PERSPECTIVES IN

Biosecurity

VOLUME 4/2019

ISSN 2538-0125

ePress

Unitec Institute of Technology
TE WHARE WĀNANGA O WAIRAKA

PERSPECTIVES IN BIOSECURITY **VOLUME 4/2019**

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Founded at Unitec Institute of Technology in 2017.

Cover image: Painted lady (*Gladiolus carneus*), a native to southern Africa, growing on the Castlecliff dunes, Whanganui.
Photograph by Colin Ogle.

An ePress publication
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ISSN 2538-0125

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EDITORIAL

It is not often authors get the opportunity to report on the detection, identification and management (and potentially the eradication) of a probable invasive species all in the same paper. In their paper in this issue of *Perspectives in Biosecurity*, Peter de Lange et al do just this, documenting the chance discovery in Auckland of the yellow Himalayan raspberry (*Rubus ellipticus*), one of the world's most invasive plant species. The origin of this plant is unknown but it has almost certainly arrived in New Zealand through a human-mediated pathway.

The origin of naturalised alien plant species across the globe is dominated by garden escapees (Hulme et al., 2018), and given that a significant part of the lucrative ornamental nursery industry is built on trade in alien plant species, their hybrids, cultivars and varieties (Drew, Anderson, & Andow, 2010), this naturalisation of alien plant species is likely to continue. New Zealand mirrors this global pattern, with most naturalised plant species originating from deliberately introduced ornamental garden plants (Esler, 1988). There is evidence that this process of naturalisation is still continuing (Sullivan et al., 2005), thus it is not surprising that, in New Zealand, urban, agricultural and other inhabited areas tend to have a higher concentration of exotic plant species than do more distant natural vegetation areas (Sullivan, Timmins, & Williams, 2005).

New Zealand now has more naturalised vascular plant species than native (Heenan et al., 2002; Howell & Sawyer, 2006). Private and public gardens are the epicentres for new plant invasions, and the highly disturbed nature of urban areas, as well as transit corridors such as railways and roads, enable newly established species to expand their ranges rapidly. In our other paper in this issue of *Perspectives in Biosecurity*, Colin Ogle and Graeme La Cock document monocotyledonous exotic plants in the process of naturalisation, ranging from casual occurances to fully naturalised species, in the Manawatu Ecological District. Their study is indicative of the wider New Zealand situation with respect to alien plants.

To manage the threat of invasive plant species, it is essential to have a comprehensive system of surveillance. This includes regular searches for newly arrived species, as well as monitoring plant species that are already resident for indications they may be naturalising. While the decline of botany teaching at tertiary level and an ageing workforce are barriers to this (Woodland, 2007; Drea, 2011; Kramer & Havens, 2015), the use of tools such as iNaturalist (www.inaturalist.org) to record sightings of potential new or spreading species can provide access to experts for field workers.

The two papers in this issue represent examples of successful surveillance, but also highlight the need for trained botanists active in the field to maintain current knowledge of naturalised plants in New Zealand.

Dan Blanchon and Mel Galbraith
Editors

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PERSPECTIVES IN
Biosecurity
VOLUME 4/2019

Additional records and observations of monocotyledons naturalised or casual in Manawatu Ecological Region, New Zealand, 1980–2019.

Colin C. Ogle and Graeme D. La Cock

Key words: Foxton Ecological District; Manawatu Plains Ecological District; Pātea; Whanganui; Hāwera; Koitiata; Castlecliff; *Bomarea multiflora*; *Carex pendula*; *Freesia laxa*; *Gladiolus carneus*; *Phragmites karka*; Adventive monocotyledon; Naturalised plant; Casual plant; weed.

This publication may be cited as: Ogle, C.C., La Cock, G.D. (2019). Additional records and observations of monocotyledons naturalised or casual in Manawatu Ecological Region, New Zealand, 1980–2019, *Perspectives in Biosecurity, 4*, 6–32.

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ISSN 2538-0125

Additional records and observations of monocotyledons naturalised or casual in Manawatu Ecological Region, New Zealand, 1980-2019.

Colin C. Ogle and Graeme D. La Cock

Abstract

It has been 38 years since a comprehensive account of adventive monocotyledons in New Zealand was published, other than for grasses. This paper examines new adventive monocotyledon records from the Manawatu Ecological Region (MER), in the south-west of the North Island. Evidence is given for accepting five taxa as Naturalised and 64 as Casual. Of the Casual records, 36 are recorded in MER as New records for New Zealand. Three of the Naturalised taxa and 13 New Casual plant records are from the sand-country portion of MER, namely Foxton Ecological District (FED). Ten of the New Casual taxa have established from garden discards or plantings in dunes, two are recent garden escapes. Twenty-three New Casual plant records are from the marine terrace portion of MER (Manawatu Plains Ecological District, MPED), most being cultivation escapes within gardens. Several of these Casual taxa are sufficiently well established, in one or more sites, that it is likely they will naturalise in the future.

In addition to New records, we include 33 Casual occurrences of monocotyledon taxa in MER, taxa which have been collected elsewhere in New Zealand, some of which have been published in reports or newsletters in the past.

Introduction

There are approximately 25,000 exotic plant species in New Zealand (Duncan & Williams, 2002), of which around 2500 are adventive (Howell & Sawyer, 2006). Adventive dicotyledons, gymnosperms and pteridophytes have been listed and described (Webb, Sykes, & Garnock-Jones, 1988) and additions have been listed in six subsequent papers in the *New Zealand Journal of Botany*, most recently in Heenan, de Lange, Cameron and Parris (2008). However, it has been 38 years since a comprehensive account of adventive monocotyledons in New Zealand was published (Healy & Edgar, 1980), other than for grasses (Edgar & Connor, 2000; 2010).

A reappraisal of the entire adventive monocotyledon flora for the whole of New Zealand would be a large task; this paper examines new records from one geographic part of New Zealand, the Manawatu Ecological Region (MER) (Simpson, 1982; McEwen, 1987) in the south-west of the North Island. It lists taxa which were either not included by Healy and Edgar (1980) or Edgar and Connor (2010), or mentioned by them as minor entries (sometimes known as zeta [ζ] entries), representing failed or minor naturalisations.

Background

Manawatu Ecological Region (MER) lies in the south-west of the North Island (Figure 1) (Simpson, 1982; McEwen, 1987). It comprises two Ecological Districts (EDs), namely 31.02 – Foxton Ecological District (FED), characterised by sand dunes and associated dune features such as lakes, wetlands and estuaries (Ravine, 1992) and, inland of the sand country, 31.01 – Manawatu Plains Ecological District (MPED), which is defined by its uplifted marine terraces (Ravine, 1995).[1] Indigenous vegetation now comprises only a small proportion of MER: <5% for FED (Ravine, 1992), and around 2% for MPED (Ravine, 1995). Pastoral farming is the predominant land use, with some exotic forestry (mostly *Pinus radiata*), cropping, horticulture and urban development. There are numerous urban areas, the largest being Palmerston North (population 83,500) which is inland on the Manawatu River and lying on MPED, and Whanganui (population 43,800) which straddles MPED and FED, reaching the coast at the mouth of the Whanganui River. Many towns and villages are situated on the coastal dunes, ranging from Pātea in the north to Paekakariki in the south. Other towns occupy the marine terraces, mostly along the routes of State Highways 1 and 3.

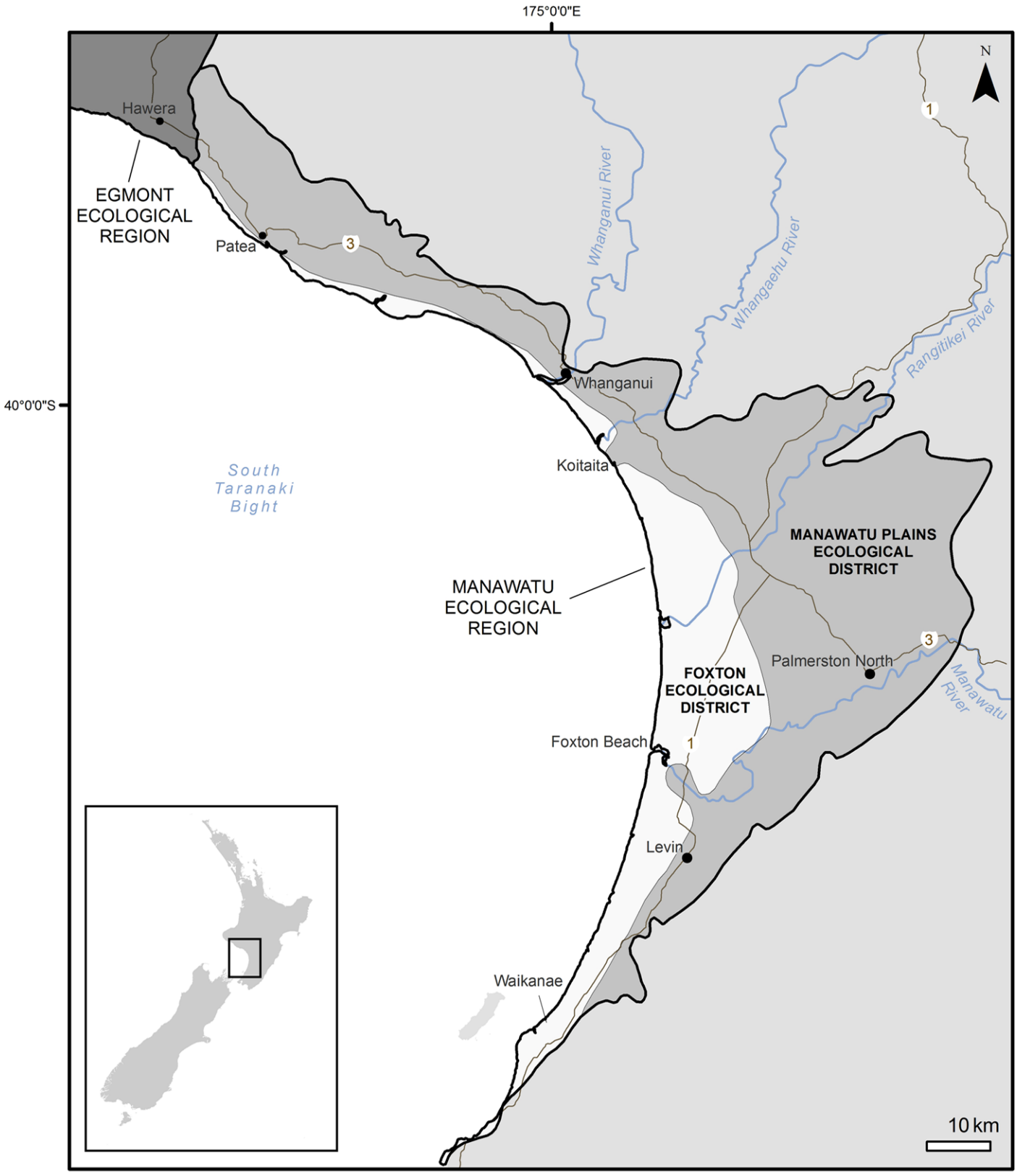

Figure 1. Manawatu Ecological Region on the west coast of the North Island, New Zealand.

Much of MER lay in what was the Wanganui Conservancy of the New Zealand Department of Conservation between 1987 and 2011, along with all or parts of the following Ecological Regions (ERs) which lie outside MER: Egmont, Taranaki, Rangitīkei and Moawhango (Department of Conservation, 1997). For much of this time, both authors of this paper were resident in Whanganui, and listed and collected plant specimens, especially adventive species, for herbaria. In the course of other work, we visited all these ERs

regularly, but because most of the adventive plant species were found in MER, our focus is on this ER for this paper. Three records from Hāwera, < 10 km west of MPED, are included in this report and, when we examine totals of species, are included with the topographically similar MPED.

Methods

The paper lists taxa recorded in MER which were either not mentioned by Healy and Edgar (1980) or Edgar and Connor (2010), or were mentioned by them as ζ entries.

Our checklist was compiled primarily from our opportunistic surveys covering the period 1988–2019, during which we collected vascular plant specimens for New Zealand herbaria, most going to CHR (herbarium codes are listed by Thiers, 2018). Most were pressed before posting, but some succulents, bulbous and cormous plants, and some flowers, were sent fresh for identification. A few of our collections were sent to AK, WELT and NZFRI.

The lists which follow are arranged alphabetically, firstly by families then by genera within each family. Families follow the recommendations of the Angiosperm Phylogeny Group (APG II, 2003; APG III, 2009; APG IV, 2016). The list was supplemented by herbarium records made by other collectors. We include a published record of the grass *Agrostis nebulosa*, collected in 1961 (AK 216331), but not mentioned by Edgar and Connor (2010). A compilation of past records of adventive plants (Enright, Ogle, & Sawyer, 2003) was searched for records in MER south of the Manawatu River.

Each taxon is listed as a New Record where it appears that MER is the location of the first collection in New Zealand. Where the earliest known record is outside of MER, it is specified as a First Record and MER records are specified as Additional Records. Doubts had been expressed by some ecologists about the abundance or range of a small number of adventive monocotyledon species throughout New Zealand. For those species, we list as Additional Records all the known, discrete collections of naturalised plants. Generally, however, for most Casual species, records from outside MER are not listed in this paper, unless they are First Records for New Zealand. Publishing every record for every Casual species appears to us to be unnecessary. Except for *Carex pendula*, all Healy and Edgar (1980), and Edgar and Connor (2010) references in this listing refer to taxa treated by those authors as ζ records.

We followed the usage of earlier papers on adventive dicotyledons, conifers and pteridophytes in New Zealand (most recently, Heenan, de Lange, Cameron, & Parris, 2008), who stated that their listing process was 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). That included the two major categories of Naturalised and Casual:

- **Naturalised** – populations are self-maintained by seed or vegetative reproduction, or they occur repeatedly in natural or semi-natural habitats or in urban environments.
- **Casual** – taxa that have become established in the urban environment from garden plants and typically include, for example, plants that are considered garden escapes and garden discards.

Following the concepts advocated by de Lange et al. (2005) and adapted by Heenan et al. (2008), we applied to the Casual category four subcategories, as follows, with examples from MER:

- **Cultivation Escape** – plants that have established themselves and are regenerating only in the immediate vicinity of the cultivated parent plant (e.g., *Iris innominata*).
- **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 naturalised (e.g., *Sparaxis grandiflora*).
- **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., *Iris unguicularis*).
- **Intentional Release** – species that have been intentionally planted or had seed sown with the purpose of their becoming naturalised species (e.g., *Watsonia aletroides*).

Taxa are listed only where it is evident that plantings have then resulted in natural recruitment.

Naturalised taxa are listed first, followed by Casual taxa. For Naturalised species in MER, all additional records, mostly from AK and CHR, are listed for all of New Zealand. Barring *Carex pendula*, none had appeared in the *Flora of New Zealand* (Healy & Edgar, 1980; Edgar & Connor, 2010) as fully documented species although

some had appeared as minor (sometimes known as zeta [ζ]) entries. Casual taxa are listed in two groups, viz. New and First Records for New Zealand:

- **New Records** – taxa not previously recorded in MER, and for which there are no known earlier herbarium collections from beyond MER, and the record has not been published.
- **First Records** – taxa not previously recorded in MER, but for which there are known earlier herbarium collections from beyond MER or the record has been published, such as ζ entries in the *Flora of New Zealand* (Healy & Edgar, 1980; Edgar & Connor, 2010). These records are listed chronologically by date of collection for each taxon.

The New Zealand Plant Conservation Network (NZPCN) has brief descriptions of all the species in this paper. It also has photographs of most of them, some from the actual plants represented by cited herbarium specimens.

FULLY NATURALISED RECORDS FOR NEW ZEALAND

ALSTROEMERIACEAE

***Bomarea multiflora* (L.f.) Mirb.**
Figures 2A, 2B, 2C.

FIRST RECORD: Healy & Edgar (1980).
VOUCHER: AK 105812, *W. F. Metcalf s.n.*, 19 Nov 1964, South Auckland, Waikato, Onewhero.
SELECTED ADDITIONAL RECORDS: CHR 75042, *L. P. Coleman s.n.*, 16 Jan 1951, Manawatu, Palmerston North; CHR 473942, *C. C. Ogle 2105*, 24 Mar 1991, Rangitīkei, Marton, Jefferson Line, Greystoke Scenic Reserve; CHR 498007, *D. Ravine, (C. C. Ogle 2693)*, Dec 1993, Palmerston North, Colyton, Pollock Road; CHR 572433, *N. Gallagher s.n.*, 9 Nov 2005, Manawatu, Taonui Road; CHR 591750, *G. D. La Cock s.n., A. Hawcroft & C. C. Ogle*, 3 Apr 2007, Rangitīkei, Hunterville, Rangatira Road; WELT SP091334 (dup. AK 353311), *P. Brownsey s.n., L. Perrie*, 26 Nov 2011, Rangitīkei, Hunterville, Rangatira Road.
NOTES: Cultivation Escape. The first known collection is CHR 75042, *L. P. Coleman*, 16 Jan 1951, where it is stated to be 'wild in garden'. This is earlier than the record cited by Healy and Edgar (1980), where they record it as a 'garden escape'.

Figure 2. Naturalised *Bomarea multiflora*. **A.** scrambling in hedgerow and planted trees beside Rangatira Road, near Hunterville, Rangitikei, on 3 April 2007. Flowers (**B**) and fruit (**C**). Photos © Colin Ogle

There are some 24 discrete collections of *Bomarea multiflora* from the wild in CHR, almost all collected since 1980. Some were named as *B. caldasii*, but the CHR database states that *Bomarea caldasii* (Kunth) Herb. (1837) is a synonym for *Bomarea multiflora* (L.f.) Mirb. (1804). The majority come from Manawatu-Rangitīkei, Banks Peninsula and Otago Peninsula, where collectors have usually commented that the species was well established. We rate this species as Naturalised because it has greatly increased its range and abundance in the past three decades. In 2008, it was added by the New Zealand Ministry for Primary Industries to the national list of Unwanted Organisms.

CYPERACEAE

***Carex pendula* Huds.**
drooping sedge, Otahuna sedge, Figures 3A, 3B.

FIRST RECORD: Healy & Edgar (1980).
VOUCHER: CHR 143709, *A. J. Healy s.n.*, 7 Feb 1962, Canterbury, Tai Tapu, 'Otahuna'.
SELECTED ADDITIONAL RECORDS: WELT 70423, *A. J. Healy s.n., I. R. Fryer*, 26 Feb 1963, Canterbury, near Tai Tapu, 'Otahuna'; CHR 497495, *H. D. Wilson BP224*, 10 Jan 1984, Banks Peninsula, 'Otahuna', near Tai Tapu; CHR 501044, *C. D. Meurk s.n.*, 28 Nov 1994, Christchurch, Heathcote River, Thorrington; CHR 515452, *C. D. Meurk GM 71/1*, 12 Nov 1997, Christchurch, Heathcote River, Thorrington; AK 236555, *T. Hatch, s.n.*, 29 Oct 1998, South Auckland, Pukekohe, Runciman Road, Joy Plants Perennial Nursery; AK 288301, *P. J. de Lange 6233 & T. de Lange*, 29 Sep 2004, Auckland City, Western Springs, bottom of Bullock Trail; CHR 580861, *C. C. Ogle 4938 & F. McGowan*, 10 Dec 2005, Whanganui, Westmere, SH3, 'Ngarakau' plant nursery; CHR 580860, *C. C. Ogle 4937*, 12 Dec 2005, Palmerston North, Centennial Lagoon, below 'Caccia Birch' house; CHR 591735, *C. C. Ogle 5185*, 26 Feb 2007, Taranaki, New Plymouth, Carrington Rd, Pukeiti Rhododendron Trust; CHR 592340, *C. C. Ogle 5325*, 26 Sept 2007, Taranaki, New Plymouth, Carrington Rd, Pukeiti Rhododendron Trust; CHR 603247, *G. Bradfield s.n.*, 13 Jan 2009, Christchurch, Fendalton, Waimari Stream, by bridge next to Bowling Club; CHR 630182, *M. von Tippelskirch s.n.*, 1 Feb 2013, Lincoln University, corner of Ellesmere Junction Road and Weedons Road, Lincoln; CHR 641884, *L. Huggins, s.n.*, 17 Jan 2017, Stewart Island, DOC Visitor Centre; CHR 654797, *A. Brown s.n.*, 30 Nov 2018, Southland, Gore, Pukerau, 48 Pukerau Street, Pukerau Nursery.
NOTES: Cultivation Escape. This robust clumping sedge was first recognised in New Zealand in 1962 in Canterbury near Tai Tapu, south of Christchurch and east of Lincoln. Subsequent herbarium specimens were all from this general area of Canterbury until 1998, when

Figure 3. A. Fruiting naturalised plant of *Carex pendula*, Ashgrove Terrace beside Heathcote River, Cashmere, Christchurch, 28 April 2019. **B.** Fruiting heads of a naturalised plant of *Carex pendula*, Ernle Clark Reserve, Heathcote River, Cashmere, Christchurch, 28 Dec 2017. Photos © Jon Sullivan

specimens were first collected from the Auckland area. We have collected it from three sites in MER and the adjoining Egmont Ecological Region in the period 2005-2007. Herbarium specimens of adventive plants have now come from at least nine discrete sites nationally, but there are more shown in iNaturalist (https://inaturalist.nz/taxa/49365-Carex-pendula), especially in Canterbury.

Carex pendula was included as an adventive species by Healy and Edgar (1980) and not as a ζ record, despite there being just one record (CHR 143709) known to the authors. We have included the species in this paper to recognise its increase in abundance and range since that publication, and to rate it as Naturalised rather than Casual.

Several herbarium collections have come from plant nurseries, including AK 236555, CHR 580861 and CHR 654797; two others (CHR 641884 and CHR 591735) are from gardens where they may have been planted. Therefore, it appears that at least some of the spread of *Carex pendula* was from commercial growers who, perhaps unwittingly, supplied it for wetland restoration projects as well as gardens. It was noted by de Lange et al. (2005, p. 146 that it is "frequently sold by garden centres in the Auckland region (sometimes erroneously as *C. geminata* Schkuhr), and is widely planted, often in the belief that it is indigenous". In 2012, it was added by the New Zealand Ministry for Primary Industries to the national list of Unwanted Organisms.

IRIDACEAE

***Freesia laxa* (Thunb.) Goldblatt & J.C.Manning**
red freesia, false freesia, Figure 4.

FIRST RECORD: Healy & Edgar (1980).
VOUCHER: AK 138550, *E. G. Turbott s.n.*, 17 Nov 1975, Auckland, Parnell, Cathedral Place (as *Lapeirousia laxa*).
SELECTED ADDITIONAL RECORDS AK 138550, *E. G. Turbott s.n.*, 17 Nov 1975, Auckland, Parnell, Cathedral Place (cited in Healey & Edgar, [1980] as a ζ record); AK 138551, *J. H. Goulding s.n.*, 18 Nov 1975, Auckland, Remuera; AK 152036, *J. H. Goulding s.n.*, 7 Oct 1980, North Auckland, Whangaparaoa Peninsula, Tindalls Bay, foreshore reserve; AK 305651, *E. Cameron s.n.*, 17 Nov 1982, Auckland, Auckland University grounds; AK 168444, *R. O. Gardner s.n.*, 13 Sep 1984, Auckland, Herne Bay, 74 Sarsfield Street; AK 188917, *M. M. Saies s.n.*, 17 Dec 1989, North Auckland, Kaipara, Arapaoa;

Figure 4. Flowers of naturalised *Freesia laxa*; Upper Oakley Creek, Tāmaki, Owairaka, Auckland, 21 Oct 2006. Photo © Peter de Lange

CHR 480263, *W. R. Sykes 346/92*, 30 Nov 1992, North Auckland, Kawau Island, above Mansion House Bay; AK 215371, *E. Cameron s.n.*, 9 Nov 1993, Auckland, Rangitoto Island, west of Rangitoto Wharf near start of Kowhai Track; AK 221450, *E. G. Turbott, s.n.*, 16 Jan 1995, Auckland, Parnell, Ayr Reserve by Cathedral Place; CHR 529863, *W. R. Sykes 434/97*, 5 Dec 1997, North Auckland, Warkworth, Hamilton Road; AK 250167, *E. Cameron s.n.*, 1 Oct 1999, Bay of Plenty, eastern Whanarua Bay; AK 307034, *J. E. Crawford s.n.*, 2006, North Auckland, Hokianga, Horeke Road, 500m north of Giles Road; AK 301117, *E. Cameron s.n.*, 18 Nov 2007, Auckland, Waitakere, just south of French Bay, 31 The Parade; AK 306449, *M. Young s.n.*, 3 Dec 2007 North Auckland, Scandrett Regional Park, Kawau Bay; CHR 568485, *C. C. Ogle 4439 & J. Howard*, 29 Nov 2003, Rangitīkei, Kākāriki Road, 'Westoe'; AK 290264, *J. Boow s.n.*, 10 Jan 2005, North Auckland, Mahurangi, Scandrett Regional Park, north end Martins Bay; AK 297919, *P. J. de Lange 6788, T. de Lange & F. de Lange*, 21 Oct 2006, Auckland, Tāmaki, Owairaka, Oakley Creek; AK 340067, *R. O. Gardner s.n.* 22 Oct 2008, Auckland, Manukau Harbour, Mangere, Favona; AK 348968, *M. Wilcox s.n.*, 11 Oct 2013, Northland, Ahipara, dunes north of Kaka Street; AK 363325, *N. Goldwater s.n.*, 29 Nov 2016, Waiheke Island, Matiaia, Atawhai Reserve.

Figure 5. *Gladiolus carneus*. **A. & B.** Flowers of a cultivated plant, 21 Oct 2007, grown from corms of wild plants in dunes at Castlecliff Beach, Whanganui. Photos © Colin Ogle

NOTES: Cultivation Escape and possible Garden Discard, in open forest, grassland and waste areas. The species was accepted as a ζ entry by Healy and Edgar (1980). Also known as *Anomatheca laxa* (Thunb.) Goldblatt. There have been numerous collections of *F. laxa* since Edgar and Healy (1980), from sites where it is stated to be self-established or spreading, some not near planted specimens. It can multiply and reach new sites by seed and corms and we therefore regard *F. laxa* as Naturalised.

***Gladiolus carneus* F.Delaroche**
painted lady, Figures 5A, 5B.

FIRST RECORD: CHR 252697, *L. Esler s.n.*, 20 Oct 1973, Auckland, Glen Eden, Waikumete Cemetery.
SELECTED ADDITIONAL RECORDS: AK 176511, *J. Mackinder s.n.*, 27 Oct 1985, Auckland, Manukau Harbour, Cornwallis Road; AK 176485 (also CHR 436754), *A. E. Esler s.n.*, 27 Oct 1986, Auckland, Glen Eden, Waikumete Cemetery; AK 189969, 189972-73, *A. E. Wright s.n.*, 23 Oct 1989, Auckland City, Greenlane rail line; CHR 518722, *C. C. Ogle 3443*, *I. Bell*, *J. Bell & R. C. Ogle*, 31 Oct 1998, Whanganui, Castlecliff Beach; CHR 570822, *C. C. Ogle 4384*, 23 Oct 2003, Whanganui, Whanganui airport road; CHR 586854, *C. C. Ogle 5104*, 31 Oct 2006, Whanganui, Castlecliff Beach; AK 300960, *P. J. de Lange 7040, J. R. Rolfe & R. O. Gardner*, 22 Oct 2007, Auckland, near Laingholm, Little Muddy (Tangiwai Stream) Creek, near car park; AK 304850, *M. Wilcox s.n.*, 27 Oct 2008, Waiheke Island, Waikopua Bay, Esplanade Reserve; AK 348981, *M. Wilcox s.n.*, 11 Oct 2013, Northland, Ahipara, dunes north of Kaka St; AK 348915, *M. Wilcox s.n.*, 13 Oct 2013, Northland, Lake Ohia, road beside Rangiputa Station off Inland Road; CHR 637037, *C. C. Ogle 6332 & R. C. Ogle*, 9 Nov 2014, Rangitīkei, Turakina, Koitiata Beach.

NOTES: Cultivation Escape and Garden Discard. Some colonies may have started from deliberately planted corms in unmanaged sites, especially dunes. Because *G. carneus* is well established in more than ten discrete sites, some as large populations, and it can be spread, e.g., by corms in garden soil or by machinery in road works, or by seed, we regard this species as Naturalised.

Figure 6. A. Dense stand of *Phragmites karka*; Tahapa East Reserve, Meadowbank, Auckland, 21 June 2011. **B.** Florets of *Phragmites karka*; Tahapa East Reserve, Meadowbank, Auckland, 21 June 2011. Photos © Michael Wilcox

POACEAE

***Phragmites karka* (Retz.) Trin. ex Steud.**
Figures 6A, 6B.

FIRST RECORD: Wilcox (2011).
VOUCHERS: AK 325496-97, AK 325734, *M. D. Wilcox s.n.*, 2 Jun 2011, Tahapa East Reserve, Meadowbank, Auckland.
SELECTED ADDITIONAL RECORDS: CHR 585551, *C. C. Ogle 4996*, 25 May 2006, Rangitīkei, Rangitīkei River estuary, Tangimoana; CHR 586735, *P. D. Champion s.n.*, 5 Sep 2006, Rangitīkei, Rangitīkei River floodplain in pasture, Tangimoana; CHR 586736, *P. D. Champion s.n.*, 5 Sep 2006, Rangitīkei, Rangitīkei River near Flock House, Bulls; CHR 621647, *D. Glenny 11501*, 28 July 2012, Auckland, Meadowbank, Tahapa Crescent; AK 359163, *D. Austin s.n.*, 12 Oct 2015, Auckland, Manurewa, Coxhead Road.
NOTES: Intentional Release, Cultivation Escape. It is presumed that this large rhizomatous grass was planted originally for estuarine reclamation or stock fodder, from which sites it has spread, sometimes extensively. The first time *P. karka* was recognised in New Zealand was from the collection made at the Rangitīkei River estuary in May 2006 (CHR 585551). In September 2006, Paul Champion showed that it was distributed along 7 km of the lower reaches of the same river (Champion, 2006). It covered an estimated 120 m^2 at Meadowbank in Auckland (Wilcox, 2011), from where several more collections in AK have been made since then, and 200 m^2 at Manurewa in 2015. It closely resembles *P. australis*, in which some authorities include it (Lansdown, 2013), and it has been confused sometimes with giant reed, *Arundo donax* (Champion, 2006). Characters by which to distinguish it from *A. donax* and *P. australis* are discussed and illustrated by Wilcox (2011).

After its recognition in 2006 in the Rangitikei River, *P. karka* was found to be well established at Meadowbank in Auckland (Wilcox 2011), and at Manurewa. Although established at relatively few sites, the large extent of *P. karka* at these sites causes us to recognise it as Naturalised. There is also a likelihood of other people seeing its potential to colonise river banks and estuaries and planting it in such places.

CASUAL – NEW RECORDS FOR NEW ZEALAND

ALSTROEMERIACEAE

***Alstroemeria ligtu* L.**
Peruvian lily

NEW RECORD: CHR 592299, *G. D. La Cock (Ogle 5273)*, 14 Jul 2007, Rangitīkei, Turakina, Koitiata.
SELECTED ADDITIONAL RECORDS: CHR 607852, *G. D. La Cock (Ogle 5273)*, 14 Jul 2007, Rangitīkei, Turakina, Koitiata, (grown on at CHR by I. Schönberger and identified and vouchered by W. Sykes, Nov 2008); CHR 591901, *G. D. La Cock (Ogle 5233)*, 14 Sep 2007, Rangitīkei, Turakina, Koitiata; CHR 604462, *C. C. Ogle 5503*, 1 Jan 2009, Whanganui, Whanganui River, bank above estuary; CHR 638014, *C. C. Ogle 6356 & R. C.*

Ogle, 14 May 2015, Whanganui, Kaiiwi, Rangitatau East Road, Bushy Park.
NOTES: Garden Discard. CHR 592299, 607852 and 591901 all came from the same patch of *Alstroemeria ligtu* (*A. ligtu* hybrid) in an informal green-waste dump among dunes. The Pacific Bulb Society (undated) states that *Alstroemeria* has been hybridised extensively and, specifically, that *Alstroemeria haemantha* was brought to England in 1927 and was crossed with *Alstroemeria ligtu* var. *angustifolia*, which had been sent back to England from the Andes in 1925, to produce the *ligtu* hybrids.

AMARYLLIDACEAE

***Haemanthus coccineus* L.**
blood lily

NEW RECORD: CHR 618131, *G. D. La Cock s.n.*, 4 Jun 2010, Pātea, dunes near river mouth.
NOTES: Garden Discard. The site was a green-waste dump in dunes. The original collection comprised seven bulbs with large strap-like leaves but no flowers. Plants were grown on until flowering in two Whanganui gardens and at Landcare Research at Lincoln, Canterbury. Flowering material of one of the Whanganui garden-grown specimens, CHR 618130, was collected on 27 Feb 2012. It was grown from 2012 to 2017 beside some 30 bulbs of a garden-sourced Whanganui clone of *Haemanthus coccineus*; the Pātea-sourced bulbs have flowered consistently three to four weeks before the Whanganui clone and they also lose their leaves in October, some four weeks before the Whanganui clone. It is not known whether these differences are taxonomically significant.

***Nerine bowdenii* W.Watson**
nerine

NEW RECORD: CHR 572328, *G. D. La Cock s.n.*, 16 Jun 2005, Whanganui, St John's Hill, east side of Great North Road, 35-55 m south of Parsons Rd intersection
NOTES: Garden Discard. Four patches under trees on steep clay slope, flowering, probable garden discards from road above. The perianth was bright pink.

***Nerine sarniensis* var. *curvifolia* f. *fothergillii* (Andrews) Traub**

NEW RECORD: CHR 591749, *A. Hawcroft s.n. & G. D. La Cock*, 3 Apr 2007, Rangitīkei, Putorino Road, on banks of the Rangitīkei River.
NOTES: Garden Discard. One flowering clump of rooted bulbs; CHR 591749 was described by W. Sykes (from fresh material) as having "perianth scarlet; lobes 3-5-4 x 0.8 – 1 cm, oblong, strongly recurving. Filaments 4.5-5 cm long, scarlet, bunched at anthesis. Style similar to filaments but often slightly longer." Also known as *Nerine fothergillii* (Andrews) M.Roem., *Nerine sarniensis* f. *fothergillii* (Andrews) Traub, *Nerine sarniensis* (L.) Herb.

ARACEAE

***Arisaema taiwanense* J.Murata**
Taiwan cobra lily

NEW RECORD: CHR 614091, *C. C. Ogle 5788 & C. R. Higgie*, 6 Nov 2010, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.
NOTES: Cultivation Escape. Seedlings in vicinity of planted flowering specimens, under planted trees in extensive gardens.

ARECACEAE

***Chamaerops humilis* L.**

NEW RECORD: CHR 526564, *C. R. Higgie & C. C. Ogle 6558*, 4 March 2018, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.
NOTES: Cultivation Escape. Occasional seedlings within 10 m of planted fruiting specimens.

ASPARAGACEAE

***Asparagus retrofractus* L.**
ming asparagus fern

NEW RECORD: CHR 526237, *C. C. Ogle 4039*, 16 Feb 2002, Whanganui, Durie Hill, Durie Vale Road.
NOTES: Garden Discard. Two plants on very steep, vine-covered hillslope below road.

***Eucomis zambesiaca* Baker**

NEW RECORD: CHR 526561, *C. C. Ogle 6555, C. R. Higgie, N. A. Higgie, R. C. Ogle*, 4 March 2018, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.

Figure 7. A. Flowering patch of naturalised *Lachenalia bulbifera*, in dunes with *Ammophila arenaria* and *Yucca gloriosa*, Bamber St, Castlecliff, Whanganui, 4 July 2016. Photo © Lynne Douglas. **B.** Naturalised *Lachenalia bulbifera*, in dunes with *Ammophila arenaria*, Bamber St, Castlecliff, Whanganui, 20 June 2017. Photo © Colin Ogle

NOTES: Cultivation Escape. Planted patch ca 2 m diameter, plants with many fruiting heads and seedlings common, up to 2 m from fruiting plants. Obtained in 2013 under the cv name of 'Tiny Piny Sweetie'. Most of the 'Tiny Piny' cultivars have coloured flowers and stems, the result of hybridisation, but the plants at Paloma Gardens were uniformly green and cream, including the seedlings.

***Eustrephus latifolius* R.Br.**
wombat vine

NEW RECORD: CHR 526566, *C. C. Ogle 6560, C. R. Higgie, N. A. Higgie & R. C. Ogle,* 4 March 2018, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens. NOTES: Cultivation Escape. Planted beside a garden fence and seedlings were common nearby. The original plant was purchased in about 2008, under the incorrect name of *Heteropterys angustifolia,* and seedlings were not seen until 2018.

***Lachenalia bulbifera* (Cirillo) Asch. & Graebn.**
red lachenalia, Figures 7A, 7B.

NEW RECORD: CHR 541850, *G. D. La Cock s.n.*, 21 Jul 2000, Whanganui, Castlecliff Beach, Bamber Street. ADDITIONAL RECORD: CHR 526205, *C. C. Ogle 3910*, 30 Jun 2001, Whanganui, Purnell/Selwyn Street Corner, 'Purnell House', dunes at rear of disused sports fields. NOTES: Garden Discard. Leaves unspotted, corolla red-pink with pale greenish tips to the tepal lobes. CHR 526205 was identified by W. Sykes at CHR as the cultivar 'Crimson Joy'. *Lachenalia* is mentioned as a zeta (ζ) entry in Edgar and Connor (2010) but the species was not identified, as no specimens had been seen. Other than those cited here, just seven more collections are known in New Zealand herbaria, three of those being from Rangitoto Island. The remaining collections were all from coastal dunes, as were the two cited Whanganui collections. In the wild, *L. bulbifera* can form large colonies, by natural multiplication of the bulbs. By 2017, the dune site of CHR 541850 comprised patches > 5 m across, among *Ammophila arenaria* and *Oxalis pes-caprae*. Because of its abundant bulbs, especially in light soils, the species can be quite difficult to eradicate once established.

***Nolina longifolia* (Karw. ex Schult.f.) Hemsl.**
Oaxacan tree, bear grass

NEW RECORD: CHR 604460, *C. C. Ogle 5501 & C. R. Higgie*, 30 Dec 2008, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.
NOTES: Cultivation Escape. Seedlings in vicinity of planted fruiting specimens.

***Veltheimia bracteata* Harv. ex Baker**
forest lily

NEW RECORD: CHR 585604, *G. D. La Cock, s.n.*, 30 Jun 2005, Pātea, dunes near river mouth.
NOTES: Garden Discard. Established in a public green-waste dump. The material collected from Pātea was sent live to CHR, where it was grown to confirm its identity; it was collected and accessioned in CHR by I. Schönberger on 4 Sep 2006.

***Yucca gigantea* Lem.**
giant yucca

NEW RECORD: CHR 640825, *G. D. La Cock, s.n.*, 24 Nov 2010, Pātea, dunes near river mouth.
NOTES: Garden Discard. The material collected by GLC from a green-waste dump in dunes west of Pātea River mouth was cultivated in Whanganui, Durie Hill, 22 Forres Street. In October 2016, the plant was identified by local horticulturalist C. R. Higgie and the foliage that was pressed, '*C. C. Ogle 6441*', became CHR 640825.

ASPHODELACEAE

***Kniphofia caulescens* Baker**
red-hot poker

NEW RECORD: CHR 615110, *C. C. Ogle 5907*, *C. R. Higgie & R. C. Ogle*, 20 May 2011, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.
NOTES: Cultivation Escape. The putative parent plants, represented by CHR 615109, were growing in pasture 100 m distant, where they had been discarded because too many seedlings were establishing in the extensive adjoining gardens.

***Kniphofia rooperi* (Moore) Lem.**
red-hot poker

NEW RECORD: CHR 572329, *G. D. La Cock s.n.*, 30 Jun 2005, Pātea, dunes near river mouth.
NOTES: Garden Discard. Single plant growing and flowering in green-waste dump site.

BROMELIACEAE

***Ochagavia carnea* (Beer) L.B.Sm. & Looser**
cardoncillo

NEW RECORD: CHR 514115, *C. C. Ogle 3270*, 26 Sep 1997, Whanganui, Aramoho railyards.
NOTES: Garden Discard. One clump with old flower heads growing in gravel on edge of railyard, with mostly annual weeds.

***Puya chilensis* Molina**
puya

NEW RECORD: CHR 615117, *C. C. Ogle 5914*, *C. R. Higgie & R. C. Ogle*, 20 May 2011, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.
NOTES: Cultivation Escape. The putative parent plant, represented by CHR 615116, was growing in pasture 100 m distant where it had been discarded because too many seedlings were establishing in the extensive adjoining gardens.

COLCHICACEAE

***Wurmbea stricta* (Burm.f.) J.C.Manning & Vinn.**

NEW RECORD: CHR 638027, *C. C. Ogle 6369*, 25 Sep 2015, Whanganui, Bastia Hill, 115 Mount View Road.
NOTES: Cultivation Escape. Growing in a gravel driveway in extensive gardens where *W. stricta* was planted nearby, on a limestone rockery.

IRIDACEAE

***Crocus tommasinianus* Herbert**
early crocus

NEW RECORD: CHR 507976, *C. C. Ogle 2943*, 23 Jul 1995, Whanganui, Whanganui River, Papaiti Road.
NOTES: Intentional Release or Garden Discard. Patch of plants ca 2 m diameter, established in occasionally grazed pasture between Papaiti Road and the river bank; a house and garden were across the road from the *Crocus* patch. Flowers lilac with paler centre.

***Dietes grandiflora* N.E.Br.**
fortnight lily, butterfly iris

NEW RECORD: CHR 608147, *C. C. Ogle 5698,* 5 Dec 2009, Whanganui, Market Place, Mōutoa Gardens.
NOTES: Cultivation Escape. Locally common seedlings growing in cracks between sealed footpath and the base of concrete edging of the adjoining garden which is planted with *D. grandiflora*.

***Hesperantha cucullata* Klatt**
Bokkeveld evening-lily

NEW RECORD: CHR 644224, *C. C. Ogle 6475,* 20 Sep 2016, Whanganui, Bastia Hill, 115 Mount View Road.
NOTES: Cultivation Escape. In garden lawn adjoining a gravel area used as a holding area for potted corms, bulbs and other plants, including *H. cucullata*. Corolla white except the outer three tepals are pink-purple on their outer surfaces.

***Iris innominata* L.F.Hend.**
Pacific iris

NEW RECORD: CHR 614528, *C. C. Ogle 5834*, 4 Oct 2010, Wellington, Whanganui, Durie Hill, Forres Street.
NOTES: Cultivation Escape. Hundreds of seedlings establishing over > 15 years in the vicinity of planted specimens.

***Iris xiphium* L.**
Spanish iris

NEW RECORD: CHR 511223, *C. C. Ogle 3117*, 7 Jul 1996, Whanganui, beside railway between Liverpool and Grey Streets.
ADDITIONAL RECORD: CHR 532909, *C. C. Ogle 3584*, 3 Aug 1999, Pātea, dunes near river mouth.
NOTES: Garden Discard. Growing in green-waste dump in dunes.

***Moraea huttonii* (Baker) Oberm.**

NEW RECORD: CHR 656108, *C. C. Ogle 6623*, 22 Nov 2018, Whanganui, St Johns Hill, 16 Virginia Heights.
NOTES: Cultivation Escape. Self-established among planted *Coprosma acerosa* in sandy soil, about 13 m from a planted, flowering and fruiting, plant of *M. huttonii* (CHR 656107). The original plant was cultivated in the garden of I. and J. Bell on Bastia Hill, Whanganui.

***Romulea citrina* Baker**

NEW RECORD: CHR 638029, *C. C. Ogle 6371*, 30 Sep 2015, Whanganui, Bastia Hill, 115 Mount View Road.
NOTES: Cultivation Escape. Growing in an infrequently mown lawn near potted specimens. It proved difficult to confirm a species name for this *Romulea* as our photographs and pressed material lacked all the details needed to use the key in Manning and Goldblatt (1991). The plant appears to have died out in the lawn and pots at Whanganui.

***Sparaxis grandiflora* (D.Delaroche) Ker Gawl.**
large harlequin flower

NEW RECORD: CHR 591903, *G. D. La Cock & C. C. Ogle 5235*, 15 Jul 2007, Rangitīkei, Turakina, Koitiata.
SELECTED ADDITIONAL RECORDS: CHR 606559, *G. D. La Cock, s.n.*, 21 Aug 2007, Pātea, dunes near river mouth; CHR 592343, Rangitīkei, *C. C. Ogle 5328*, *G. D. La Cock*, *L. Stowell*, 14 Sep 2007, Wellington, Rangitīkei, Turakina, Koitiata.
NOTES: Garden Discard. Well-established locally in a green-waste dump in dunes at Koitiata where the plants had flowers described as "40 mm diameter; corolla lobes 35 mm; red on outer surfaces with white margin right around; white inside with yellow throat in lower ½ and a thin red stripe. Culm dark red in upper two thirds." The flowers on CHR 616167 A&B (*W. R. Sykes 60/09*, 28 Oct 2009, Canterbury, Christchurch, Halswell, Kennedy's Bush Road) were described as being "… slightly irregular; perianth 3-3.7 cm long, uniformly deep scarlet except for cream base and purplish band down centre of segments."

***Watsonia fourcadei* J.W.Mathews & L.Bolus**

NEW RECORD: AK 240470, *C. C. Ogle 96 & I. Bell*, 31 Oct 1998, Whanganui, Castlecliff, north-west end of beach.
SELECTED ADDITIONAL RECORDS: AK 240713, 240714, *C. C. Ogle 109*, 29 Aug 1999, Whanganui, Castlecliff, north-west end of beach; CHR 637028, *C. C. Ogle 6498*, 29 Oct 2017, Whanganui, Castlecliff, north-west end of beach.
NOTES: Intentional Release. Persistent in rear dunes, near base of a mudstone sea-cliff, and growing amongst *Ammophila arenaria, Gazania linearis, Lagurus ovatus, Senecio elegans*; with scattered clumps of *Watsonia meriana* subsp. *meriana* and *W. aletroides*. Possibly planted some decades ago along > 2 km of dunes but plants are now large, forming patches to 2 m or more diameter. It has not proved possible to identify young *Watsonia* plants growing near these patches as being *W. fourcadei* because *W. meriana* and *W. aletroides* grow with them. Some isolated patches of flowering *W. meriana* contain young plants (e.g. CHR 644104, *C.C. Ogle 6499*), undoubtedly self-established from seed.

JUNCACEAE

***Juncus* sp. (aff. *J. pallidus* R.Br., *J. sarophorus* L.A.S. Johnson)**

NEW RECORD: CHR 593521, *C. C. Ogle 5359*, 20 Dec 2007, Whanganui, Durie Hill, 22 Forres Street.
SELECTED ADDITIONAL RECORDS: CHR 604161, *C. C. Ogle 5442*, 6 Jan 2009, Whanganui, Durie Hill, 22 Forres Street; CHR 614510, *C. C. Ogle 5818*, 20 Dec 2010, Whanganui, Durie Hill, 22 Forres Street.
NOTES: Cultivation Escape. Seedlings come up freely in between planted shrubs around the planted *Juncus*, and in driveway to 5 m distant. The original fruiting plant was given to me as a rooted piece by R. Rudd of Castlecliff, who bought it from a native plant nursery in Otaki as '*Juncus sarophorus*'. Its very robust size and shiny green stems with continuous pith do not match *J. sarophorus*. Rudd's cultivated plant was vouchered as AK 297408, *C. C. Ogle 4962*, 1 July 2006, Whanganui, Castlecliff, 115A Karaka St. Rudd (personal communication to CCO.) eliminated his plant soon after the CHR collection was made, because he said he was getting too many seedlings. Part of it was taken to 22 Forres Street, Whanganui, where it produced culms to 1600 mm tall (CHR 593521) and, within a year, seedlings were appearing in the garden and driveway up to 5 m distant from the planted specimen. Like *J. sarophorus*, it has flowers evenly spaced along the branches. After the collection CHR 614510 was made, which included live seedlings sent to Landcare Research NZ at Lincoln for growing-on, every plant was eliminated from 22 Forres Street, Whanganui. If this taxon is not a known species for New Zealand, it has considerable weed potential, in pastures and gardens.

LILIACEAE

***Lilium ×hollandicum* Bergmans**

NEW RECORD: CHR 572236, *C. C. Ogle 4694*, 11 Sep 2000, Pātea, dunes near river mouth. Cultivated at Whanganui, Durie Hill, 22 Forres Street, by CCO and vouchered to CHR as his #4694, 15 Dec 04.
NOTES: Garden Discard. Green-waste dump site.

MUSACEAE

***Musa sikkimensis* Kurz**
Darjeerling banana

NEW RECORD: CHR 526587, *C. R. Higgie, s.n.*, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens, 30 Apr 2018.
NOTES: Cultivation Escape. Paloma Gardens have planted clumps of *M. sikkimensis* that now bear flowers and ripe fruit (CHR 526596 F-G); seed locally abundant on the ground with seedlings.

POACEAE

***Ampelodesmos mauritanicus* (Poir.) T.Durand & Schinz**
stramma, Mauritanian grass

NEW RECORD: CHR 569841, *C. C. Ogle 4461 & C. R. Higgie*, 18 Dec 2003, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.
NOTES: Cultivation Escape. About six seedlings self-established within 2 m of a planted flowering specimen in extensive gardens.

***Chusquea galeottiana* Rupr. ex Munro**

NEW RECORD: CHR 526658, *C. R. Higgie & C. C. Ogle 6562*, 4 Mar 2018, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens; AK 375510, *C. C. Ogle 6652 & C. R. Higgie,* 7 Feb 2019, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.
NOTES: Cultivation Escape. Dense thicket of seedlings 400-1500 mm tall, in area about 5 m diameter where a mature plant died after flowering in 2012. The seedlings appeared about a year later, some exceeding 2 m by March 2019.

***Chusquea gigantea* J.P.Demoly**

NEW RECORD: AK 375513, *C. C. Ogle 6651 & C. R. Higgie*, 7 Feb 2019, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens.
NOTES: Cultivation Escape. A 5-m diameter planted clump of this bamboo, flowering, with ca 20 seedlings 5 m distant, derived from a previous flowering.

***Phyllostachys heterocycla* (Carrière) S.Matsum.**
moso bamboo

NEW RECORD: CHR 606556, *C. C. Ogle 5643 & R. C. Ogle*, 25 Oct 2009, Whanganui, Gerse Street, Matarawa Stream.
NOTES: Cultivation Escape. Suckering through mown lawn of the street berm from the adjacent garden planting to the street gutter. Often known as *Phyllostachys edulis*.

CASUAL – FIRST RECORDS FOR THE MANAWATU ECOLOGICAL REGION

AMARYLLIDACEAE

***Agapanthus praecox* subsp. *minimus* (Lindl.) F.M.Leight.**

FIRST RECORD: CHR 592780, *C. Howell, s.n.*, 15 Jan 2008, Wellington city.
SELECTED ADDITIONAL RECORDS: CHR 609415, *C. C. Ogle 5759*, 18 Jun 2010; Hāwera, Wilson St., 'Brydon Court'; CHR 610011, *R. C. Ogle & C. C. Ogle 5768*, 3 Aug 2010, Hāwera, 105 Glover Rd; CHR 601012, *R.C. Ogle & C. C. Ogle 5769*, 3 Aug 2010, Hāwera, 108 Wilson St.
NOTES: Cultivation Escape. Established in cracks in pavement, the base of walls and in unmown lawns, close to established plantings. The additional records all come from Hāwera on the Taranaki volcanic ring plain (Egmont Ecological Region), < 10 km west of MER. The taxon is widely cultivated in MER and, in Whanganui, CCO has photographed garden escapes (http://www.nzpcn.org.nz/flora_details.aspx?ID=7692).

***Allium ampeloprasum* L. and *A. porrum* L.**
leek

FIRST RECORDS: *Allium ampeloprasum*, T. F. Cheeseman (1883: 293); *A. porrum*, G. M. Thomson (1922: 482).
VOUCHERS: for *A. ampelosporum*, AK 95699, *T. F. Cheeseman* (no date), Northland, Mangonui; for *A. porrum*, CHR 121720, *A. J. Healy 57/297*, 29 Jan 1957, Otago, Dunedin Harbour area.
ADDITIONAL RECORD: CHR 532889, *C. C. Ogle 3564*, 3 Aug 1999, Pātea, dunes near river mouth.

Between AK and CHR, there are 11 collections of wild leeks from discrete sites, five being identified as *A. ampeloprasum* and six as *A. porrum*. These include the three specimens cited above. We see no useful purpose in citing the remainder here because of taxonomic uncertainties, as outlined below.
NOTES: Garden Discard (although possibly self-established from a previous year's discard). In grassland near human habitation and abandoned gardens; also in a green-waste dump in dunes. *A. porrum* and *A. ampeloprasum* were ζ records in Healy and Edgar (1980). They cite the first record of *A. porrum* as G. M. Thomson (1922, p. 482), for a record from the Marlborough Sounds. There is no specimen to support Thomson's record because he, in turn, cited a written record by Buick (1900, p. 156). Buick's report is also not an actual sighting and is unsupported by an herbarium specimen. The first substantiated record of *A. ampeloprasum* in the wild appears to be the 1957 collection made by A. J. Healy (CHR 121720).

We have been unable to resolve formal names for wild collections of leeks in New Zealand and have grouped the records of *A. ampeloprasum* and *A. porrum* for this paper. As pointed out to us by Dr. Peter de Lange (personal communication 29 March 2019), *Allium* taxa are a complicated group, because of a long history of human domestication and hybridisation that is still being debated. Widely known as *A. porrum*, the domestic leek was referred to as *A. ampeloprasum* by Friesen, Fritsch, & Blattner (2006) and other authors. However, Hirschegger, Jakše, Trontelj, & Bohanec (2010) provide

evidence for retention of both species. Staff at CHR (I. Schönberger, personal communication, 27 March 2019) advise that *A. porrum* is a correct name, if *A. porrum* and *A. ampeloprasum* are treated as separate species but, when the two are considered to be the same species, *Allium porrum* is a rejected (nom. rej.), heterotypic synonym of *A. ampeloprasum* L. (https://naturalhistory2.si.edu/botany/codes-proposals/display_new.cfm). (Smithsonian National Museum of Natural History, Appendix IV, Proposal 1258).

***Allium cepa* L.**
onion

FIRST RECORD: Healy and Edgar (1980), as a ζ record, and who cite G. M. Thomson (1922, p. 278) for a record of a "more or less wild" garden onion from the Marlborough Sounds. This may be an error, because there is no specimen to support the record and the report appears to be of cultivated plants (Thomson, 1922, p. 482). Healy and Edgar (1980) noted that onions occur as "a casual garden outcast in both North and South Islands and…on Campbell Island." The records below are the only collections we found in AK and CHR of onions growing outside of cultivated areas.
SELECTED ADDITIONAL RECORDS: CHR 123117, *R. J. L. Sheeby s.n.*, 29 Dec 1959, Christchurch, Islington; CHR 572479, *G. D. La Cock, s.n.*, 2 Aug 2004, Manawatu, Himatangi Beach; CHR 572338, *C. C. Ogle 4773 & G. Jane*, 1 Mar 2005, Whangaehu River mouth, Whitiau Scientific Reserve; AK 304121, *P. J. de Lange, s.n.*, 1 Dec 2008, Chatham Islands; AK 304864, *P. J. de Lange, s.n.*, 22 Dec 2008, Bay of Plenty, Tauranga, Mount Maunganui (urban area).
NOTES: Cultivation Escape. CHR 572479 was one of two onions found sprouting on a low terrace beside the river, presumed to have been carried here after floods in a local river, while CHR 572338 was locally common, growing among flood debris on a tidal river bank.

ARACEAE

***Arisarum vulgare* O.Targ.Tozz.**
friar's cowl

FIRST RECORD: AK 286420, *E. Cameron s.n.*, 5 May 2004, Auckland, Mt Eden, Shackleton Road: "Rampant through vegetable garden…area 6 m x 6 m."
SELECTED ADDITIONAL RECORDS: CHR 606562, *C. C. Ogle 5760*, 18 Jun 2010, Hāwera, 16 Arthur St; CHR 610006, *C. C. Ogle 5763*, 3 Aug 2010, Hāwera, 16 Arthur St; AK 332591, *L. Clapcott & W. Moore, s.n.*, 07 Aug 2012, Waikanae, 31 Tui Crescent. Appeared in a garden where it had not been known for 60 years.
NOTES: Cultivation Escape. CHR 606562 was flowering in grazed sheep pasture some 200 m from the nearest garden, where planted specimens were also flowering, with many seedlings close by (CHR 610006). The Hāwera collections both come from a farm close to town on the Taranaki volcanic ring plain (Egmont Ecological Region), < 10 km west of MER.

***Monstera deliciosa* Liebm.**
fruit salad plant

FIRST RECORD: Martin (2002).
VOUCHER: CHR 354550, *A. E. Esler 5851*, *W. M. Hamilton, R. Beever & M. L. Scott*, 7 Dec 1978, Auckland, Little Barrier Island, Te Maraeroa, mouth of the Te Waikāherē [Waikōhare] Stream.
ADDITIONAL RECORD: CHR 532881, *C. C. Ogle 3556*, 4 Mar 1999, Whanganui, Virginia Rd, walking track beside 'Deer Park'.
NOTES: Garden Discard. Although CHR 354550 was collected from the wild in 1978, the species was not recorded by Healy and Edgar (1980). Since 1980, about 12 discrete collections of naturalised plants of *Monstera deliciosa* have been lodged in AK, and most were post-2000. All were from Northland and Auckland regions, including Great Barrier Island (Aotea). Four collections were stated to be derived from dumped garden waste and four presumed to have established from seed. The Whanganui collection (CHR 532881) was from garden waste and it has not persisted, being smothered in rank grasses and vines.

ASPARAGACEAE

***Albuca bracteata* (Thunb.) J.C.Manning & Goldblatt**
pregnant onion

FIRST RECORD: CHR 509305, *W. R. Sykes 527/95*, Auckland, Rangitoto Island, Islington. The specimen was collected by R. O. Gardner & P. de Lange in March 1995 (P. de Lange, personal communication), grown on in a Christchurch garden and flowering material vouchered on 18 Dec 1995 database.
ADDITIONAL RECORD: CHR 608090, *C. C. Ogle 4501*,

23 May 2004, Whanganui, Whanganui East, Ikitara Road.
NOTES: Garden Discard and Cultivation Escape.

***Aloe arborescens* Mill.**
krantz aloe

FIRST RECORD: CHR 474013, *Sykes W.R. 374/91*, 12 Aug 1991, Auckland, St Heliers Bay.
SELECTED ADDITIONAL RECORDS: CHR 536411, *C. C. Ogle 3645*, 20 Jul 2000, Whanganui, Bastia Hill, Wairere Road.
NOTES: Garden Discard and Cultivation Escape. We have not accepted the published record of Sykes (1992) as a First Record for *A. arborescens* because he wrote of CHR 465478, collected 6 Dec 1989 from Rangitoto Island, that plants at that site "…cannot be considered adventive because they have not reproduced themselves."

There are about ten discrete collections in CHR and AK that represent naturalising plants, the majority being from Auckland and Banks Peninsula. Most are said to be spreading to some degree, by rooting from sprawling plants, and generally these were on rocky sites where garden plants have been discarded or have spread down-slope. CHR 536411 was from a plant spreading vegetatively down a near-vertical slope below an urban street in Whanganui.

***Aloiampelos ciliaris* (Haw.) Klopper & Gideon F.Sm.**
climbing aloe

FIRST RECORD: AK 296600, *E. Cameron s.n.*, 19 Mar 1989, Auckland, Remuera, Upland Road. The collection label stresses that there were "Only a few plants (not planted)….Probably established [on scoria cliff beside road] from plants cultivated at top of the cliff."
SELECTED ADDITIONAL RECORDS: CHR 536412, *C. C. Ogle 3646*, 20 Jul 2000, Whanganui, Whanganui East, Shakespeare Road; CHR 541849, *G. D. La Cock*, 21 Jul 2000, Whanganui, Castlecliff Beach, Bamber Street. Sykes (1992) also included this species from Rangitoto, saying, "One straggling plant on an old garden site…*A. ciliaris* is only a relic of cultivation."
NOTES: Cultivation Escapes and/or Garden Discards. The Whanganui records were both from plants scrambling through boxthorn (*Lycium ferocissimum*). Also known as *Aloe ciliaris*.

***Chlorophytum comosum* (Thunb.) Jacques**
spider lily

FIRST RECORD: CHR 177853, *G. I. Collett*, Mar-Apr 1965, Nelson, Northwest Nelson, Kahurangi Point.
SELECTED ADDITIONAL RECORDS: CHR 498124, *C. C. Ogle 2781*, 13 Feb 1994, Whanganui, St Johns Hill, Virginia Lake Reserve; CHR 586783, *C. C. Ogle 5034*, 18 Jul 2006, Whanganui, Gonville, Purnell St, Purnell House.
NOTES: Garden Discard and/or Cultivation Escape. Appears to be spread by vegetative growth (tuberous roots) only. On the label for CHR 177853, W. R. Sykes (11 Oct 1967) expressed doubt about the specimen's identity, saying, "capsules, basal leaf parts & roots needed to confirm this species". This may be the reason the record from 1965 was not included by Healy and Edgar (1980). Collections since 1980 have been accepted as this species. The Whanganui collections were both from old dunes.

***Eucomis comosa* (Houtt.) Wehrh.**
pineapple lily

FIRST RECORD: La Cock (2005)
VOUCHER: CHR 567209, *G. D. La Cock, s.n.*, 30 Oct 2002, Pātea, dunes near river mouth.
SELECTED ADDITIONAL RECORDS: CHR 586108, *G. D. La Cock, s.n.*, 12 Feb 2007, grown in a Whanganui garden, originally from Pātea green-waste dump on 27 Jun 2006. The original Pātea collection comprised "Just the bulb and a couple of short leaves growing in the wind-blown sand"; AK 299989, *P. J. de Lange CH821*, 26 Jun 2007, Chatham (Rekohu) Island, Waitangi (de Lange et al., 2011); AK 330223, *M. White, s.n.*, 14 Feb 2012, Auckland Region, Papakura, Mill Road, near Walters Road intersection; AK 348899, *M. Wilcox, s.n.*, 11 Oct 2013, Ahipara, dunes north of Kaka Street, behind golf course.
NOTES: Garden Discard

***Hyacinthus orientalis* L.**
hyacinth

FIRST RECORD: CHR 83207, *A. J. Healy 53/865*, 7 Sep 1953, Trentham, Hutt Valley.
ADDITIONAL RECORD: CHR 586850, *R. C. Ogle & C. C. Ogle 5100*, 2 Sep 2006, Rangitīkei, Turakina, Koitiata.
NOTES: Garden Discard. Both records cited here were of one or two plants established from discarded plants.

The site for CHR 586850 is an informal green waste dump in dunes and contained two plants, noted as having flowers of either pale pink or bright violet.

***Lachenalia aloides* (L.) Asch. & Graebn.**
Cape cowslip

FIRST RECORD: AK 273491, *E. Cameron, s.n.*, 2 Sep 1984, Auckland, Rangitoto Island, back of bay just east of Rangitoto wharf.
ADDITIONAL RECORD: CHR 532888, *C. C. Ogle 3563 & G. D. La Cock*, 3 Aug 1999, Pātea.
NOTES: Garden Discard. Leaves dark-spotted. Established in dunes near river mouth, a public green-waste dump.

***Ruscus aculeatus* L.**
butcher's broom

FIRST RECORD: CHR 385675, *J. R. Chapman s.n.*, 22 Oct 1986, North Canterbury, near Loburn.
SELECTED ADDITIONAL RECORDS: CHR 514126, *C. C. Ogle 3281*, 24 Sep 1997, Whanganui, Whanganui River, Papaiti Road, walkway near Holly Lodge (now gone); CHR 568476, *C. C. Ogle 4430*, 7 Oct 2003, Whanganui, Virginia Lake Reserve; CHR 567490A, *H. Campbell s.n.*, 26 Jan 2004, near Nelson, Wakefield, Waikari Reserve; CHR 572377, *C. C. Ogle 4813 & J. Bell*, 27 May 2005, Whanganui, Bastia Hill, 115 Mount View Road; CHR 591843, *B. Winder s.n.*, 31 May 2007, Kahutara, South Wairarapa; CHR 608113, *H. Webb s.n.*, 12 Feb 2010, Rangitikei, Porewa, Norwood Line.
NOTES: Cultivation Escape and Garden Discard. The first known wild collection, CHR 385675, was from a single discarded shrub growing on a river bed and it is likely that CHR 514126 was also from a garden discard. However, the species also self-establishes from seed, e.g., CHR 572377 comprised seedlings from under a tall hedge of *Acca sellowiana* and several other collections are from single plants in native forest, suggesting establishment from seed.

***Yucca gloriosa* L.**
Spanish dagger

FIRST RECORD: Healy & Edgar (1980).
VOUCHER: CHR 205997, *P. Dow s.n.*, 7 July 1970, Gisborne, on dunes.
ADDITIONAL RECORD: CHR 466844, *C. C. Ogle 1890*, 1 Apr 1990, Rangitīkei, on dunes between Turakina and Whangaehu River mouths.
NOTES: Garden Discard. A ζ entry in Healy and Edgar (1980). The original collection from Gisborne and all later collections in CHR are from coastal situations, mostly on dunes where they are stated to be "garden relics". They flower freely but do not appear to set seed. This species is not regarded as fully naturalised because wild plants do not appear to spread unaided, except by occasional rooting from pieces of damaged plants.

ASPHODELACEAE

***Kniphofia linearifolia* Baker**
marsh poker

FIRST RECORD: CHR 91492, *A. J. Healy 55/57*, 18 Jan 1955, Christchurch, Riccarton.
ADDITIONAL RECORD: CHR 610020, *C. C. Ogle 5777*, 9 Jun 2010, Whanganui, Anzac Parade, James McGregor Memorial (Kōwhai) Park.
NOTES: Cultivation Escape. The original record was stated to be "adventive along railway reserve; garden escape, spreading" making it surprising that it was not included by Healy and Edgar (1980). The species' weed potential is also shown by CHR 610020 where the collecting notes state, "Seedlings very common within radius of 2 m of [planted] parents".

COMMELINACEAE

***Tradescantia cerinthoides* Kunth**
inch plant

FIRST RECORD: Sykes (1992).
VOUCHER: CHR 420936, *W. R. Sykes 223/85*, 21 Nov 1985, Auckland, Rangitoto Island, Islington.
SELECTED ADDITIONAL RECORDS: CHR 591897, *G. D. La Cock, L. Stowell & C. C. Ogle 5229*, 14 Sep 2007, Rangitīkei, Turakina, Koitiata; CHR 646104, *C. C. Ogle 6600 & R. C. Ogle*, 1 Aug 2018, Whanganui, St John's Hill, 16 Virginia Heights.
NOTES: Garden Discard and Cultivation Escape. CHR 420936 was a small patch on basalt lava, near an old house site. CHR 591897 was spreading vegetatively from discarded pieces in an informal green-waste dump in dunes. Plants fragment readily at stem nodes, the pieces taking root readily. There is one unpublished report of seedlings in New Zealand (cited by Hill, 2007).

However, CHR 646104 comprised seedlings that appeared spontaneously in 2018, on old dune sands in a garden close to planted flowering specimens, and seedlings have continued to appear at this site up until March 2019. Beyond MER, there are about nine collections in AK and CHR that appear to have originated as garden discards or escapes from cultivation and most or all spreading vegetatively to relatively minor degrees (Gardner & de Lange, 1996; de Lange et al., 2005). Because most of the spread of *T. cerinthoides* has been vegetative, and it is established in the wild in fewer than ten sites, we believe it is not yet fully Naturalised. For the future, seedlings should be documented wherever they are found, because their appearance indicates a greater potential for spread than has been demonstrated to date.

CYPERACEAE

***Carex morrowii* Boott**
Japanese sedge, Morrow's sedge

FIRST RECORD: AK 297976, *P. J. de Lange 6808*, 9 Dec 2006, Hamilton, Ann Street, Waikato River bank.
SELECTED ADDITIONAL RECORDS: CHR 609369, *C. C. Ogle 5738*, 19 Feb 2010, Whanganui, Liverpool Street, 'Rapido Café' (now 'Villa Café'); CHR 554375, *P. J. de Lange 12374*, 7 Nov 2014, Dargaville, Victoria Street, Hobson's Choice Motel; AK 355757, *P. J. de Lange 12404* & *J. R. Rolfe*, 20 Nov 2014, Horowhenua District, Te Horo, abandoned carpark beside SH1.
NOTES: Cultivation Escape. Planted tussocks of CHR 609369 were surrounded by self-established seedlings. The seed heads had lost their utricles but were identified as *C. morrowii* by comparison with nursery plants. Specimens collected elsewhere, before and after the Whanganui one, include a full range of flower and fruiting heads.

The label for CHR 554375 states that this sedge was abundantly naturalised in motel grounds and that they were mostly of the "usual variegated cultivar (*Carex morrowii* cv. Evergold – sometimes sold as *C. oshimensis* cv. Evergold) but also reverted plants present like this one." https://www.inaturalist.org/observations/1714482

IRIDACEAE

***Dietes iridioides* (L.) Sweet**
fortnight lily, butterfly iris

FIRST RECORD: AK 288158, *B. Parris, s.n.*, 30 Mar 2004, Northland, Bay of Islands, Kerikeri, 21 James Kemp Place.
ADDITIONAL RECORD: CHR 586890, *C. C. Ogle 5140*, *I. Bell*, *J. Bell & R. C. Ogle*, 22 Jun 2007, Whanganui, Bastia Hill, 115 Mount View Road.
NOTES: Cultivation Escape. CHR 586890 comprised seedlings which were abundant under the base of a garden's internal hedge and in the adjoining open garden, up to 5 m from planted specimens. This species is often sold under the incorrect name of *D. grandiflora*; the flowers are similar but *D. grandiflora* has erect leaves and flower stems compared with the lax leaves and decumbent flower stems of *D. iridioides*. The latter seems to self-establish more frequently than *D. grandiflora*. "Frequent self-seeding" was noted also by Parris for AK 288158, as well as being "proliferous at end and part way along flower stems". Potentially an invasive species in milder parts of New Zealand. In my own garden (CCO, personal observation), I have tried to pick all seed capsules and destroy them before seeds ripen.

***Iris unguicularis* Poir.**
Algerian iris

FIRST RECORD: CHR 473500, *P. J. de Lange 914,* 20 Jul 1991, Wellington, Eastbourne, Robinson Bay.
ADDITIONAL RECORD: CHR 586784 A&B, *C. C. Ogle 5035*, 18 Jul 2006, Whanganui, Gonville, Purnell Street, Purnell House.
NOTES: Garden Discard. Both records are from old dunes near urban gardens.

***Ixia paniculata* D.Delaroche**

FIRST RECORD: Healy and Edgar (1980).
VOUCHER: CHR 224767, *E. Edgar & S. J. Astridge, s.n.*, 10 Oct 1972, Auckland, Muriwai Road near Waimauku; this collection bears a note that a duplicate was placed at Botany Division Substation, Auckland, which appears to be AK 216893.
ADDITIONAL RECORD: CHR 568456, *C. C. Ogle 4410*, 3 Nov 2003, Whanganui, Airport Road.
NOTES: Garden Discard. The original record was

published as a zeta (ζ) entry based on a collection from a single clump of plants (Healey & Edgar, 1980) beside a road. Only a few wild collections have been made of *Ixia paniculata* in New Zealand since then, again usually on roadsides. The species self-establishes from seed in cultivation.

***Libertia chilensis* (Molina) Gunckel**

FIRST RECORD: AK 258461-63, *R. Beever s.n.*, 5 Sep 2002, Auckland, Mt Albert Research Centre. https://www.inaturalist.org/observations/1714482
SELECTED ADDITIONAL RECORDS: CHR 586848, *C. C. Ogle 5098*, 12 Sep 2006, Palmerston North, Massey University; AK 319310, *P. J. de Lange 9371*, 5 Dec 2010, Hamilton, St Andrews, Waikato River, Matakanohi Reserve; CHR 526577, *C. C. Ogle 6571*, 9 March 2018, Whanganui, Kaiiwi, Bushy Park; AK 371235, *C. C. Ogle 6503*, 10 Apr 2017, Whanganui, Kaiiwi, Rangitatau East Road, Bushy Park.
NOTES: Cultivation Escape. All four known sites with naturalising plants are close to cultivated specimens. For the first collection, AK 258461-63, R. Beever noted many seedlings after heavy seeding the previous season and stated "looks to have the potential to be a weed of open places". CHR 586848 was from abundant seedlings growing in cracks between tar-sealed car-park and base of concrete edging of adjoining garden which is planted with *L. chilensis*. The species is widely sold in nurseries and grown in gardens. To date, it has been collected less commonly as self-establishing plants than we would have expected, given its success in just a few places. More records of its naturalising are expected. *L. formosa* is a synonym, and the species is often sold under this name. http://www.theplantlist.org/tpl1.1/record/kew-323176

At Bushy Park (CHR 526577), *L. chilensis* seedlings were common in a perennial garden that included about six large clumps of the species. Some clumps had flowers with the three larger, inner tepals that were broad and imbricating, but other plants had narrow, non-imbricating, inner tepals. In other respects, all the plants appear similar. These probably represent intraspecific variation but it is also possible that they could be different taxa (D. Blanchon, personal communication, Sept 2018).

***Melasphaerula graminea* (L.f.) Ker Gawl.**
fairy bells

FIRST RECORD: AK 296708, *E. Cameron, s.n.*, 5 Sep 1989, Auckland, University of Auckland grounds in rock garden.
ADDITIONAL RECORD: CHR 568482, *J. Bell & C. C. Ogle 4436*, 2 Aug 2003, Whanganui, Bastia Hill, 115 Mount View Road.
NOTES: Cultivation Escape. Specimen CHR 568482 was noted as "one of the most aggressive weeds in this 2 ha garden – spreading by tubers and seeds". Since 1989, collections of *M. graminea* in AK mostly noted just one or a few plants naturalising, until AK 297500, collected by *P. J. de Lange*, 20 Sept 2006, Auckland, Mt Albert, St Lukes Church cemetery grounds, where it was noted to be "certainly naturalised and spreading". Its aggressive spread in the one known site in Whanganui suggests it could become a naturalised plant in future.

***Moraea polystachya* (Thunberg) Ker**
peacock iris

FIRST RECORD: CHR 466644, *W. R. Sykes 66/90*, 17 Apr 1990, Poverty Bay, near Ngatapa, Eastwoodhill.
ADDITIONAL RECORD: CHR 644225, *C. C. Ogle 6476*, 9 Jul 2016, Whanganui, Bastia Hill, 115 Mount View Road.
NOTES: Cultivation Escape. A few plants establishing near original plantings.

***Watsonia aletroides* (Burm.f.) Ker Gawl.**

FIRST RECORD: CHR 312838, *P. J. Garnock-Jones s.n.*, 12 Nov 1977, Taranaki, Plymouth Road, near Oakura.
SELECTED ADDITIONAL RECORDS: CHR 518720, *C. C. Ogle 3441*, 27 Oct 1998, Whanganui, Castlecliff, north-west end of beach; CHR 592342, *C. C. Ogle 5327*, 14 Sep 2007, Rangitīkei, Turakina, Koitiata.
NOTES: Intentional Release. CHR 518720 came from Castlecliff Beach where it was growing as robust clumps along ca 2 km of hind-dunes (and where it was still present in 2018) and mostly near patches of *W. fourcadei* and *W. meriana* among a sparse-to-dense cover of *Ammophila arenaria* and *Ficinia nodosa*. All three *Watsonia* species here may have been planted some decades ago but many of the flowering plants are now patches 2 m diameter or more. Young *Watsonia* plants near mature plants of *W. aletroides* have not proved possible to identify positively as *W. aletroides*, because *W. fourcadei* and *W. meriana* grow with them.

Nearby, some isolated patches of flowering *W. meriana* contain young plants (e.g. CHR 644104, *C.C. Ogle 6499*), undoubtedly self-established from seed, and plants from here produce seed in cultivation.

LILIACEAE

***Cardiocrinum giganteum* (Wall.) Makino**
giant Himalayan lily

FIRST RECORD: CHR 234082, *B. H. Macmillan 72/948*, 28 May 1972, Otago, Herbert, Waianakarua River Gorge.
SELECTED ADDITIONAL RECORDS: CHR 570531, *C. C. Ogle 4550*, 18 Dec 03, Whanganui, Fordell, Pōhutukawa Lane, Paloma Gardens; CHR 585617, *N. Gallagher, s.n.*, 11 Oct 2006, Manawatu, Pohangina Valley, corner of No.1 Line and Pohangina Valley East Road; CHR 641276, *C. C. Ogle 6394*, 4 Feb 2016, Whanganui, Kaiiwi, Rangitatau East Road, Bushy Park.
NOTES: Cultivation Escape. Most records of self-establishing seedlings are under native or exotic trees and shrubs, often near original plantings. To limit its spread in Pukeiti Rhododendron Trust gardens in North Taranaki, staff and volunteers remove seed heads soon after flowering. It has potential to become a naturalised plant in the future.

***Lilium longiflorum* Thunb.**
Easter lily

FIRST RECORD: CHR 495411, *P. J. de Lange 2484*, 20 Oct 1993, Cuvier (Repanga) Island, lighthouse settlement.
ADDITIONAL RECORD: CHR 572477, *G. D. La Cock, s.n.*, 16 Aug 2005, Pātea, dunes near river mouth.
NOTES: Garden Discard. On site of old demolished buildings (CHR 495411) or in a green-waste dump (CHR 572477).

POACEAE

***Agrostis nebulosa* Boiss. & Reut.**
cloud grass

FIRST RECORD: Esler (1978).
VOUCHER: AK 216331, *A. E. Esler, s.n.*, 14 Feb 1961, Palmerston North, Massey University
NOTES: Spontaneous Occurrence. A. E. Esler, personal communication to E. K. Cameron, ca 2009, was that

Figure 8. *Festuca trachyphylla*. **A**. Seedlings self-established beside a row of planted specimens, between concrete wall and plastic ground cover, Whareroa, western side of Lake Taupō, on 12 Dec 2015; CHR 641310. **B.** Close-up view of the blade, ligule and sheath. Photos © Colin Ogle

this collection was from a wild plant in the gardens at Massey University. Although Esler (1978) had published the record in his *Botany of the Manawatu*, it is not mentioned by Edgar and Connor (2010). A duplicate specimen, collected by Esler on the same date and from the same place, was received at AK from Esler's personal herbarium in 2014 and accessioned as AK 362961 (E. K. Cameron, personal communication).

***Chimonobambusa marmorea* (Mitford) Makino**
marble bamboo

FIRST RECORD: Edgar and Connor (2010) as a ζ entry.
SELECTED ADDITIONAL RECORDS: CHR 541194, *C. C. Ogle 3783*, 12 Dec 2000, Whanganui, Durie Hill, Purua Stream; CHR 591889, *C. C. Ogle 5225*, 9 Sep 2007, Whanganui; Durie Hill, Purua Stream.
NOTES: Cultivation Escape. Edgar and Connor (2010) noted that this bamboo is "sometimes cultivated, and may spread from there". Beside the Purua Stream in Whanganui it is a vigorously suckering patch 30 m x 50 m extending from the stream bank, up a steep hillslope and into the adjoining garden, with rhizomes extending 10-15 m in a single season. It could not be eliminated from the adjoining garden despite ten years of mechanical and chemical control. The culms are mostly up to 4 m tall and < 10 mm diameter; the brown and white marbled sheaths are distinctive. C. R. Higgie (personal communication) regards it as a very invasive bamboo.

***Festuca trachyphylla* (Hack.) Krajina**
Figures 8A, 8B.

FIRST RECORD: CHR 183883, *G. M. Thomson s.n.*, Jan 1881, Otago, Maungatua, Taieri County.
SELECTED ADDITIONAL RECORDS: CHR 165561, *A. P. Druce s.n.*, Dec 1966, Hawkes Bay, Havelock North, Te Mata Peak; CHR 190089, *A. J. Healy 68/345*, 9 Nov 1968, Central Otago, Taieri R., Kokonga; CHR 641310, *C. C. Ogle 6426*, 15 Dec 2015, Lake Taupo, Whareroa; CHR 656117, *C. C. Ogle 6665 & M. Keys*, 13 Jan 2019; CHR 656128, *C. C. Ogle*, 24 Mar 2019, Whanganui, Maria Place Extension, by fire station.
NOTES: Spontaneous Occurrence and Cultivation Escape. Until March 2019, CHR had filed collections of *F. trachyphylla* under *F. ovina* and *F. glauca*. After Dr Kerry Ford at CHR redetermined several as *F. trachyphylla*, she showed that the species had been collected as early as 1881, probably plants established from pasture seed. A feature of the collections made in 2015-19 is the abundant seedlings that have appeared near garden plantings of these pale grey tussocks. Plants that have been sold in nurseries as *F. glauca* do not appear to set viable seed (CHR 563509, *A. J. Healy 00/69*; K. Ford, personal communication, March 2019) but, perhaps within the past decade, the similar *F. trachyphylla* may have been sold under the name of *F. glauca*. It may yet prove to be quite invasive in dry, sparsely vegetated areas.

***Zea mays* L.**
maize

FIRST RECORD: Edgar & Connor (2010).
VOUCHER: CHR 510874, *F. C. Duguid, s.n.*, 20 May 1976, Levin, beside railway line.
SELECTED ADDITIONAL RECORDS: AK 274836 (originally AKU 18409), *E. K. Cameron 3435*, 19 May 1985, Matamata, near Piako River, north of Matamata; CHR 565711, *G. D. La Cock & C. C. Ogle 4249*, 14 Jan 03, Taranaki, Hāwera, Glover Rd, disused stock sale-yards by 'Taranaki Farmers' store.
NOTES: Spontaneous Occurrence. A ζ entry in Edgar and Connor (2010), where the authors point out that it is unlikely to survive for long out of cultivation. Plants arise from spilled grain or, perhaps, whole grain spread as food for stock or wildfowl.

Discussion

This paper considered 69 taxa of non-native monocotyledons in Manawatu Ecological Region as being new records of adventive plants in New Zealand or as taxa whose adventive status in New Zealand had not been fully documented before. Five of these 69 taxa are considered Naturalised, and the other 64 taxa are considered Casual.

When compared against Healy and Edgar (1980) and Edgar and Connor (2010), 31 of the 69 adventive monocotyledons in MER are New records for New Zealand. Thirty-eight monocotyledon taxa that were new to MER ("Additional records" in list) were first recorded elsewhere in New Zealand. Six of these were ζ records in either Healy and Edgar (1980) or Edgar and Connor (2010). One other, *Carex pendula*, was published in Healy and Edgar (1980), based on a single collection in the South Island.

Naturalised species are those which are already widespread or which we regard as especially aggressive

colonisers, thus having considerable potential to be invasive on a wide scale. Our five naturalised species are *Bomarea multiflora*, *Carex pendula*, *Freesia laxa, Gladiolus carneus*, and *Phragmites karka*.

The remaining 64 species we regard as being Casual. However, several of these Casual species are so well-established locally, and spreading, that they appear to be capable of being invasive on a wider scale, so becoming Naturalised in the future. These include *Cardiocrinum giganteum*, *Chimonobambusa marmorea*, *Dietes iridioides*, *Libertia chilensis, Melasphaerula graminea*, and an unidentified robust *Juncus* species.

The spread of *Cardiocrinum giganteum* is managed in some public and private gardens by removing green seed-heads after flowering. This practice has been adopted by some New Zealand gardeners who grow, but who wish to control, other invasive monocotyledons such as *Lilium formosanum*, *Agapanthus praecox* subsp. *praecox* and *Hedychium gardnerianum.*

Of the New adventive monocotyledon records, 13 were from FED, and 23 from MPED. The majority were Cultivation Escapes and Garden Discards. Three kinds of places dominated the sites where they were found: formal and informal green-waste dump sites; private and public gardens; and wild areas used by gardeners to establish colourful plants from their gardens.

Green-waste dumps, either approved by local authorities, such as seven species in dunes at the Pātea River mouth (Ogle 2002; La Cock 2005), or informal dumping, such as two species at Koitiata near the Turakina River mouth, were sources of widely grown garden plants. These plants established, usually vegetatively, from bulbs, corms and other propagules which had been discarded. Examples are *Sparaxis grandiflora*, *Watsonia aletroides* and *Eucomis comosa*.

Two extensive, private gardens in MPED, where knowledgeable garden enthusiasts are growing species not widely cultivated by the average gardener, provided 44% of our New records. Eleven of these were from near Fordell, east of Whanganui. Nine were from Whanganui city, including three from a garden that once supplied the cut-flower trade (Lighton, 1973). The majority of these established as cultivation escapes within the gardens, but two taxa established vegetatively from green waste placed in a neighbouring paddock. Several other records from MPED were from smaller private gardens around Whanganui. Many of the plants in gardens were self-establishing from seed. *Nolina longifolia*, *Kniphofia caulescens*, *Wurmbea stricta*, *Moraea huttonii* and *M. polystachya* are examples. This finding is in keeping with many of the first collections of naturalised plants in Hawaii, many being from near arboreta, botanic gardens, nurseries or experimental plantings (Wester, 1992). A link between invasive palms and gardens (Meyer, Lavergne, & Hodel, 2008), and other evidence highlights the role that botanic gardens might play in plant invasions across the globe (e.g., Hulme, 2011).

In Northland, New Zealand, Sullivan, Timmins and Williams (2005) showed that the proximity and size of human settlements were the dominant factors controlling the number of exotic plant species into coastal forests. None of the sites where we recorded monocotyledon species discussed in this paper were close to coastal native forest, and we found just two examples inland. Seedlings of *Cardiocrinum giganteum* were about 5 m inside the forest margin at Bushy Park near Whanganui, from a planted specimen in the adjoining garden. *Freesia laxa* naturalised in a native forest remnant, downslope from 'Westoe' gardens in the Rangitikei district, east of Marton.

Of the FED records, only *Moraea huttonii* and *Festuca trachyphylla* were from private gardens. In this dune country, gardens tend to be small and have less variety of plants than on the more fertile terrace soils of MPED.

Some 'wild' areas in FED seem to have been used by gardening enthusiasts as places to establish colourful plants from their gardens. The appearance of several species in the dunes at the western end of Castlecliff Beach, Whanganui can be explained by their being planted initially. Examples are *Watsonia aletroides*, *W. fourcadei* and *Gladiolus carneus*, but they grew with *Dierama pendula*, *Gazania lineata*, *G. rigens, Scilla peruviana*, *Tritonia crocata*, *T. lineata* and *Lampranthus glaucus*, most of which have naturalised and spread from their presumed initial planting sites. Similarly, *Phragmites karka* almost certainly spread in the Rangitīkei River estuary from plantings near Tangimoana.

Of the 69 taxa discussed in this paper, only the grass, *Agrostis nebulosa*, is an annual and it does not appear to have survived in New Zealand. We suggest that perennials are more likely to establish as adventive species, and about 36 of the 69 species have bulbs, corms or fleshy rhizomes that allow them to: survive drought, as in sand dunes or gravel; undergo short-distance expansion of their ranges as the bulbs or corms multiply; be dispersed accidentally, especially in garden waste. Short rhizomes, as in *Iris innominata*, *I. unguicularis* and species of *Moraea*, *Dietes*, *Watsonia* and *Kniphofia*, allow colonies to expand only slowly but they do provide a means for plants to persist over

long periods. Plants with extensive rhizomes can allow more rapid colony expansion, especially the bamboos *Chimonobambusa marmorea* and *Phyllostachys heterocycla*, and the tall reed, *Phragmites karka*.

This paper is the first to be dedicated to additional monocotyledon weeds of a New Zealand region since the publication of Healy and Edgar (1980) and Edgar and Connor (2010), MER covering 417,800 ha is just 1.6% of NZ's mainland area (Wild for Taranaki, 2018). We encourage others to contribute similar treatments of monocotyledons for their ecological regions.

Acknowledgements

We dedicate this paper to the memory of Bill Sykes (1927-2018), a notable botanist at Landcare Research, Lincoln, with a special interest in plants from around the world. Bill was especially helpful in the identification of a number of species in this paper. We thank staff at CHR (especially Ines Schönberger and Bill Sykes; also Kerry Ford and Hamish Maule) and AK (especially Ewen Cameron); we also extend grateful thanks to people who generously allowed us to collect from their properties and provided much help with the names and origins of their plants; in particular, Clive and Nicki Higgie, Ian and Jocelyn Bell. Thanks also to Katie Milne (DOC) for the map. We thank Peter de Lange for extra information about many of the plants in this paper and also for his constructive suggestions for improving the paper. The editor and referees are thanked too, for their useful comments.

Endnotes

1. We include three records from Hāwera in MPED data. Hāwera is in Egmont Ecological Region, < 10 km west of MPED and on similar topography (Figure 1).

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First record of Himalayan wineberry (*Rubus ellipticus* var. *obcordatus* (Franch.) Focke., Rosaceae) in New Zealand

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This publication may be cited as: de Lange, Peter J., Blanchon, D.J., Doyle, E.J., Marshall, A. J., Schönberger, I., Killick, S. (2019). First record of Himalayan wineberry (*Rubus ellipticus* var. *obcordatus* (Franch.) Focke., Rosaceae) in New Zealand, *Perspectives in Biosecurity, 4*, 33–39.

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ISSN 2538-0125

First record of Himalayan wineberry (*Rubus ellipticus* var. *obcordatus* (Franch.) Focke., Rosaceae) in New Zealand

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Introduction

On June 4, 2019, during a visit by two of the authors to Gills Scenic Reserve, Albany, an unusual bramble (Figure 1) was observed emerging from a vegetated roadside bank on Gills Road (-36.722828, 174.696011). The bramble was noted growing amongst a dense tangle of pink jasmine (*Jasminum polyanthum* Franch.), blackberry (*Rubus ulmifolius* Schott) and Chinese privet (*Ligustrum sinense* Lour.). Although no flowering or fruiting material was observed a specimen was collected (*P.J. de Lange 14393 & D.J. Blanchon*, UNITEC 10706) (Herbarium acronyms follow Thiers [2008-onward]), and that specimen was run through the *Rubus* key in Webb, Sykes and Garnock-Jones (1988). Of the species recorded by Webb et al. (1988), the closest match for the Gills Road *Rubus* was Japanese wineberry (*R. phoenicolasius* Maxim.), a species which has superficially similar reddish bristly stems and leaflets whose abaxial surfaces are whitish. However, the Gills Road *Rubus* stem bristles were not glandular; while the leaves of the specimen were 3(-5)-foliolate (rather than 3-foliolate), distinctly coriaceous, (rather than chartaceous); adaxially dark green (rather than yellow-green to lime-green); glabrescent, and deeply rugose. Further, the leaflets of the Gills Road *Rubus* had truncate to obcordate, rather than acute to acuminate, apices and the leaf margins differed from *R. phoenicolasius* in being more finely and evenly serrulate.

Unable to determine its identity, images of the *Rubus* were passed to colleagues, one of whom, Sarah Killick, suggested that the specimens might be *R. ellipticus* Sm. a species not yet known from New Zealand but on the Ministry of Primary Industries (MPI) 'watch list'. Google-based searches confirmed a close match, so the specimens were run through the *Rubus* treatment in the Hawaiian Flora (Wagner, Herbst & Sohmer, 1990). The Gills Road *Rubus* matched the description of *Rubus ellipticus* var. *obcordatus* (Franch.) Focke in all respects. Accordingly, images were sent to the Allan Herbarium (CHR) where they were examined alongside Hawaiian (Hawaii, Kilauea area, near Devastation Trail, *W.R. Sykes 322/91*, CHR 474161; Hawaii, 27 miles, Volcano, *Otto Degener s.n. & Isa Degener*, CHR 380402; Hawaii, Near Laukapu Street & Wright Road, 27 Miles, Puna, *Otto Degener s.n. & Isa Degener,* CHR 182980), Himalyan (Nepal, Solu Khumbu, Dudh Kosi Catchment, Between Lukla & Surkhe, *W.R. Sykes 92/00*, CHR 537362), and Sri Lankan (Sri Lanka, Nuwara Eliya, surrounding hills, *C.F. & R.J. van Beusekom s.n.*, CHR 305441) specimens of *Rubus ellipticus* by Ines Schönberger, who confirmed the identification as "very likely". A subsequent search of *Rubus* postings on iNaturalist NZ also located another earlier (August 7, 2018) observation of *R. ellipticus* from the same location (https://inaturalist.nz/observations/15185681) that had been made by Harshi Tharaka, a contract worker for Wildlands, an environmental consultancy (M. Ford, personal communication, Wildlands Consultants Ltd, August 21, 2019) whilst doing a weed survey. That find, though correctly identified by iNaturalist respondents, is unsupported by a voucher, and had gone unnoticed by the relevant agencies until we drew their attention to it.

A further visit to Gills Road on June 8, 2019 collected additional specimens including flowering material (*P.J. de Lange 14395*, UNITEC 10775) and samples for DNA sequencing. DNA was extracted using DNeasy Plant Mini Kits (Qiagen, Germany) and following the manufacturer's instructions. The primer pairs rbcL-1F (5'-ATG TCA CCA CAA ACA GAA AC-3') and rbcL-724R (5'-TCG CAT GTA CCT GCA GTA GC-3') were used for amplification of the rbcL cpDNA region (Bafeel et al., 2012) and ITS-u1 (5'-

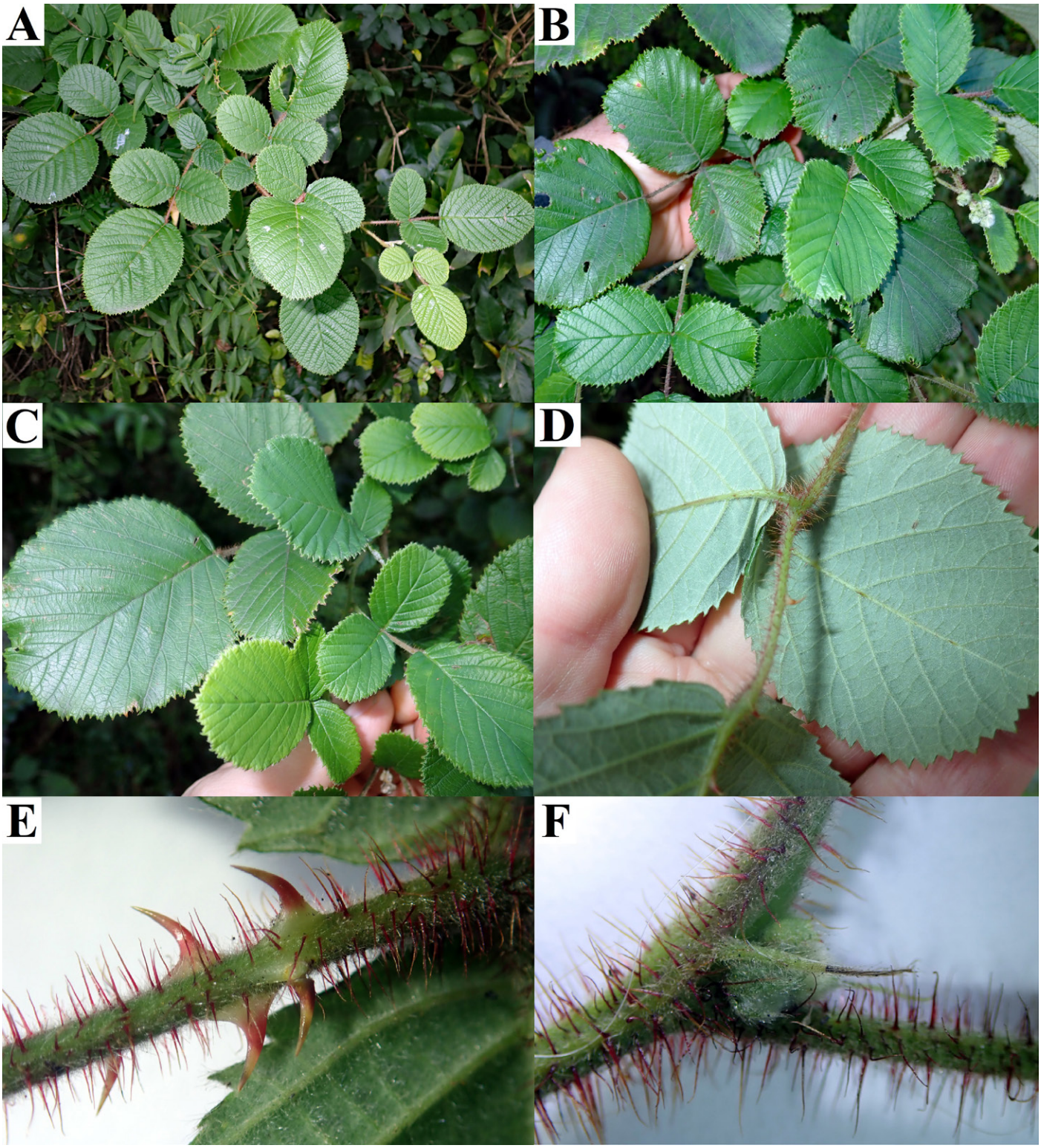

Figure 1 A-F. *Rubus ellipticus*, Gills Road, Albany. **A**. Primocane emerging from surrounding vegetation showing 5-foliolate leaves (an unusual condition in this species); **B**. Floricanes, showing an immature inflorescence, and the more usual 3-foliolate leaves, note the dark green, deeply rugose adaxial leaflet surfaces; **C**. Leaves (adaxial surface), note the elliptic truncate leaflets and the finely denticulate lamina; **D**. Leaves (abaxial surface) showing the paler whitish-green, finely velutinous leaflet surface, sparingly armed mid vein and rounded leaflet bases; **E**. Portion of stem showing prickles interspersed with red-purple bristles, sparse glandular and dense covering of finer hyaline trichomes; **F**. A portion of floricane showing stipule, and young vegetative bud. Images: P. J. de Lange

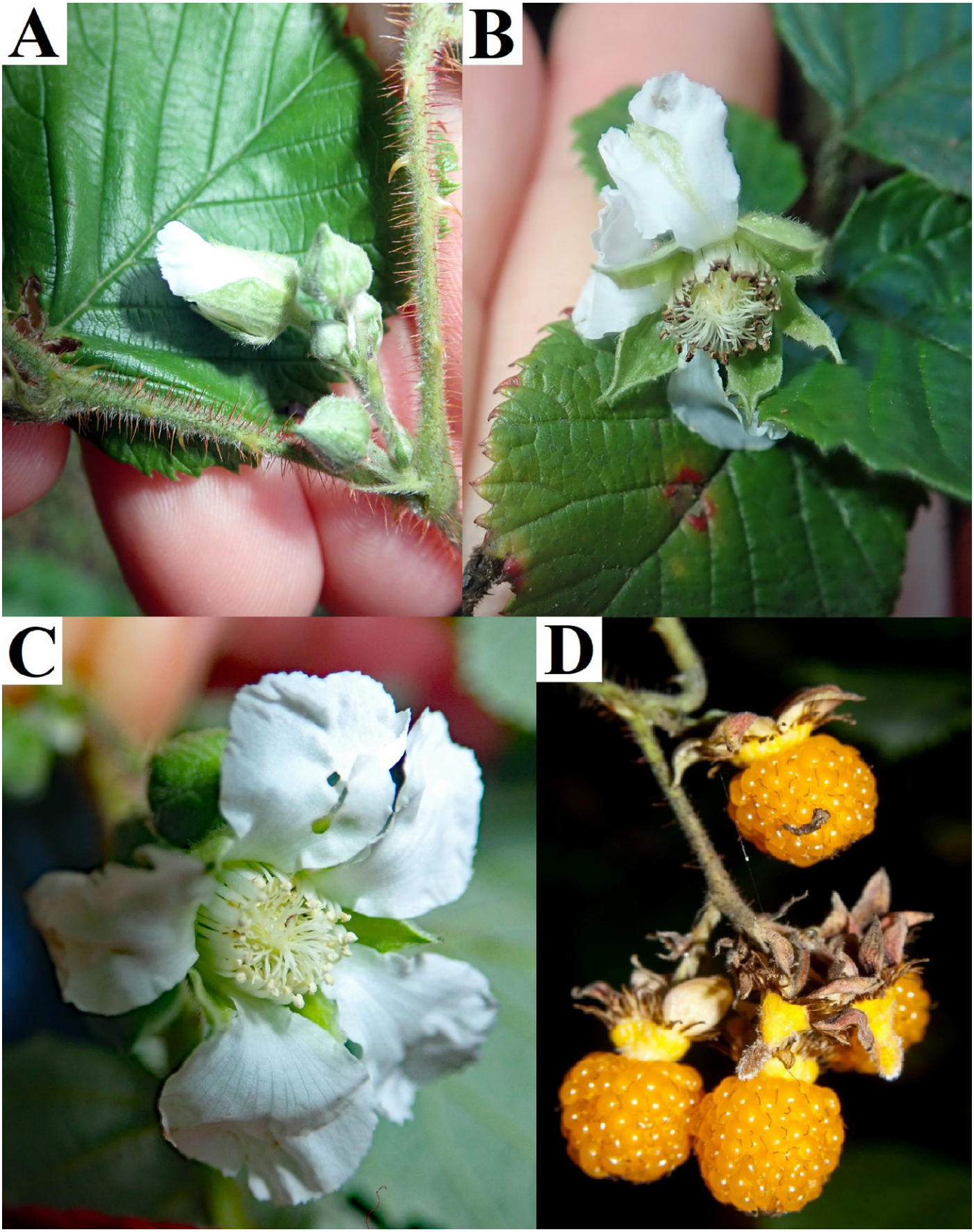

Figure 2 A-D. *Rubus ellipticus*, Gills Road, Albany. **A**. Maturing axillary inflorescence; **B**. Senescent flower showing spathulate petal with praemorse apices; **C**. Freshly opened flower; **D**. Ripe fruit. Images: P. J. de Lange, except for **D**, taken by 'the plant hunter' (see https://www.flickr.com/people/sferox/)

GGA AGK ARA AGT CGT AAC AAG G-3') and ITS-u2 (5'-GCG TTC AAA GAY TCG ATG RTT C-3') were used for amplification of the Internal Transcribed Spacer (nrDNA ITS) region (Cheng et al., 2016). Comparison of the resulting DNA sequences (Genbank accession numbers MN726349 (cpDNA rbcL) and MN718726 (nrDNA ITS)) with published sequences confirmed the identity of the *Rubus* as *R. ellipticus*. Accordingly, the find was reported to MPI who independently confirmed our findings (Laura Goudie, personal communication, Ministry for Primary Industries, Biosecurity, August 6, 2019).

Here we provide a description of *Rubus ellipticus* var. *obcordatus* based on Gills Road specimens, and describe the habitat to formally document the discovery as a new addition to the naturalised flora of New Zealand.

Taxonomy

Rubus ellipticus* var. *obcordatus (Franch.) Focke. *Biblioth. Bot. 17(Heft 72)*:199. 1911 (Sp. rub. 199.)

DESCRIPTION (FIGURES 1, 2): Stout, weakly climbing, evergreen shrub; stems 3–5m long, forming thickets several metres wide, primocanes erect, initially purple-brown maturing brownish, ±pubescent, densely invested with purple-brown or purple-red eglandular bristles, pale hyaline and sparse short glandular trichomes, armature mostly sparse, sometimes locally aggregated, glabrous prickles, these spreading or curved, up to 6mm long; floricanes initially greenish, maturing purple-brown, sparsely to moderately pilose with similar investiture to primocanes; bearing sparse, stout, straight to recurved prickles up to 6mm long, and more frequent smaller 3-4mm long, slender, spreading prickles. Leaves persistent, imparipinnate, coriaceous, leaflets 3(-5)-foliolate; petiole 20-40mm long, petiolules of lateral leaflets, subsessile sometimes up to 10mm long, those of terminal leaflet 20-30mm long; petiolule and rachis purple-red, bristly, pubescent, with sparse minute prickles; stipules proximally pale green with distal portion darker purple-green, linear to narrowly linear deltoid, 7-11 ×1-3mm, finely pubescent, with intermixed glandular hairs (these increasing in frequency toward apex); leaflets elliptic to broadly obcordate, 40-80(-90) × 30-60(-90) mm, terminal leaflet largest (60-80(-120) × 60-90mm) with those of primocanes often smaller; adaxial leaflet surface dark green, deeply rugose, sparsely pilose, glabrescent, abaxial surface initially whitish maturing green-white, finely, densely velutinous, pilose, bearing purple-red bristles along veins, adaxially veins impressed, pubescent along midvein midrib bearing sparse, stout recurved prickles and smaller straight ones; leaflet base rounded, margin minutely unevenly serrulate, teeth acute; apex acute, abruptly pointed, shallowly cordate, emarginate or subtruncate. Inflorescences terminal, in dense, short panicles 50-80 × 20-60 mm, flowers (2-)5-10(-16) per inflorescence, or present as few-flowered, often paired (rarely solitary) flowers borne in leaf axils; rachis and pedicles greenish, pubescent, furnished with fine purple bristles and sparse straight or recurved short (0.8-1.5mm long) prickles; bracts green, green brown to purple-green, linear, 5-8 finely pubescent. Pedicels 4-6(-8)mm long. Flowers 10-15mm diameter. Calyx abaxially pubescent, tomentum pale yellow, velutinous, sparsely furnished with pale purple bristles; sepals ovate, 4-5(-6) × 2-3(-4) mm, abaxially pale yellow-grey tomentose, with sparse pale purple bristles, apex abruptly acute, sometimes ±acuminate. Petals white, ± spathulate,7-9 × 8-10mm, equal to or longer than sepals, margin praemorse, ± undulose, base clawed. Stamens numerous, shorter than petals; filaments broadened and flattened basally, anthers cream. Ovary pubescent; styles glabrous, slightly longer than stamens. Fruits not seen.

SPECIMENS SEEN: New Zealand: North Island, Auckland, Albany, Gills Road: *P.J. de Lange 14393 & D.J. Blanchon*, UNITEC 10706; *P.J. de Lange 14395*, UNITEC 10775.

NOTES: New Zealand plants are referable to *Rubus ellipticus* var. *obcordatus*, which differs from the type in having obcordate to truncate rather than acuminate leaflets (Wagener et al. 1990). This variety is indigenous to tropical and subtropical continental Asia (China, Nepal, India) as well as Sri Lanka and the Philippines (Becking, 1979; Wagner et al., 1990), However, it is widely naturalised throughout tropical Africa, Australia, Ecuador, Jamaica, Costa Rica and the Hawaiian Islands (Becking, 1979; Parmar & Kuashal, 1982; Wagner et al., 1990).

Of those *Rubus* recorded as naturalised from New Zealand, *R. ellipticus* var. *obcordatus* is, as previously noted, superficially similar to Japanese wineberry (*R. phoenicolasius*). From that species it is easily distinguished by the darker green, deeply rugose, more finely serrated elliptic leaves with obcordate to truncate rather than acuminate leaflets; primocanes and floricanes furnished with purple to purple-brown, purple-

red eglandular bristles, linear to narrowly deltoid linear stipules, and flowers with white obovate to spathulate petals with praemorse apices. At the time of the discovery fruiting material was not present, however, the aggregate fruits of *Rubus ellipticus* are comprised of golden yellow rather than orange-red or dark red drupelets.

To date, *Rubus ellipticus* var. *obcordatus* is only known from private land in the vicinity of Gills Scenic Reserve and from a small area along Gills Road. In that area 14 individuals were noted during inspections by the first author. These specimens ranged in height from 1–5 metres with the tallest individuals having their growth supported by the surrounding vegetation. Most of the vines grow admixed within a heterogeneous assemblage of blackberry (*Rubus ulmifolius*), pink jasmine (*Jasminum polyanthum*), Chinese privet (*Ligustrum sinense*), tree privet (*L. lucidium* W.T.Aiton), mahoe (*Melicytus ramiflorus* J.R.Forst et G.Forst. subsp. *ramiflorus*), karamu (*Coprosma robusta* Raoul) and *C. macrocarpa* subsp. *minor* A.P.Druce ex R.O.Gardner et Heads × *C. robusta* Raoul.

Subsequent, more comprehensive searching of the area by MPI did not find any further specimens growing in the Gills Scenic Reserve.

Acknowledgements

The authors would like to thank Laura Goudie and Brian Quinn of MPI (the latter formerly so) for additional information on the extent of *Rubus ellipticus* var. *obcordatus* at the Gills Road site. Marley Ford provided us with information about the circumstances behind the August 2018 iNaturalist NZ observation of *Rubus ellipticus*.

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Ines Schönberger is the Collection Manager of the Allan Herbarium, Manaaki Whenua Landcare Research. Through her undergraduate and graduate studies at the University of Regensburg, Germany, she developed a strong botanical knowledge, with specific interests in taxonomy, systematics and ecology. During her PhD research about the biosystematics and taxonomy of the *Ozothamnus leptophyllus* (Compositae) complex in New Zealand at the University of Canterbury, Christchurch, she gained a good understanding of the New Zealand flora. Her current role involves protecting, enhancing and promoting the Allan Herbarium, and maintaining it as a useful scientific resource.

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TE WHARE WĀNANGA O WAIRAKA

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)
- All graphic imagery permissions have been attained and appropriately attributed to the source
- 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.
Tables: Each table should be on a separate page after the reference section, numbered with Arabic numerals, in the same order as they are referred to in the text of the paper, and with a short title at the top. Please do not use vertical lines. Horizontal lines should only be used at the top and bottom of the table and between the headings and the body of the table.
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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Process

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.