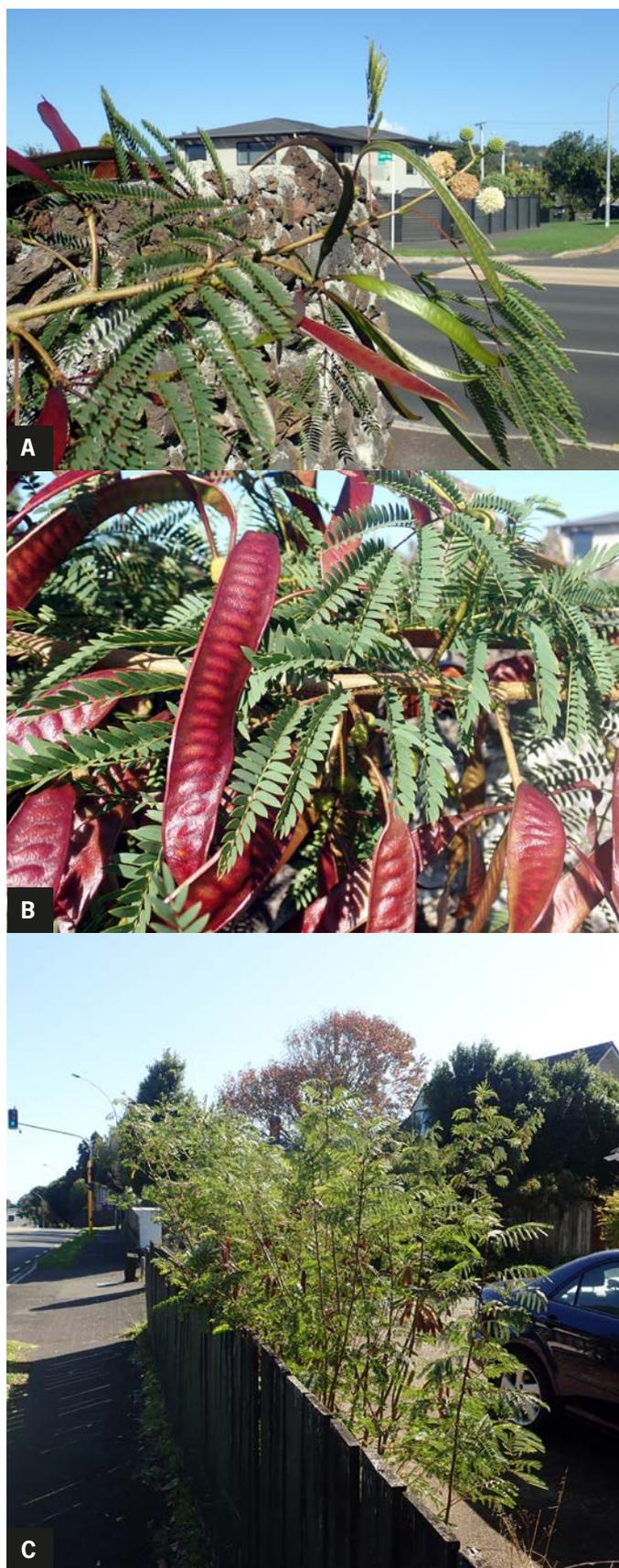


Figure 32. *Leucaena leucocephala*: (A, B) flowering fruiting material (24 April 2020) and (C) wild plants growing along fence line of rental property (4 October 2018), St Lukes, Mt Albert, Auckland. Photographs © P. J. de Lange.

ADDITIONAL RECORDS: AK 374975, *C. D. Kilgour s.n.*, 5 Nov 2017, South Auckland, Kariotahi Beach, c. 500 m south of carpark; AK 378784, *F. Duff s.n. & J. Salter*, 28 Sep 2019, Auckland, Rodney District, Mangawhai, between Mangawhai Museum and Mangawhai Park; AK 381480, *C. C. Ogle 6765*, 1 Nov 2020, Manawatu, Horowhenua, Kuku Beach.

NOTES (Figure 33): Spontaneous Occurrence. Single patch in weedy dunes, midway between beach and rear dunes at Kariotahi. At Mangawhai it was locally common in the open over a distance of 2 km, this was also the case at Omaha where this species was noted as abundant in dunes and sandy ground within the main settlement (see <https://inaturalist.nz/observations/17422807> [accessed: 11 June 2020]). On 1 Nov 2020, material was collected by CCO from Kuku Beach, south of Levin, where it was common over many metres of hind dunes. It appears that this species is rapidly expanding its range and so may qualify as Fully Naturalised in the near future.

***Senna aciphylla* (Benth. ex A.Gray) Randell**

NEW RECORD: CHR 595676, *P. B. Heenan s.n.*, 31 Jan 2008, Canterbury, Lincoln, Crop & Food Research gardens.

NOTES: Cultivation Escape. Seedlings established in garden near flowering and fruiting plants.

***Sophora howinsula* (W.R.B.Oliv.) P.S.Green**

NEW RECORD: AK 300232/CHR 552570, *P. J. de Lange 7000 & T. J. P. de Lange*, 15 Jul 2007, Auckland, Mt Albert.

NOTES: Cultivation Escape. Numerous seedlings and saplings growing under and in the general vicinity of mature fruiting tree within the Mt Albert Research Centre grounds. These plants were removed in November 2008 by the expansion of a nearby car park. The parent trees were sourced from seed collected from Lord Howe Island (R. Main pers. comm.).

***Styphnolobium japonicum* (L.) Schott**

pagoda tree

NEW RECORD: AK 379948, *M. D. Wilcox s.n.*, 19 Jan 2019, Auckland City, Freemans Bay, Hopetoun Street.

NOTES: Cultivation Escape. Seedlings under roadside tree (vouchered as AK 379947).



Figure 33. *Ornithopus compressus*, abundant weed in partially mowed turf overlying sand near Omaha Surf Club, Omaha, Omaha Bay, 8 October 2018. Photograph © P. J. de Lange.

***Vicia benghalensis* L.**

purple vetch

NEW RECORD: AK 313769, *P. D. Champion s.n.*, 17 Mar 2010, North Auckland, Dargaville

ADDITIONAL RECORD: AK 363326, *P. R. Enright 1702*, 26 Nov 2016, Wairarapa, c. 4 km NE of Featherston, by Underhill Road extension.

NOTES: Spontaneous Occurrence. Reported twice. Initially from the banks of a railway bridge on the Dargaville–Whangarei Highway where it had been reported to weeds inspectors as smothering the surrounding vegetation. When that site was inspected in March 2010, only a few immature plants were located growing on coarse gravel either side of the bridge. Subsequently this species was reported from near Featherston during November 2015 (see <http://naturewatch.org.nz/observations/2438665> [accessed: 17 November 2020]) from where it was collected in November 2016.

FAGACEAE

***Quercus calophylla* Schltdl. et Cham.**

NEW RECORD: CHR 656125, *C. C. Ogle 6640 & C. R. Higgie*, 12 Jan 2019, Whanganui, Fordell, Pōhutukawa Lane.

NOTES: Cultivation Escape. Locally common seedlings under planted tree (CHR 656124) in grazed farmland and downslope from the putative parent tree. Has previously been known as *Q. candicans* Née.

GERANIACEAE

***Geranium procurrens* Yeo × *G. psilostemon* Ledeb.**

NEW RECORD: AK 373179, *C. D. Kilgour s.n.* & *A. J. Marshall*, 27 Aug 2018, Auckland, Titirangi, Konini Road. NOTES: Cultivation Escape. Locally common over c. 5 m-2 along street verge and over a fence in an unkempt shaded lawn associated with weeds. It appears to be the cv. Ann Folkard.

***Pelargonium grossularioides* (L.) L'Hér.**

coconut storksbill

NEW RECORD: UNITEC 11214, *P. J. de Lange* 14433, 10 Nov 2018, Auckland, Oratia, Parker Road.

NOTES: Spontaneous Occurrence. Plants appeared as land was cleared for a new subdivision. These were left on the assumption that they were the superficially similar indigenous kōpata (*Pelargonium inodorum* Willd.), with the result that, by the time of collection, they had rapidly spread throughout the cleared land. A further recent observation of this species, plants that appeared in land fill, has been made from the Hawkes Bay, at Havelock North see <https://inaturalist.nz/observations/63148430> [accessed: 18 November 2020]).

GUNNERACEAE

***Gunnera manicata* Linden ex Delchev.**

NEW RECORD: CHR 565719, *C. C. Ogle* 4257 & *C. R. Higgie*, 1 Sep 2003, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES: Cultivation Escape. Present as seedlings up to 10 m from planted fruiting specimens.

HAMAMELIDACEAE

***Loropetalum chinense* (R.Br.) Oliv.**

Chinese fringe flower

FIRST RECORD: Beadel, S. et al., *Rotorua Botanical Society Special Issue* 2, 53 (2009).

VOUCHER: AK 305954/CHR 546883, *P. J. de Lange* 7952, *T. J. de Lange* & *F. J. T. de Lange*, 21 Dec 2008, Bay of Plenty, Tauranga, Maungatapu, Rotary Park.

ADDITIONAL RECORD: AK 303846, *P. J. de Lange* 7940 & *F. J. T. de Lange*, 1 Nov 2008, Auckland, Western Springs, Western Springs Park.

NOTES: Cultivation Escape. At both sites, numerous seedlings and saplings grow in the vicinity of mature fruiting adults. Although this small tree is commonly cultivated throughout New Zealand, it seems to rarely set fruit.

LAMIACEAE

***Leucosceptrum canum* Sm.**

NEW RECORD: CHR 655044, *C. R. Higgie* (Ogle 6602), Aug 2018, Whanganui, Fordell, Pōhutukawa Lane, farmland beside Paloma Gardens.

NOTES: Cultivation Escape. The putative parent plant, represented by CHR 655043, was planted in grazed pasture; seedlings were found downslope, protected from grazing in a dense patch of *Phytolacca octandra* L.

***Ocimum gratissimum* L.**

African basil

NEW RECORD: UNITEC 11191, *P. J. de Lange* 14507, 29 Dec 2019, Kawakawa Bay, Kawakawa–Orere Road.

NOTES (Figures 34A, 34B): Cultivation Escape. Single plant growing in a cracked portion of pavement between a garden fence and the wall of a corner dairy. Numerous specimens present in fenced-off garden nearby. This species, one of the so called 'Holy Basil' complex, is grown mostly by the ethnic Indian communities of New Zealand who refer to it as 'tulsi' and use it as offerings in religious ceremonies though, on occasion, the foliage is also consumed (M. Prasad pers. comm. 28 Jan. 2020).

***Perilla frutescens* (L.) Britton**

perilla

NEW RECORD: AK 327931, *B. S. Parris* 12844, 8 Apr 2008, North Auckland, Bay of Islands, Kerikeri.

ADDITIONAL RECORDS: AK 309109, *E. K. Cameron* 15388, 21 Jan 2010, Auckland, Hauraki Gulf, Waiheke Island, Ostend; AK 311862, *E. K. Cameron* 15436, 6 Apr 2010, Auckland, ex-Hauraki Gulf, Waiheke Island, Ostend; AK 323039, *E. K. Cameron* 15812, 20 Mar 2010, Auckland City, Balmoral; AK 360555, *W. R. John s.n.*, 23 Mar 2016, Auckland City, Waterview, Oakley Creek Walkway Reserve.



Figure 34. *Ocimum gratissimum*, (A, B) wild plant growing in cracked pavement on external-facing side (street side) of fence at back of roadside dairy, Kawakawa–Orere Road, Kawakawa Bay, 29 December 2019. Photographs © P. J. de Lange.

NOTES: Cultivation Escape. Three of the four site records are seedlings from nearby cultivated parents, but one is from near a stream some distance from cultivated material. Further naturalisations are likely, as the edible foliage of this species is widely used in the cooking of the South East Asian communities of New Zealand.

***Plectranthus elegans* Britten**

NEW RECORD: AK 364731, A. E. Esler 4736 & S. J. Astridge, 5 Dec 1974, Auckland, Dingle Dell.

ADDITIONAL RECORD: AK 360539, P. S. P. Bendle s.n., 30 Mar 2016, Taranaki, New Plymouth, Tupare Gardens near Mangorei Road.

NOTES: Cultivation Escape. Naturalised to a limited extent in Auckland in secondary forest. Present as seedlings and also as plants established vegetatively from dislodged pieces derived from nearby cultivated plants in New Plymouth.

***Salvia confertiflora* Pohl.**

NEW RECORD: AK 306646, B. S. Parris 12733, 4 Dec 2005, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. Shrub, occasionally self-seeding in shaded garden bed or on scoria path in sun, up to 25 m from parent plant.

***Salvia forskaehlei* L.**

NEW RECORD: AK 353067, B. S. Parris 12925, 1 Feb 2014, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. Aggressive self-seeder in garden bed close to parent plants.

***Salvia splendens* Sellow ex Nees**

scarlet sage

NEW RECORD: AK 297061/CHR 546596, P. J. de Lange 6657, 7 May 2006, Hamilton City, St Andrews.

ADDITIONAL RECORDS: AK 304862, P. J. de Lange 6657, 21 Dec 2008, Tauranga, Maungatapu, Tapari Road; AK 330214, E. K. Cameron 15797, 25 Feb 2011, Auckland, Auckland Domain, by entrance to the Wintergardens.

NOTES: Cultivation Escape. Persistent weed in garden and adjacent kerbside, cracks in concrete and mortar in brick wall.

***Satureja spicigera* (K.Koch) Boiss.**

creeping savoury

NEW RECORD: CHR 615068, C. C. Ogle 5880, 15 Feb 2011, Whanganui, Durie Hill, 22 Forres St.

NOTES: Cultivation Escape. Seedlings established between concrete paving stones near cultivated plants.

***Scutellaria indica* var. *parvifolia* Makino**

dwarf Indian skull cap

NEW RECORD: CHR 605949, W. R. Sykes 51/06, 18 Dec 2006, Banks Peninsula, Charteris Bay, Orton Bradley Park.

NOTES: Cultivation Escape. Spontaneous plant that presumably arose from parent plants that previously occurred in the vicinity.

***Teucrium fruticans* L.**

silver germander

NEW RECORD: UNITEC 11367, P. J. de Lange 14424 & F. J. T. de Lange, 6 Oct 2018, Auckland, Omaha Bay, Point Wells, Riverside Drive.

ADDITIONAL RECORD: UNITEC 11500, P. J. de Lange CH3058, 19 Sep 2019, Chatham Islands, Rēkohu / Wharekauri / Chatham Island, Chatham Island / Tuuta Airport.

NOTES: Garden Discard. Noted at Point Wells growing in wasteland amongst an assemblage of other plants derived from the illegal dumping of garden waste from adjacent gardens and, on Rēkohu, growing in shrubland where garden plants and clippings had been dumped 15 or more years previously. It is surprising that this commonly grown shrub has not been reported wild from New Zealand before.

***Thymus mastichina* L.**

NEW RECORD: AK 306654, B. S. Parris 12725, 28 Nov 2005, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. Regularly self-seeding in sunny garden bed. Seedlings 1–2 m away from parent plant.

LENTIBULARIACEAE

***Pinguicula grandiflora* Lam.**

large-flowered butterwort

NEW RECORD: AK 313764, P. D. Champion s.n. & T. K. James, 8 Nov 2007, Coromandel Peninsula, Tairua, Broken Hills near Tairua River.

ADDITIONAL RECORD: AK 330212, N. Priddle s.n. & E. Coppard, 23 Feb 2011, Coromandel Peninsula, Tairua, Broken Hills near Tairua River; AK 373187, L. K. Allison-Cooper s.n., 18 Dec 2018, Volcanic Plateau, Tongariro National Park, near Taranaki Falls.

NOTES: Intentional Release. Presumed to have been planted originally at the Broken Hills site with *Utricularia sandersonii* Oliv. where it is spreading on a wet trackside bank. Plants were also found locally well-established (also, it is assumed, from past deliberate planting) in two separate sites within Tongariro National Park near Horopito in 2015 and near Taranaki Falls in 2018 and both these are now the subject of an eradication programme by the New Zealand Department of Conservation.

LINACEAE

***Radiola linoides* Roth.**

allseed

FIRST RECORD: Gardner, R. O., *Journal of the Auckland Botanical Society* 67, 102–103 (2012).

VOUCHER: AK 329601, L. J. Forester, 4 Nov 2011, North Auckland, Kaimaumu Bog, 'Terrible Ridge.'

NOTES: Spontaneous Occurrence. Erect plants to 30 mm tall; abundant in the open on a track traversing a sandstone ridge within gumland vegetation. Presumed previously overlooked because of its diminutive size.

LINDERNIACEAE

***Bonnaya ciliata* (Colsm.) Spreng.**

fringed false pimpernel

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302086, E. K. Cameron 15010a, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-Waikato, Waipa, Kihikihi, Growing Spectrum Ltd.

NOTES: Spontaneous Occurrence. A new weed record for New Zealand that derives from the importation

of coir peat contaminated with weed seeds from Sri Lanka. To date, there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

***Torenia crustacea* (L.) Cham. et Schltldl.**

Malaysian false pimpernel

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302103, E. K. Cameron 15010b, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-Waikato, Waipa, Kihikihi, Growing Spectrum Ltd. NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date, there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

LYTHRACEAE

***Rotala rotundifolia* (Buch.-Ham. ex Roxb.) Koehne**
rotala

NEW RECORD: AK 3334924, P. J. de Lange 11151, T. J. P. de Lange & F. J. T. de Lange, 3 Nov 2012, South Auckland, Rangiriri, Rangiriri Road.

NOTES (Figure 35): Garden Discard. Growing in a roadside drain (this site was subsequently eliminated in 2014 by roadworks associated with improving nearby State Highway 1). This species was cultivated in a nearby café's inner courtyard pond, so the occurrence possibly arose from the illicit dumping of clippings from that source.

MAGNOLIACEAE

***Magnolia x soulangeana* Soul.-Bod.**

NEW RECORD: AK 298705, P. J. de Lange 6935, T. J. P. de Lange & F. J. T. de Lange, 4 Mar 2007, Auckland, Mt Albert, Sainsbury Road.

NOTES: Cultivation Escape. A single seedling growing in a poorly maintained lawn within the grounds of a former shoe factory. A large, planted adult tree (AK 300405) grew nearby. This site was destroyed in November 2009 to make way for a new shopping complex.

MALVACEAE

***Abutilon indicum* (Link) Sweet**

Indian mallow

NEW RECORD: CHR 625585, C. R. Higgie (C. C. Ogle 6579), 30 April 2018, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES: Abundant seedlings within several metres of a planted flowering and seeding shrub in an extensive garden and arboretum; the mature plant was removed early in 2018 as it was becoming too weedy. A piece of the parent plant, bearing flowers and fruit, had been collected from the same site on 16 February 2015, CHR 637033, C. C. Ogle 6328, C. R. Higgie and identified by W. R. Sykes; it was noted on the label that no seedlings had been seen up to that time.

***Althaea officinalis* L.**

marsh mallow

NEW RECORD: UNITEC 10682, P. J. de Lange 14392, 16 Apr 2019, North Westland, Fox River.

NOTES (Figure 36): Cultivation Escape. Occasional plants noted growing on cobbles along river near old bridge. Cultivated specimens seen beside nearby public toilets and are presumably the source of the wild plants.

***Anisodonteia capensis* (L.) D.M.Bates**

African mallow

FIRST RECORD: Wilcox, M. & Maddison, P. *Auckland Botanical Society Journal* 74, 30 (2019).

VOUCHER: AK 298490, M. D. Wilcox s.n., 18 Jan 2007, Auckland, Mangere sewage plant, reclamation site.

NOTES: Spontaneous Occurrence. A single plant in a reclaimed site on an earth bund. A possible parent shrub was some 2 km distant (AK 298326).

***Brachychiton acerifolius* (A.Cunn. ex G. Don)**
F. Muell.

NEW RECORD: AK 321024, B. S. Parris 12890, 24 Apr



Figure 35. *Rotala rotundifolia* growing in roadside ditch with *Myriophyllum propinquum* A.Cunn., State Highway 1, Rangiriri, Waikato (this site has since been destroyed by road widening), 1 September 2012. Photograph © P. J. de Lange.

2010, North Auckland, Bay of Islands, Kerikeri.

ADDITIONAL RECORDS: AK 320985, B. S. Parris 12964, 25 Jan 2011, Auckland City, Auckland Domain; AK 322087, E. K. Cameron 15796, 25 Feb 2011, Auckland City, Auckland Domain, on bank south of duck pond; AK 3308085, P. J. de Lange 10694 & F. J. T. de Lange, 9 Apr 2012, Auckland City, Western Springs, Auckland Zoological Gardens, Tropical Primate Exhibit; AK 332540, E. K. Cameron 15796, 12 Aug 2012, Auckland City, Auckland Domain, on lawn SE of duck pond, near road; AK 353465, P. J. de Lange 12324 & F. J. T. de Lange, 26 Jul 2014, Auckland City, corner of City Road and Symonds Street.

NOTES: Cultivation Escape. Mainly young seedlings found at four different sites all within close proximity to an adult tree or trees. However, at one location, bark around the base of a large Norfolk pine had >200 seedlings (largest 40 cm tall), 100 m away from the adult tree (AK 332540). Several seeds, germinating in their black decaying pods under a parent tree, were



Figure 36. *Althaea officinalis*, occasional plants noted growing in gravel and amongst garden waste on the side of the river near the old bridge (cultivated plants noted growing in a small garden at the entrance of nearby public toilet block), Fox River, North Westland, 16 April 2019. Photograph © P. J. de Lange.

collected eight years before these seedling records, but were not included because they were within their pods (AK 256526, M. Kenny s.n., 7 May 2002, Auckland City, Purewa Cemetery).

***Hibiscus tridactylites* Lindl.**

NEW RECORD: AK 344459, P. J. de Lange 11665 & R. O. Gardner, 7 Mar 2013, Auckland, Mt Albert, 16 Jesmond Terrace.

NOTES: Spontaneous Occurrence. Appeared as a weed in a freshly bark-mulched garden. This species had not been cultivated in the vicinity. However, there are older Auckland cultivated collections of it, suggesting that it has been present in Auckland gardens for a long time (e.g., N. Mackie s.n., 3 Jan 1932, Piha, AK 102921; A. E. Esler s.n., 3 Mar 1971, Takapuna, AK 215632) and this species has also been collected from gardens in Hastings (J. Bilkey s.n., 19 Mar 1980, AK 244227) and Levin (without collector, 10 Apr 1981, AK 244228). The seeds of members of the bladder ketmia (*Hibiscus trionum* L.) group are well known to be long-lived and leave a persistent seed bank (Craven et al. 2011), so it is possible that *H. tridactylites* had been cultivated many years ago in the site in which appeared. Alternatively, the seed could have been a contaminant in the bark mulch.

Melochia corchorifolia L.

chocolate weed

NEW RECORD: AK 302474, T. K. James s.n., 22 Apr 2008, ex-North Auckland, Kaiwaka, Kauri Park Nurseries. NOTES: Spontaneous Occurrence. Known from a single specimen which appeared as a contaminant within coir fibre potting mix.

Modiolastrum lateritium (Hook.) Krapov.

trailing mallow

NEW RECORD: CHR 525373, C. C. Ogle 3955, 16 Nov 2001, Whanganui, Anzac Parade.

ADDITIONAL RECORDS: CHR 609359, C. C. Ogle 5728 & R. C. Ogle, 16 Mar 2010, Whanganui, Anzac Parade; AK 320945, C. C. Ogle 5795, 28 Jul 2010, Whanganui, Anzac Parade.

NOTES (Figures 37A, 37B): Cultivation Escape. From before 2001 until at least 2015, a plant had established in accumulated soil and litter on a tar-sealed footpath. The source of this plant was a cultivated specimen which had sprawled over a one-metre concrete wall above the footpath. It was identified as *Sphaeralcea philippiana* Krapov., in error (Schönberger et al. 2017), and amended to *Modiolastrum lateritium* in the 2020 edition (Schönberger et al. 2020).

MELIACEAE

Toona sinensis (A.Juss.) M.Roem.

Chinese toon

NEW RECORD: AK 221875, E. K. Cameron s.n., 25 Mar 1995, Auckland, Greenlane, Woodbine Ave.

ADDITIONAL RECORD: CHR 608142, G. La Cock s.n., 27 Nov 2009, Taranaki, New Plymouth, Strandon.

NOTES: Cultivation Escape and Spontaneous Occurrence. Spreading by suckering several metres in lawn from original plantings; stems to 1 m tall. The Auckland material had pink new leaves and matched the cultivar 'Flamingo.' Also collected as a single 5 m tall tree in kanuka (*Kunzea Rchb.*) scrub, perhaps established after fire.



Figure 37. *Modiolastrum lateritium*: (A, B) wild plant sprawling over a wall and taking root in debris on footpath, Anzac Parade, Whanganui, 16 Sep 2008. Photographs © C. C. Ogle.

MOLLUGINACEAE

Mollugo nudicaulis Lam.

daisy-leaved chickweed

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302102, E. K. Cameron 15025b, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-Waikato, Waipa, Kihikihi, Growing Spectrum Ltd.

NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date, there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

***Mollugo oppositifolia* L.**

slender carpetweed

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302101, E. K. Cameron 15025a, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-Waikato, Waipa, Kihikihi, Growing Spectrum Ltd. NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date, there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

MORACEAE

***Ficus religiosa* L.**

sacred fig

NEW RECORD: AK 327590, T. K. James s.n., Feb 2009, Hamilton, Ruakura Research Centre.

NOTES: Spontaneous Occurrence. Appeared as a seed contaminant within coir fibre potting mix. Sacred fig is grown in the warmer parts of New Zealand, but fruit do not mature or produce viable seed, presumably through the lack of an insect pollinator.

MUNTINGIACEAE

***Muntingia calabura* L.**

Jamaica cherry

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302096, E. K. Cameron 15020, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-Waikato, Waipa, Kihikihi, Growing Spectrum Ltd. NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date, there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more

details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand. Recorded by Anon. (2008) as “unknown shrub 2.”

MYRTACEAE

***Eucalyptus crenulata* Blakely et Beuzev.**

Buxton gum

NEW RECORD: AK 349127, P. J. de Lange 12000 & C. C. Ogle, 25 Feb 2014, Wairarapa, Parera Road, near Eastern Shore of Lake Wairarapa.

ADDITIONAL RECORD: AK 349796, P. J. de Lange 12067 & C. C. Ogle, 25 Feb 2014, Wairarapa, Parera Road, near Eastern Shore of Lake Wairarapa.

NOTES: Cultivation Escape. Saplings and seedlings collected from the vicinity of adult trees planted along a roadside perimeter fence.

***Leptospermum morrisonii* Joy Thomps.**

NEW RECORD: AK360488, P. J. de Lange 13019 & F. J. T. de Lange, 17 Jan 2016, Auckland, Mt Albert, Bennett Street.

ADDITIONAL RECORDS: UNITEC 11368, P. J. de Lange 14425 & T. J. P. de Lange, 5 Oct 2018, Auckland, Omaha Bay, Point Wells, Riverside Road; AK 360987–AK 360988, C. D. Kilgour 2777-2778 & P. Kilgour, 25 Jan 2016 Nelson, Golden Bay, Rangihaeata, Fraser Road.

NOTES: Cultivation Escape. Seedlings collected from a brick wall in the vicinity of a street verge planting of this species in Auckland, from a roadside verge and associated coastal forest remnant, and from open clay under disturbed exotic trees in Golden Bay. New Zealand plants correspond to the cultivar ‘Burgundy’ but have been erroneously sold in this country under the name *Leptospermum nitidum* Hook.f. cultivar ‘Copper Sheen’ (see Wilcox 2013). *Leptospermum morrisonii* is now widely grown throughout the warmer parts of New Zealand. As plants readily flower and set viable seed, further naturalisations are considered likely.

***Lophostemon confertus* (R.Br.) Peter G.Wilson et J.T.Waterh.**

brush box

NEW RECORD: AK 241523, E. K. Cameron 9892, 9 Oct 1999, Auckland, Glen Eden, Waikumete Cemetery

ADDITIONAL RECORD: AK 297838/CHR 552843, P. J.



Figure 38. *Melaleuca diosmifolia*: (A) sapling growing in gumland scrub, Otaipango Road, Henderson Bay, Te Aupouri, 8 January 2017; (B) inflorescence of wild shrub growing in rawiri (*Kunzea linearis*) scrub, Kauere Road, Otaipango (Henderson Bay), Te Aupouri, 29 September 2019. Photographs © P. J. de Lange.

de Lange 6756, K. Hall & R. O. Gardner, 22 Nov 2006, Auckland, New Lynn, Waikumete Cemetery.

NOTES: Cultivation Escape. A few plants established in burnt manuka *Leptospermum scoparium* J.R.Forst. et G.Forst. scrub with planted adult trees nearby. Both collections from the same locality.

***Melaleuca citrina* (Curtis) Dum.Cours.**

crimson bottlebush

NEW RECORD: CHR 234944, A. J. Healy 75/81, 11 Feb 1975, Christchurch, Riccarton, Peverill Street.

ADDITIONAL RECORDS: NZFRI 26155, C. C. Ogle 4951, 21 Dec 2005, Manawatu, SH3, Sanson, Mt Stewart; AK 301870, M. D. Wilcox s.n., 16 Feb 2008, North Auckland Land District, Rodney, Tomarata Lake, northern shore.

NOTES: Cultivation Escape. Noted in a few locations as sparingly established in the vicinity of planted specimens. As this species is widely cultivated throughout New Zealand, further naturalisations are expected.

***Melaleuca diosmifolia* R.Br.**

diosma-leaved honey myrtle

NEW RECORD: AK 362932, Find 13280 & K.A. Raharaha, 17 Sep 2016, Te Aupouri Peninsula, Otaipango Road, Raharaha Property

NOTES (Figures 38A, 38B): Cultivation Escape. Commonly cultivated in the warmer parts of New Zealand, especially in the far north where it is seen as hedging around rural properties and coastal settlements. In some places it has started to establish, though so far, always in the vicinity of planted fruiting, adult specimens. Wilcox (2014) reported this species naturalised on the sand dunes at Ahipara and cultivated at the nearby Ahipara Holiday Park in Northland but the record is not substantiated as he only vouchered a cultivated specimen (AK 349022).

***Syzygium jambos* (L.) Alston**

rose apple

NEW RECORD: AK 327560, *T. J. Martin s.n.*, 25 Feb 2011, North Auckland, Takou Bay.

NOTES: Cultivation Escape. Occasional wild seedlings to c. 0.2 m tall in dense shade under a canopy of planted fruiting adults.

OLEACEAE

***Fraxinus griffithii* C.B. Clarke**

Himalayan ash

NEW RECORD: AK 370883, *C. C. Ogle 6511*, 5 Feb. 2018, Whanganui, Wicksteed St.

NOTES: Cultivation Escape. About 20 seedlings, up to 1.2 m tall, in gravel alley between a tall wall and carpark; west aspect, hot, dry, with seedlings up to 5 m from a row of 8 planted specimens.

ONAGRACEAE

***Ludwigia hyssopifolia* (G.Don) Exell**

linear-leaf water primrose

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302097, *E. K. Cameron 15021*, *R. O. Gardner & M. N. Lee*, 28 Mar 2008, cultivated ex-Waikato, Waipa, Kihikihi, Growing Spectrum Ltd.

ADDITIONAL RECORDS: AK 312348/AK 312349/CHR 553868, *S. P. Benham s.n.*, 20 Apr 2010, Auckland, inner Hauraki Gulf, Motuihe Island, Native Plant Nursery.

NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

***Ludwigia repens* J.R.Forst.**

water primrose

NEW RECORD: AK 313772, *P. D. Champion s.n.*, 5 Dec 2008, Auckland, Western Springs, Meola Creek.

ADDITIONAL RECORD: AK 313774, *P. D. Champion s.n.*, 16 Apr 2010, cultivated ex- Auckland, Western Springs, Meola Creek.

NOTES: Intentional Release. Submerged in spring head pool near creek with a mix of other exotic species. This population was destroyed sometime in 2015 as the result of ongoing changes to the Western Motorway.

***Oenothera lindheimeri* (Engelm. et A.Gray)**

W.L.Wagner et Hoch

NEW RECORD: AK 284003, *B. S. Parris 12582*, 15 May 2003, North Auckland, Bay of Islands, Kerikeri.

ADDITIONAL RECORDS: AK 294837, *E. K. Cameron 13265*, 28 Dec 2005, Auckland City, Balmoral, Thames Street; AK 330546, *E. K. Cameron 16017*, 28 Mar 2012, Auckland, Manurewa, Hill Road, Auckland Regional Botanic Gardens.

NOTES: Cultivation Escape. Self-seeds into open sites in gardens and cracks in footpaths near to where its cultivated. This plant is also known as *Gaura lindheimeri* Engelm. et Gray.

PAPAVERACEAE

***Bocconia frutescens* L.**

plume poppy

NEW RECORD: AK 221768, *L. Goffart s.n.*, 23 Feb 1995, Auckland, Mount Albert, corner Mount Albert Road and Kerr Taylor Ave, Alberton grounds.

ADDITIONAL RECORD: AK 353931, *J. R. Rolfe s.n.*, 18 Aug 2014, Auckland, Northcote, Cobblestone Lane; AK 347640, *P. J. de Lange 11878*, 6 Oct 2013, Hamilton, Maeroa, Edgecumbe Gully; AK 353076, *P. J. de Lange 12306*, 6 Jan 2014, Auckland, University of Auckland campus, near marae; AK 363547, *D. M. T. Seon s.n.*, 1 Feb 2017, North Auckland, Mangonui, Butler House grounds

NOTES: Spontaneous Occurrence. Collected five times: once as a mature, fruiting adult growing in wasteland on the margin of a gully system in Hamilton, twice as seedlings that appeared in private gardens, while the other records are of seedlings growing in wasteland

on the campus of the University of Auckland and in a similar situation within an urban park. Plume poppy is occasionally cultivated in the warmer parts of New Zealand, and as plants produce copious viable seed within fleshy fruits that are attractive to birds, further occurrences are anticipated.

***Macleaya cordata* (Willd.) R.Br.**

five-seeded plume poppy

NEW RECORD: AK 236007, *E. K. Cameron 9050*, 23 Dec 1997, Auckland, opposite the Auckland Domain, Titoki Street.

ADDITIONAL RECORD: AK 301736/CHR 552553, *P. J. de Lange 7263 & T. J. P. de Lange*, 10 Feb 2008, Auckland, Western Springs, Meola Creek, near North Western Motorway.

NOTES: Cultivation Escape. Collected twice from a private garden and from rough grassland overlying scoria rubble on wasteland at the back of a park on land that had once been used to grow 'wild flowers.' *Macleaya* is widely cultivated for its spectacular silvery leaves and freely self-sows in garden settings, so further naturalisations are anticipated. We use the name *M. cordata* here provisionally because it is now known that this species is scarce in cultivation worldwide, and as has been shown for Europe many cultivated plants and naturalisations attributed to that species seem to represent *M. xkewensis* Turrill (see <http://alienplantsbelgium.be/content/macleaya> [accessed: 17 November 2020]). This nothotaxon is a common and widely cultivated hybrid between *M. cordata* and *M. microcarpa* (Maxim.) Fedde (Turrill 1958).

PASSIFLORACEAE

***Passiflora apetala* Killip**

bat-wing passion flower

NEW RECORD: AK 305720/AK 305726-28/CHR 553118, *W. D. Teal s.n. & L. J. Forester*, 23 Jul 2009, North Auckland, Whangarei, Kamo.

ADDITIONAL RECORDS: AK 307135-41, *L. J. Forester s.n.*, 7 Aug 2009, North Auckland, Kamo; UNITEC 11193, *P. Bell-Butler s.n.*, 31 Jul 2019, North Auckland, Kamo; AK 340689, *G. M. Hoskins s.n.*, 4 Jul 2013, North Auckland, South Kaipara, Woodhill Forest; AK 340953, *G. M. Hoskins s.n.*, 8 Jul 2013, North Auckland, South Kaipara, Helensville, Parkhurst; AK 348319, *G.*

M. Hoskins s.n., 31 Jan 2014, North Auckland, South Kaipara, Woodhill Forest; AK 351713, *G. M. Hoskins s.n.*, 30 Apr 2014, North Auckland, South Kaipara, Woodhill Forest.

NOTES: Spontaneous Occurrence. Several patches of adult fruiting vines with abundant seedlings over c. 3 ha in a disturbed native forest area of Kamo. Single adult and small patches of seedlings in Woodhill Forest c. 3 km distant from an old nursery at Parkhurst where it was once cultivated. All plants found have been destroyed.

***Passiflora foetida* L.**

stinking passionflower

NEW RECORD: AK 327595, *T. K. James s.n.*, Mar 2009, Hamilton, Ruakura Research Centre.

NOTES: Spontaneous Occurrence. Appeared as a contaminant within coir fibre potting mix.

PAULOWNIACEAE

***Paulownia elongata* S.Y.Hu.**

NEW RECORD: NZFRI 19112/AK 226383, *C. E. Ecroyd s.n.*, 29 Oct 1990, Bay of Plenty, Rotorua, McIntyre Ave near Scott Street at back of Crematorium.

ADDITIONAL RECORDS: AK 310807, *E. K. Cameron 15329*, 5 Dec 2009, Auckland, Balmoral, Balmoral Road; AK 367482/AK 367483, *P. A. Aspin 654a-b*, 30 May 2017, South Auckland, Awhitu District, Matakawau, north off Hatton Road.

NOTES: Cultivation Escape. Known from three localities, all collected near cultivated adult trees, two sites with single seedling/saplings, but at the Awhitu farm-forestry site in a recently burnt area there were hundreds of seedlings and several saplings >3 m tall after 2 years.

***Paulownia fortunei* (Seem.) Hemsl.**

dragon tree

NEW RECORD: AK 298461, *E. K. Cameron 14402*, 4 Feb 2007, Auckland, Balmoral, Balmoral Road.

ADDITIONAL RECORD: AK 313997, *P. J. de Lange 9191*, 12 Jan 2009, Auckland, Mt Albert, Challinor Street.

NOTES: Cultivation Escape. Spreading from seed and also vegetatively through suckering many metres from planted trees.

PHYLLANTHACEAE

***Phyllanthus debilis* J.G.Klein ex Willd.** niruri

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302095, E. K. Cameron 15019, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-Waikato, Waipa, Kihikihi, Growing Spectrum Ltd.

NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date, there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

PIPERACEAE

***Peperomia griseo-argentea* Yunck.**

NEW RECORD: AK 300524, B. S. Parris 12824, 23 Aug 2007, North Auckland, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. One self-sown plant in deep shade, 25 m away from parent plant; has survived two winters in this site.

PLANTAGINACEAE

Callitriche peploides* Nutt. var. *peploides

NEW RECORD: CHR 625887, C. C. Ogle 6180, 10 Mar 2013, South Taranaki, Waverley, Nukumarū, Lake Waikato.

NOTES: The sole specimen was collected as *C. petriei* R.Mason, from lakeside turf dominated by indigenous plants. This specimen was subsequently redetermined as *C. peploides* var. *peploides* by R. V. Lansdown. Access to Lake Waikato, a privately owned water body, is by permission only so it is one of the least accessible dune lakes in South Taranaki, thereby reducing the chances of accidental transfer of aquatic plants to it. It seems likely, therefore, that *C. peploides* occurs elsewhere in the district's dune lakes and beyond, but has not been recognised as distinct from *C. petriei* by New Zealand botanists.

PLATANACEAE

***Platanus orientalis* L.** Oriental plane

NEW RECORD: CHR 593558, C. C. Ogle 5396 & R. C. Ogle, 20 Feb 2008, Whanganui, 96 Ridgway Street.

NOTES: Cultivation Escape. Seedling in crack between footpath and base of old post office; both sides of the street are lined with plantings of the cultivar 'Autumn Glory' made in ca. 1998 (e.g., CHR 593557).

POLYGONACEAE

***Reynoutria multiflora* (Thunb.) Moldenke** tuber fleecflower

NEW RECORD: AK 357902, S. L. Happy s.n., 29 May 2015, Auckland City, New Lynn, Lynwood Ave.

ADDITIONAL RECORDS: AK 357903, S. L. Happy s.n., 27 Jul 2015, Auckland City, New Lynn, Lynwood Ave; CHR 640117, S. L. Happy s.n. 6 Apr 2016, Auckland City, New Lynn, Lynwood Ave.

NOTES: Cultivation Escape. This species was originally planted in an urban garden for medicinal purposes, and subsequently spread invasively. Although flowering freely, seed set has yet to be observed; the plants have produced root tubers which has further facilitated this species' spread. Because of the aggressive spread observed, eradication was attempted. Also known as *Fallopia multiflora* (Thunb.) Haraldson, and *Polygonum multiflorum* Thunb.

PORTULACAEAE

Portulaca pilosa* L. subsp. *pilosa

NEW RECORD: CHR 216460, W. R. Sykes 63/71, Banks Peninsula, Little River.

NOTES: Cultivation Escape. Established on a gravel drive. This particular form is known by the cultivar name 'Hortualis.'

PRIMULACEAE

***Lysimachia monelli* (L.) U.Manns et Anderb.** blue pimpernel

NEW RECORD: CHR 637125 C. C. Ogle 6240, 26 Jan 2014, Whanganui, Bastia Hill, 115 Mount View Road.

ADDITIONAL RECORDS: AK 377205, P. J. de Lange 14122, 14 Feb 2018, Auckland, Auckland City, Mt Albert, Unitec Institute of Technology campus; AK 377406, P. J. de Lange 14415, 1 Mar 2018, Auckland, Auckland City, Mt Albert, Unitec Institute of Technology campus.

NOTES: Cultivation Escape. Scattered plants (CHR 637125) self-established in gravel driveway; planted in garden up to 10 m distant. Also collected from wasteland strewn with building rubble.

PROTEACEAE

***Banksia baxteri* R.Br.**

NEW RECORD: AK 360899, P. J. de Lange 13152 & G. M. Crowcroft, 7 Feb 2016, Hawke's Bay, Hastings, Splash Planet.

NOTES: Cultivation Escape. A few shrubs and saplings present within a dense unkept shrubbery mostly comprised of overgrown *Sophora molloyi* Heenan & de Lange, *Ligustrum sinense* Lour., and other shrubs. Several clearly planted – mature flowering and fruiting specimens of *B. baxteri* were noted nearby. It seems likely that fruiting material taken from these had been discarded within the overgrown shrubbery, and that this had been the source of the wild plants.

***Banksia prionotes* Lindl.**

NEW RECORD: AK 364660 A, B, P. J. de Lange 13452, 7 Feb 2016, Hawkes Bay, Hastings, Splash Planet.

NOTES: Cultivation Escape. A spindly specimen 3 m tall in an overgrown shrubbery. Larger, well-established and clearly planted specimens present nearby. The wild individual was noted growing out of the base of self-sown *Sophora molloyi* Heenan et de Lange in a rock face.

Banksia spinulosa* Sm. var. *spinulosa hair pin banksia

NEW RECORD: UNITEC 11177, P. J. de Lange 14493, 6 Dec 2019, Coromandel Peninsula, Kuaotunu, Kuaotunu Stream mouth.



Figure 39. *Grevillea juniperina*: (A) flowers on planted specimen (source of wild plants), 16 September 2014; (B) seedlings growing on clay roadside bank below garden where planted flowering and fruiting adult seed source (A) occurs, Mount View Road, Whanganui, 16 Sep 2014. Photographs © C. C. Ogle.

NOTES: Cultivation Escape. Presumably escaped from deliberate plantings, though a brief search failed to locate plants in adjacent gardens. The sole specimen seen was growing amongst *Apodasmia similis* (Edgar) B.G.Briggs et L.A.S.Johnson, *Machaerina juncea* (R.Br.) T.Koyama, *Phormium tenax* J.R.Forst. et G.Forst. and hybrid swarms of *Myoporum laetum* G.Forst. × *M. aff. insulare* R.Br. This species is not commonly grown in New Zealand.

***Grevillea juniperina* R.Br.**

juniper leaf grevillea

NEW RECORD: AK 286703, N. J. D. Singers 019, 2 Nov 2003, Volcanic Plateau, Ōwhango, near Kakahi Stream. ADDITIONAL RECORD: CHR 635169, C. C. Ogle 6285, 16 Sep 2014, Whanganui, Bastia Hill, Mount View Road. NOTES (Figure 39): Cultivation Escape. The Ōwhango record was two roadside plants, 1.5 m tall, that appeared to be wild. At Bastia Hill, scattered seedlings to 750 mm tall appeared spontaneously on a steep, clay roadside bank; the putative parent plant, planted and flowering, was at top of the bank, about 1 m above.

***Grevillea rosmarinifolia* A.Cunn.**

NEW RECORD: AK 313995, P. J. de Lange 9192, T. J. P. de Lange & F. J. T. de Lange, 7 Jul 2009, Auckland, Western Springs Park. NOTES: Cultivation Escape. A single shrub growing out of joint in columnar basalt lava outcrop in urban park. Although there are now no further plants present in nearby gardens, mature fruiting specimens had been present in the general area in the last eight years.

RANUNCULACEAE

***Delphinium staphisagria* L.**

lice-bane

NEW RECORD: AK 379236-37, S. A. Heiss-Dunlop s.n., 5 Dec 2019, Auckland City, by outer boundary of Cornwall Park near Campbell Road. NOTES (Figures 40A, 40B): Cultivation Escape. Local, a few plants spreading along a fence-line and onto pasture. Presumed spreading from an unofficial planting. Plants to 1.5 m tall, flowers mauve. Ten days after the collection, all plants were demolished by browsing stock and, the following spring, they reappeared from existing root stock.



Figure 40. *Delphinium staphisagria* (A, B) naturalising in Cornwall Park, Auckland and surviving after grazing, 2 Dec 2019. Photographs © Shelley Heiss-Dunlop.

RHAMNACEAE

***Colletia paradoxa* (Spreng.) Escal.**

anchor plant

NEW RECORD: CHR 604459, *C. R. Higgle & C. C. Ogle* 5500, 30 Dec 2008, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES: Cultivation Escape. Occasional seedlings established on clay slope, up to 5 m from planted specimen.

***Phyllica pubescens* Ait.**

NEW RECORD: CHR 644227, *C. C. Ogle* 6478 & *R. C. Ogle*, 9 July 2016, Whanganui, Bastia Hill, 115 Mount View Road.

NOTES: Escape; occasional seedlings self-establishing on limestone rockery and adjoining gravel driveway, from the site where a putative parent shrub was planted but died more than 15 years ago. This suggests that the seeds are long-lived in the soil. There has been confusion in New Zealand as to which specific name to use for this species and it is often grown and sold as *P. plumosa* L., a different species.

ROSACEAE

***Malus sieboldii* (Reg.) Rehd.**

Toringo crabapple

NEW RECORD: AK 309998, *P. J. de Lange*, 16 Feb 2010, Auckland, Waiheke Island, Awaawaroa Bay, Waimanga Bay.

ADDITIONAL RECORD: AK 378984, *P. J. de Lange* 14487, 18 Oct 2019, Auckland, Mt Albert, Guardwell Terrace

NOTES (Figures 41A, 41B, 41C): Cultivation Escape. Both instances of naturalisation occurred in the vicinity of older planted trees.

***Rosa laevigata* Michx.**

Cherokee rose

NEW RECORD: AK 379875, *S. A. Heiss-Dunlop* 410, 29 Jul 2019, West Auckland, Te Henga, Bethells Road, by Matuku Link Reserve.

NOTES (Figure 42): Cultivation Escape. Spreading extensively, climbing up and over existing native vegetation, covering an area of 3 m × 10 m along

roadside; spiny rosehips plentiful. Treated in the SE United States as an invasive species.

***Rubus ellipticus* var. *obcordatus* (Franch.) Focke.**

Himalayan wineberry

FIRST RECORD: *de Lange et al.* 2019, *Perspectives in Biosecurity* 4, 33–39 (2019).

VOUCHER: UNITEC 10706, *P. J. de Lange* 14393 & *D. J. Blanchon*, 4 Apr 2019, Auckland, Albany, Oteha Valley, Gills Road.

ADDITIONAL RECORDS: UNITEC 10775, *P. J. de Lange* 14395, 8 Apr 2019; Auckland, Albany, Oteha Valley, Gills Road; CHR 657088, *B. Quinn s.n.*, 11 Apr 2019, Auckland, Albany, 14 Appleby Road; AK 345687, *H. A. Cox s.n.*, 22 Nov 2019, Auckland Region, Albany Village, road reserve.

NOTES: Sparingly established through roadside shrubland and in adjacent wasteland bordering indigenous forest remnant. Also noted as sporadic seedlings in roadside vegetation nearby the Albany Junior High School.

***Rubus pentalobus* Hayata**

cloudberry

NEW RECORD: CHR 591796/AK 364951, *H. J. Webb s.n.*, 23 Nov 2007, Rangitikei, Hunterville.

ADDITIONAL RECORD: AK 345687, *P. J. de Lange* 11710, 8 Sep 2013, Auckland, Western Springs, Auckland Zoo.

NOTES: Cultivation Escape. Collected from Hunterville as a “rampant and aggressive ground cover” and from Auckland where it was noted as a persistent patch growing through a basalt stone wall. Presumably it had been planted here at some stage or it had come in with the building materials used to construct the wall.

***Rubus ursinus* Cham. et Schldl.**

boysenberry

NEW RECORD: AK 181947; *D. J. Court s.n.*, 10 Mar 1977, Waikato Region, Matamata, railway embankment.

ADDITIONAL RECORDS: CHR 475299, *C. C. Ogle* 2140, 5 Nov 1991, Whanganui, Mowhanau Stream mouth; CHR 497961, *C. C. Ogle* 2676, 8 Nov 1993, Rangitikei, Ohingaiti, between S.H.1 and railway; AK 303787, *P. J. de Lange* 7546 & *P. B. Cashmore*, 6 Dec 2007, Whirinaki Forest, Waione Frost Flat, Waione Stream; CHR 640037, *C. C. Ogle* 6375, 14 Dec 2015, Volcanic Plateau, Raetihi, Ward Street.

NOTES: Cultivation Escape. It seems likely that plants have arisen from bird-dispersed fruits or fruit discarded



Figure 41. *Malus sieboldii*: (A) sapling growing in the crown of a planted street-verge *Prunus serrulata*, in association with *Cotoneaster glaucophyllus* and *Cordyline australis*, Mt Albert, Auckland, 5 March 2019; (B, C) flowers and fruits of wild shrub, Mt Albert, Auckland (flowers 19 October 2019, fruits 5 March 2019). Photographs © P. J. de Lange.

by humans, as there were no known plantings of *R. ursinus* in most locations.

RUBIACEAE

Alberta magna E.Mey.

NEW RECORD: AK 306645, B. S. Parris 12734, 8 Dec 2005, Bay of Islands, Kerikeri.

NOTES: Cultivation Escape. Occasional seedlings noted growing close to parent tree.

Luculia grandifolia Ghose

NEW RECORD: AK 374690, B. S. Parris 12956, 10 Oct 2018, North Auckland, Bay of Islands, Kerikeri.

NOTES: One plant, established 2 m away from parent plant. Flowers white, strongly fragrant.



Figure 42. *Rosa laevigata*, (A, B) uncontrolled and spreading vines of *Rosa laevigata* alongside Matuku Link Reserve, Bethells Road, West Auckland, covering an area 30 m × 3 m, 29 July 2019. Photographs © Shelley Heiss-Dunlop.

***Oldenlandia corymbosa* L.**

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302090, E. K. Cameron 15014, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-North

Auckland, Kaiwaka, Kauri Park Nurseries.

NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

***Richardia brasiliensis* Gomes**

tropical Mexican clover

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302092, E. K. Cameron 15016, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-North Auckland, Kaiwaka, Kauri Park Nurseries.

NOTES: Spontaneous Occurrence. A nursery weed suspected to have come from contaminated coir peat from Sri Lanka. To date there are no records outside of the nursery trade. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

***Spermacoce assurgens* Ruiz et Pav.**

button weed

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302091, E. K. Cameron 15015, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-North Auckland, Kaiwaka, Kauri Park Nurseries.

NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

RUTACEAE

***Choisya ternata* Kunth**

Mexican orange blossom

NEW RECORD: CHR 565472, *C. C. Ogle 4160*, 4 Sep 2002, Whanganui, Taupō Quay, edge of Trafalgar Square car park.

NOTES: Cultivation Escape. Originally planted as a row of shrubs but now a thicket from suckering. A common shrub in the New Zealand nursery trade and suckers are often found close to planted specimens. Webb et al. (1988) noted that this species persists by suckering.

SAPINDACEAE

***Acer rubrum* L.**

Red maple

NEW RECORD: CHR 637040, *C. R. Higgie & C. C. Ogle 6335* 2 Feb 2015, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES: Cultivation Escape. Locally up to 8 seedlings m⁻² in garden shrubbery and 10 m from a planted tree in nearby pasture.

SAXIFRAGACEAE

***Astilbe rivularis* Buch.-Ham. ex D. Don**

river astilbe

NEW RECORD: AK 317259, *C. C. Ogle 5762, R. C. Ogle & A. Brooker*, 18 Aug 2010, Taranaki, New Plymouth, Carrington Road, between Kaitoke and Pouakai Ranges, close to the Pukeiti Café and Information Centre.

NOTES: Cultivation Escape. Some 20–30 seedlings noted growing on brick walls of raised gardens in the vicinity of planted adult shrubs. This species was brought to Pukeiti Gardens, Taranaki, from a horticultural expedition to Yunnan in China, close to the Burmese border (J. Howard pers. comm.), but its identity remained unknown. On 26 February 2007, Graeme La Cock and CCO collected seedlings on a bank of Carrington Road outside Pukeiti Visitors' Centre, along with material from the planted small tree in the Gardens, and it was sent as fresh material to CHR. Because this material cannot be traced at CHR, a new collection was made from close to the same site, on 18 August 2010 (AK 317259, cited

above). On 17 October 2007, J. Howard (pers. comm. to CCO) took fresh flowering material from his own garden, 'Westoe,' near Marton, Rangitikei to CHR (CHR 505586 A-D/AK 356412), where the species was identified for the first time in New Zealand as *Astilbe rivularis*.

***Bergenia crassifolia* (L.) Fritsch**

Siberian tea

FIRST RECORD: de Lange, P. J., et al., *Checklist of Vascular Plants Recorded from Chatham Islands*. Wellington Hawke's Bay Conservancy, Department of Conservation (2011).

VOUCHER: CHR 594741, *P. B. Heenan s.n. & P. J. de Lange*, 13 Sep 2007, Chatham Islands, Chatham Island, Awatotara Creek, Tuanui house grounds.

NOTES: Cultivation Escape. *Bergenia crassifolia* is the currently accepted name for plants widely cultivated as *B. cordifolia* Sternb.

SCHISANDRACEAE

***Illicium anisatum* L.**

Japanese star anise

NEW RECORD: CHR 614098, *C. C. Ogle 5790 & C. R. Higgie*, 6 November 2010, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES: Cultivation Escape. Seedlings growing in the immediate vicinity of cultivated parent plants.

SCROPHULARIACEAE

***Chaenostoma cordatum* (Thunb.) Benth.**

NEW RECORD: AK 351594, *A. E. Wright 14211*, 22 Feb 2014, Christchurch, Worcester Boulevard, by Avon River bridge.

ADDITIONAL RECORDS: UNITEC 10774, *P. J. de Lange 14394 & T. J. P. de Lange*, 2 Jun 2019, Auckland, North Shore, Glenvar Road; AK 361406, *P. J. de Lange 13159*, 16 Jul 2016, Wairarapa, Masterton, Waltons Ave; AK 355676, *A. E. Wright 14214*, 16 Mar 2014, Christchurch, Worcester Boulevard, by Avon River bridge; AK 355677, *A. E. Wright 14215*, 18 Apr 2014, Christchurch, Worcester Boulevard, by Avon River bridge; CHR 637251, *T. R. Partridge s.n.*, 21 Apr 2015, Christchurch, Worcester Boulevard, by Avon River bridge.

NOTES: Cultivation Escape. In the North Island, plants have been found naturalised in wasteland and along a roadside, places where it is assumed they established from illegally dumped garden waste. In the South Island, between February and April 2015, a small group of plants appeared within part of the former Christchurch Central Business District red (exclusion) zone (designated as a result of 2011 Christchurch Earthquake) until rubble clearance and weed spraying for the opening of the zone eliminated it. *Chaenostoma cordatum* is widely sold in the New Zealand nursery trade under the name *Bacopa* Aubl. cultivar 'Snowflake' and is also known as *Sutera cordata* (Benth.) Kuntze.

***Nemesia foetens* Vent.**

NEW RECORD: AK 291230, B. S. Parris 12593, 1 Sep 2003, North Auckland, Kerikeri.

ADDITIONAL RECORD: AK 307574, P. J. de Lange 8191 & J. R. Rolfe, 23 Oct 2009, North Auckland, Dargaville, Main Street.

NOTES: Cultivation Escape. Seedlings and mature flowering and fruiting plants collected in the vicinity of planted specimens in a garden and a semi-derelict car park.

***Nemesia fruticans* (Thunb.) Benth.**

NEW RECORD: CHR 624895, C. C. Ogle 6095, 15 Jan 2013, Whanganui, 7 Pitt Street.

ADDITIONAL RECORD: WELT SP104056, L. R. Perrie 7178, 15 Feb 2015, Wellington, Roseneath, Thane Road; CHR 654791, C. C. Ogle 6617, 12 Nov 2018, Whanganui, 18 Devon Road, Springvale, Springvale Nursery.

NOTES: Spontaneous Occurrence. Flowering plants have been collected as a weed in a suburban garden where this species had not knowingly been cultivated; also as plants growing in cracks in tar-sealed footpath; and in a plant nursery gravel yard used to store bulk garden supplies.

***Scoparia dulcis* L.**

licorice weed

FIRST RECORD: Anon., *New to New Zealand Weeds – A Guide to Weeds Found in Imported Coir Peat*. Biosecurity New Zealand, Wellington, New Zealand (2008).

VOUCHER: AK 302084, E. K. Cameron 15008, R. O. Gardner & M. N. Lee, 28 Mar 2008, cultivated ex-South Auckland, Waipa, Kihikihi, Growing Spectrum Ltd.

Seedlings also occurred at North Auckland, Kaiwaka, at Kauri Park Nurseries.

NOTES: Spontaneous Occurrence. Plants derive from the importation of coir peat contaminated with weed seeds from Sri Lanka. To date there are no records outside of the nursery industry, where the coir peat is used in potting mixes. James et al. (2012) provide more details on the occurrence of this and other weed species derived from the contaminated coir peat imported to New Zealand.

***Scrophularia grandiflora* DC.**

NEW RECORD: CHR 605945, W. R. Sykes 47/06, 3 Dec 2006, Canterbury, Christchurch, St Albans.

NOTES: Cultivation Escape. Scattered young plants establishing from a nearby cultivated specimen.

***Verbascum chaixii* Vill.**

nettle-leaved mullein

NEW RECORD: AK 330548, E. K. Cameron 16019, Auckland, Manurewa, Hill Road, Auckland Regional Botanic Gardens.

NOTES: Cultivation Escape. Widely naturalised in cottage garden where originally planted.

SOLANACEAE

***Capsicum pubescens* Ruiz et Pav.**

rocoto

NEW RECORD: AK UNITEC 11699, P. J. de Lange 147692 & T.J.P. de Lange, 24 Dec 2019, Auckland, Auckland City, Mt Albert, Unitec Institute of Technology campus.

NOTES: Spontaneous Occurrence. Single plant noted growing in rubble-strewn wasteland. Presumably arose from bird-dispersed seed, as *Capsicum pubescens*, especially the yellow-fruiting cultivar, is now a popular garden plant, widely cultivated in the northern North Island. As *Capsicum pubescens* is more cold-tolerant than many other *Capsicum* chillies grown in New Zealand, and is a prolifically fruiting and selfing species, further naturalisations are considered likely. Indeed, one of us (PdL) had previously observed this species sparingly naturalised in a Whangarei garden in the late 1990s but the specimen on which that observation was based has been misplaced.

***Nierembergia hippomanica* Miers**

cup flower

NEW RECORD: AK 357909, *P. J. de Lange* 12820, 19 Feb 2015, Hawke's Bay, Mahia, Mahia Beach Settlement. NOTES: Cultivation Escape. Scattered plants of a blue-flowered clone noted growing amongst kikuyu grass (*Cenchrus clandestinus*) in modified sand dunes along roadside. Presumably arose from plants grown in nearby residential gardens, though this species was not seen in any gardens bordering the road. Although not widely grown in New Zealand, *Nierembergia hippomanica* is a popular garden plant in some parts of the North Island, so further naturalisations are considered likely.

***Physalis angulata* L.**

cutleaf groundcherry

NEW RECORD: AK 327589, *T. K. James s.n.*, Feb 2009, Hamilton, Ruakura Research Centre. NOTES: Spontaneous Occurrence. Appeared as a contaminant within coir fibre potting mix.

***Solanum insanum* L.**

NEW RECORD: AK 337387, *W. Stahel s.n.*, 5 Feb 2013, Bay of Plenty, Tauranga, 421 Joyce Road, Bloomz Nursery.

ADDITIONAL RECORD: AK 351071, *W. Stahel s.n.*, 9 Apr 2014, Bay of Plenty, Tauranga, 421 Joyce Road, Bloomz Nursery.

NOTES: Spontaneous Occurrence. Plants 'appeared' in nursery amongst planted seedlings. Presumably they arose as a seed contaminant of the potting mix. *Solanum insanum* (believed to be the wild progenitor of eggplant (*S. melongena* L.)) is an aggressive weedy species of tropical regions – it is probably native to East Africa though it now has a distribution from Africa across the Middle East to India and Sri Lanka. The New Zealand collections are probably this species though, in some respects, they fall within *S. melongena*, which is not unexpected as the two species frequently hybridise (*S. Knapp pers. comm.*).

***Solanum maturecalvans* Bitter**

NEW RECORD: CHR 604458, *C. C. Ogle* 5499 & *C. R. Higgin*, 30 Dec 2008, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

NOTES: Cultivation Escape. A suckering shrub forming

a loose patch c. 10 m diameter. Plants noted to be flowering and fruiting but no seedlings found here.

***Solanum wendlandii* Hook.f.**

giant potato creeper

FIRST RECORD: Beadel, S., et al., *Rotorua Botanical Society Special Issue* 2, 80 (2009).

VOUCHER: AK 305951/CHR 553124, *P. J. de Lange* 7952, 21 Dec 2008, Bay of Plenty, Tauranga, Maungatapu, Taipari Street.

NOTES: Garden Discard. The plant was a single vine covering a large area of mixed, mostly indigenous, secondary regrowth in a gully below an urban road. The top of the gully system is frequently used by locals as an illegal garden waste dumping ground so it is assumed that the *Solanum* arose from discarding clippings. *Solanum wendlandii* is an uncommon cultivated plant in New Zealand and does not seem to set fruit, but it grows readily from trimmings and rooted pieces of stem.

THEACEAE

***Camellia reticulata* Lindl.**

NEW RECORD: AK 284000, *B. S. Parris* 12583, 25 May 2003, North Auckland, Bay of Islands, Kerikeri.

ADDITIONAL RECORDS: CHR 626109, *C. C. Ogle* 6143b; CHR 626110, *C. C. Ogle* 6144b, 7 April 2013, Whanganui, Westmere, Bason Botanic Reserve.

NOTES: Cultivation Escape. Seedlings self-established within close proximity to planted and individually labelled *C. reticulata* shrubs. The adjoining planted shrubs were labelled: 'Leonard Messel' (AK 284000), 'Lasca Beauty' (CHR 626109) and 'Dr Clifford Parkes' (CHR 626110).

***Camellia sasanqua* Thunb.**

sasanqua camellia

NEW RECORD: AK 312698, *E. K. Cameron* 15458 & *C. Ashton*, 26 Apr 2010, Auckland City, Auckland Domain.

ADDITIONAL RECORDS: AK 367248, *P. J. de Lange* 13589 & *T. J. de Lange*, 7 Dec 2016, Auckland, Birkenhead, Eskdale Bush Scenic Reserve; CHR 621594, *C. C. Ogle* 6064, 25 June 2012, Manawatu, Feilding, 138 West Street.

NOTES: Cultivation Escape. Locally abundant in Eskdale Bush Scenic Reserve and Auckland Domain. At Eskdale, mature trees, saplings and seedlings are common;

seedlings at Auckland Domain, many still with the seed attached, occur under a 2–4 m planting of *Camellia sasanqua* canopy in bark garden; at Feilding, six seedlings were under putative parent bushes on bare earth beside a driveway.

***Camellia taliensis* (W.W.Sm.) Melch.**

fried egg plant

NEW RECORD: AK 317071, C. C. Ogle 5782b, 5 Sep 2010, Whanganui, Westmere, Bason Botanic Reserve.

NOTES: Cultivation Escape. Noted as seedlings self-established within 1.5 m of planted flowering shrubs. In New Zealand, this species has long been known as *Gordonia yunnanensis* (Hu.) H.L.Li and also as *Polyspora yunnanensis* Hu.

***Polyspora axillaris* (Roxb. ex Ker Gawl.) Sweet ex G. Don**

fried egg plant

NEW RECORD: AK 361403, P. J. de Lange 13156, 23 Jul 2016, Auckland, Mt Albert, Asquith Ave.

NOTES (Figure 43): Cultivation Escape. Scattered saplings growing in wasteland that had formerly supported housing. Mature planted flowering and fruiting trees are present nearby (e.g., P. J. de Lange 13157, AK 361404). This species has long been known in New Zealand as *Gordonia axillaris* (Roxb. ex Ker Gawl.) Endl.

THYMELAEACEAE

***Gnidia squarrosa* (L.) Druce**

yellow daphne

NEW RECORD: CHR 616236, I. Bell & C. C. Ogle 5938, 23 Oct 2011, Whanganui, Bastia Hill, 115 Mount View Road.

NOTES: Cultivation Escape. Seedlings locally common in rock and gravel garden, near planted flowering shrub.

URTICACEAE

***Debregeasia longifolia* (Burm.f.) Wedd.**

orange wild rhea

NEW RECORD: AK 331615/AK 331616/CHR 599118, J. L. Stevenson s.n., 10 Jul 2012, Auckland City, Grafton Mews.

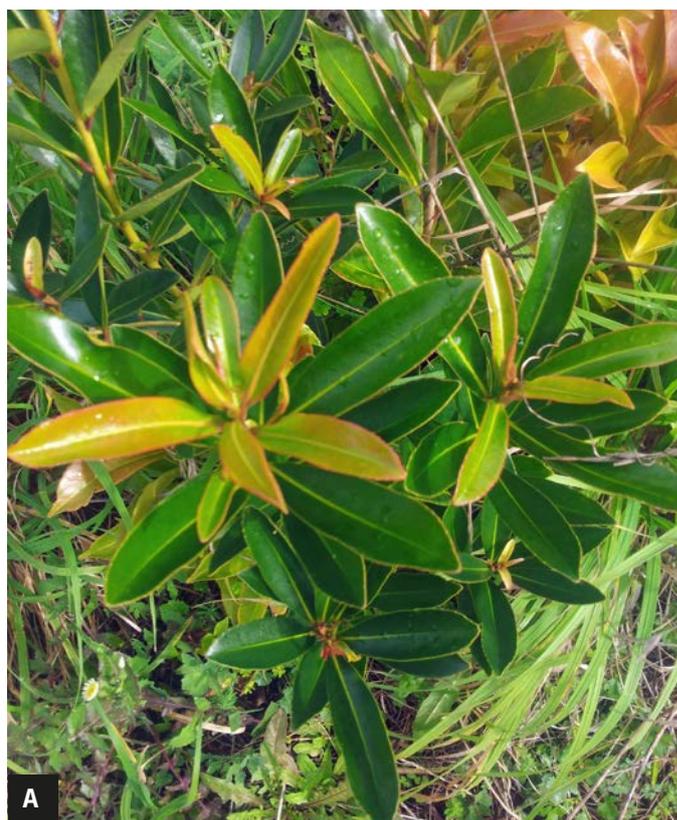


Figure 43. *Polyspora axillaris*, (A) one of several wild shrubs growing in the derelict grounds of a former block of flats (this site has since been destroyed as part of a new housing development), Mt Albert, Auckland, 23 June 2016), and (B) flowers from one of the older established specimens. Photographs © P. J. de Lange.

ADDITIONAL RECORDS: AK 337643, *V. Cox s.n.*, 19 Feb 2013, North Auckland, Kaiwaka, Pebblebrook Road; AK 331836, *E. K. Cameron 16043*, 21 Jul 2012, Auckland City, Auckland Domain; AK 337777, *E. K. Cameron 16100*, 25 Feb 2013, Auckland City, Auckland Domain; AK 378043, *J. O. Warden s.n.*, 7 Aug 2019, North Auckland, Tara, edge of the Hakaru River, Jude Road.

NOTES: Cultivation Escape, Spontaneous Occurrence and Garden Discard. Originally cultivated at Kari Street nursery in Grafton c. 2002, but was removed because it started spreading by seed. The fruit is fleshy and orange and is presumably spread by birds; the tiny seeds readily germinated c. 4 months after sowing (e.g., *E. K. Cameron 16081*, AK 336206). Two of the records were not associated with the nursery: one appeared amongst other plants (Kaiwaka) and the other was associated with a garden waste pile (Tara).

VIOLACEAE

Viola betonicifolia Sm.

NEW RECORD: CHR 591861, *C. C. Ogle 5205, I. Bell & J. Bell*, 29 March 2007, Whanganui, Bastia Hill, 115 Mount View Road.

ADDITIONAL RECORD: AK 379870, *D. L. Welsh s.n.*, 4 Jun 2020, North Auckland, Whangarei Harbour, Headland's Farm Park, Manganese Point Road.

NOTES: Cultivation Escape. In Whanganui, growing occasionally and spontaneously from seed in pots of bulbs laid out in garden; also established in adjoining mown lawns – present here “for decades” (I. Bell pers. comm.) and it has not been possible to eradicate it. In Whangarei, scattered clumps thrive in shade, growing up through groundcover; possibly came in with new topsoil.

ERRATUM

APIACEAE

Anethum graveolens L.

dill

This sporadically occurring cultivation escape was accidentally listed by Heenan et al. (2002) using the name *Anthemis graveolens* L. *Anthemis graveolens* Schur. (Asteraceae) is not to our knowledge present in New Zealand. What was intended was the first notification of *Anethum graveolens* then noted as starting to naturalise in New Zealand. Although *Anethum* has since been collected in a number of sites throughout the country, it remains uncommon, with virtually all occurrences recorded to date deriving from the limited spread of plants in the vicinity of places where it is in cultivation.

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Table 1. *Cotoneaster* taxa newly recorded as Fully Naturalised or Casual in New Zealand by Glenný (2014).

ζ (zeta) indicates species in Webb et al. (1988) that were known from just one or very few collections and which did not appear to be naturalised

N indicates name change only (not a new taxon)

<i>Cotoneaster</i> Medik species (Glenný 2014)	Fully naturalised	Casual	Name in Webb et al. (1988)
<i>C. bullatus</i> Bois	×		ζ
<i>C. coriaceus</i> Franch. N	×		<i>C. lacteus</i>
<i>C. dammeri</i> C.K.Schneid.		×	
<i>C. divaricatus</i> Rehd. & E.H. Wilson		×	
<i>C. franchetii</i> Bois var. <i>franchetii</i> N	×		<i>C. franchetii</i>
<i>C. frigidus</i> Wall. ex Lindl.	×		
<i>C. hebephyllus</i> Diels		×	
<i>C. horizontalis</i> Decne.	×		
<i>C. integrifolius</i> (Roxb.) G.Klotz	×		
<i>C. marquandii</i> G.Klotz		×	
<i>C. microphyllus</i> Wall. ex Lindl. var. <i>microphyllus</i> N	×		<i>C. microphyllus</i>
<i>C. pannosus</i> Franch.	×		ζ
<i>C. perpusillus</i> (C.K.Schneid.) Flinck & Hylmö.	×		
<i>C. x</i> suecicus G.Klotz, Beitr.		×	
<i>C. x</i> watereri Exell	×		

Table 2. Name changes for *Salix* taxa recorded as Fully Naturalised or Casual in New Zealand by Glenny & Jones (2019) and one new Casual record.

<i>Salix</i> L. taxa (Glenny & Jones 2019)	Fully naturalised	Casual	Name in Webb et al. (1988)
<i>Salix acutifolia</i> Willd.	×		<i>Salix daphnoides</i> subsp. <i>acutifolia</i> (Willd.) Blytt & O.C.Dahl
<i>Salix alba</i> L.	×		<i>Salix alba</i> L. var. <i>alba</i> ; <i>Salix alba</i> var. <i>vitellina</i> (L.) Stokes
<i>Salix atrocinerea</i> Brot.	×		<i>Salix cinerea</i> subsp. <i>oleifolia</i> (Sm.) Macreight
<i>Salix</i> × <i>fragilis</i> L. (<i>S. alba</i> L. × <i>S. euxina</i> I.V.Belyaeva)	×		<i>Salix fragilis</i> L.; <i>Salix</i> × <i>rubens</i> Schrank
<i>Salix myricoides</i> Muhl.	×		<i>Salix glaucophylloides</i> Fernald
<i>Salix</i> × <i>pendulina</i> f. <i>salamonii</i> (Carrière) I.V.Belyaeva (<i>S. babylonica</i> L. × <i>S. fragilis</i> f. <i>vitellina</i> (L.) I.V.Belyaeva)	×		<i>Salix alba</i> var. <i>vitellina</i> (L.) Stokes; <i>Salix</i> × <i>chrysocoma</i> Dode
<i>Salix pentandra</i> L.		×	
<i>Salix</i> × <i>smithiana</i> Willd. (<i>S. cinerea</i> L. × <i>S. viminalis</i> L.) (= <i>S. xsericans</i> Tausch. ex Kern.)		×	

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Author Instructions

Scope

Perspectives in Biosecurity is a multi-disciplinary electronic journal of research papers, and other outputs, covering all aspects of the field of biosecurity, including, but not restricted to: invasion biology and ecology, invasive species identification/diagnostics, management and eradication/control, new invasive species records, modelling, biosecurity law and policy, relationships between human society and invasive species.

The journal primarily publishes:

- Research papers of 5,000 words
- Short notes of 1,000 to 3,000 words
- Reviews of 5,000 to 10,000 words

Due to the multi-disciplinary nature of biosecurity, other output types including creative and multimedia ones will be considered at the discretion of the editors.

All papers and other outputs are subject to anonymous double blind peer review prior to acceptance and publication. Accepted manuscripts requiring revision must be returned within two months of the date of the request for revision. Manuscripts received after this date will be considered as new submissions. Papers are published online after acceptance and all corrections have been made.

Manuscript submission

Manuscripts should be submitted as Microsoft Word documents to epress@unitec.ac.nz with *Perspectives in Biosecurity* in the subject field. All documents must be:

- In English
- Double-spaced
- Pages and lines numbered continuously

Please confirm in your submission that:

- All authors have approved the submission
- All relevant animal welfare and conservation permissions have been obtained (i.e. animal ethics approvals and collecting/research permits)
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- Contact ePress at epress@unitec.ac.nz if you wish to submit files that cannot be emailed due to size.

Style of papers

Papers must use SI units, UK English and the appropriate macrons in Māori (please visit <http://www.maoridictionary.co.nz/> for guidance on using macrons in Māori words). Correct taxonomic nomenclature must also be used.

Research papers and short notes are to include the following elements:

Title: Informative and concise description of the content of the paper.

Authors: Include the names of all authors who have had a significant role in the research. Include the addresses of all authors and the email address of the corresponding author/s.

Abstract: A summary of the main findings of the paper (up to 300 words).

Key words: Up to ten key words.

Text: The main headings will normally be: Introduction, Materials and Methods, Results, and Discussion. It is permitted to have a combined Results and Discussion section.

Acknowledgements: Acknowledge all those who provided significant assistance to the research, sources of funding, details of Animal Ethics approvals, permit numbers and landowner approvals for research and/or specimen collection.

References: Use the Harvard *Name-Year* system. It is the authors' responsibility to maintain accurate and up to date referencing and citations. Contact ePress if you require further instruction.

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Figures: These can be photographs, line drawings, maps or graphs, and must be submitted initially on separate pages, and numbered to follow their order they appear in the text. Figures must be clear and easy to interpret. Colour figures are acceptable as this is an online publication. Figure legends should be presented after the references in the initial submission. Reviews and other output types will follow some of the above conventions, but due to their nature there will be some differences.

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Once you have submitted your work following the submission guidelines detailed above, you will be sent an email of receipt. Your work will then be viewed by the editorial team and you can expect to have a response within two to four working weeks. If the editorial team has decided to steer your work towards publication, it will undergo the double blind review process, this can take up to three months. Reviewer feedback will be collated and sent to you.

Acceptance

Authors will be asked to email the revised manuscript (including any responses to referee comments) as a Microsoft Word document within two months of receiving an acceptance email. All figures must be supplied electronically as separate .jpg files, as large as possible. Page proofs will be sent by email to authors for approval and papers will appear online as they are approved.