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## Vascular flora of Norfolk Island: some additions and taxonomic notes

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**Abstract** A total of 75 taxa (including 1 hybrid) are reported as new to the flora of the Norfolk Island group, in the south-west Pacific Ocean. Of these 1 is endemic (*Achyranthes margaretarum*), and 10 (2 pteridophytes, 8 anthophytes) taxa are

considered indigenous and appear to represent either new natural long-distance colonisations of Norfolk Island group from Australia and New Zealand or are new identifications of indigenous taxa either treated under other indigenous names or as naturalised in the Norfolk Flora. The remaining 64 taxa are considered naturalisations from resident gardens, or recent arrivals via human traffic from Australia or New Zealand. Aside from these records we discuss and update information on a further 27 taxa either covered by the last Norfolk Island flora treatment, or noted in subsequent works. A new species, *Geranium gardneri*, is described and treated as indigenous to Australia and naturalised in Norfolk I. and New Zealand. *Nephrolepis flexuosa* is reinstated for the non-tuberous, high-polyploid fern previously included within a broad circumscription of *N. cordifolia*, and which is indigenous at least to Norfolk I., Raoul I., Lord Howe I., New Zealand, and Fiji. The new combination *Boehmeria australis* subsp. *dealbata* is made for the Raoul I. (Kermadec Islands group) endemic, and *Elymus multiflorus* subsp. *kingianus* for the Norfolk and Lord Howe Island wheatgrass. The New Zealand *Cordyline kaspas* and Raoul I. *Rhopalostylis cheesemani* are relegated to synonymy within the Norfolk I. *Cordyline obtecta* and *Rhopalostylis baueri*, respectively, which are now no longer considered endemic. *Dianella intermedia* and *Pennantia endlicheri* are treated as endemic to Norfolk I. and *Senecio australis* as indigenous. Two species, *Ipomoea cairica* and *Oxalis exilis*, previously treated as naturalised are recognised as indigenous, while *Homalanthus populifolius* is now considered naturalised and so is excluded from the indigenous flora. A new treatment for Norfolk I. *Oxalis* Sect. *Corniculatae* is offered, and three of the four taxa reported from the island group but treated by the current flora as part of *O. corniculata* sens. lat. are recognised at species rank. Of these we consider only one, *O. exilis*, to be indigenous, and treat *O. choonodes* and *O. radicata* as probably naturalised. We also report the first naturalised occurrence of *O. corniculata* sens. str. from the island group and exclude *O. perennans* from the

flora. *Isolepis cernua* var. *setiformis* is recognised for the Norfolk I. *Isolepis* previously treated as probably endemic and unnamed.

**Keywords** Norfolk Island group; vascular flora; taxonomy; *Geranium*; *G. gardneri*; new species; *Nephrolepis flexuosa*; reinstated name; *Boehmeria*; *Boehmeria australis* subsp. *dealbata*; *Elymus*; *Elymus multiflorus* subsp. *kingianus*; new combinations; *Cordyline*; *C. obtecta*; *C. kaspar*; *Rhopalostylis*; *R. baueri*; *R. cheesemani*; synonymy; typification; new records; taxonomic notes; Australian Flora Series

## INTRODUCTION

Visits by five of us to Norfolk Island over the last 27 years have produced a number of additions to the flora since the publication of the Flora of Norfolk Island (Green 1994). The majority of these plants are either garden escapes or cosmopolitan weeds, but a few are considered indigenous to Norfolk Island and so have more biogeographical interest, particularly with respect to their ability to disperse and establish under present-day conditions. A number of taxonomic and nomenclatural changes, and some points where our taxonomic interpretation differs from that of Green (1994), are also presented.

## MATERIALS AND METHODS

Voucher specimens are mostly held in the herbarium of the Auckland War Memorial Museum (AK) and the Allan Herbarium, Lincoln (CHR). Two of the fern collections cited in this paper are held only by the herbarium of the Australian National Parks & Wildlife Service, Kingston, Norfolk I. This is without an official acronym, and is called here "Herb. ANPWS". Other herbarium abbreviations follow Holmgren et al. (1990).

The term "Norfolk Island group" refers collectively to the island of this name and the two adjacent smaller islands, Nepean and Phillip. Where only the large island is meant this is termed "Norfolk I."

Families are arranged according to the recommendations of the Angiosperm Phylogeny Group (APG II 2003). However, for convenience we retain the traditional Dicotyledonae and Monocotyledonae divisions of the Angiosperms.

Where possible we have also provided the Norfolk I. vernaculars for the taxa discussed in this paper.

## TAXONOMY

### New species

*Geranium* L., *Sp. Pl.* 2, 676 (1753)

TYPE SPECIES: *Geranium sylvaticum* L. (fide Green 1994, p. 258).

*Geranium gardneri* de Lange, sp. nov.

DIAGNOSIS: *Geranium gardneri* a *G. solanderi* Carolin radice palari cylindrica (gradatim) contracta, foliis divisoribus (et) adaxiale valde pubescentibus, pilis longis curvatis retrorsis in petiolo et pedicello, (et) petalis parvioribus adscendentibus alveolisque dorsalibus seminum plerumque 4–6 (lateribus) differt.

*Geranium gardneri* differs from *G. solanderi* Carolin by the cylindrical, tapering taproot, less divided leaves adaxially markedly pubescent, by the long hairs of the petiole and pedicel curved, retrorse, and ascending, smaller petals, and by the dorsal alveolae of the seed mostly 4–6 sided.

HOLOTYPE (Fig. 1): AK 151759, *R. O. Gardner* 2712, 18 Apr 1980, New Zealand, Great Barrier Island, Tryphena Scenic Reserve, "c. 270 m, abundant on grassy open ridge".

DESCRIPTION: Perennial herb; taproot cylindrical tapering distally, to c. 15 mm diam., flesh red-brown becoming paler internally; caulorrhiza short, thick, bearing spirally arranged basal leaves and long axillary procumbent to weakly ascending flowering stems. Pubescent on all parts; the longer hairs pointed, curved, often with prominent raised base; glandular hairs short-stalked, inconspicuous (or absent). Basal leaves with paired narrow triangular stipules; petiole terete, seldom pink distally, to c. 200 × 15 mm diam., densely pubescent especially distally, the long hairs rather coarse, curved, usually 0.7–1.2 mm long, retrorse but never appressed, shorter straight and crisped retrorse hairs also present. Lamina ± orbicular in outline, to c. 60 mm diam., seldom pink on margins and abaxial veins; lobes moderately deep, usually 5 or 7 per leaf, obovate; larger lobes with (3–)5(–7) teeth; median and larger lateral teeth oblong to broad-triangular, c. 1.7:1 length: breadth, obtuse to subacute, mucronate. Lamina pubescent above, marginally and below, hairs curved c. 1 mm long, antrorse, with raised bases marking the lamina finely tuberculate. Flowering stems glabrescent with age, hairs as for petioles. Cauline leaves opposite, as basal leaves but smaller, usually 3 or 5 lobes per leaf; teeth 3(–5) per lobe, subacute. Flowers twinned (occasionally single if early or late in season); peduncle and pedicel hairs as petioles.

**Fig. 1** Holotype of *Geranium gardneri* (R. O. Gardner 2712, AK 151759).



Sepals 5, enlarging in fruit, then ovate, outer sepals c.  $4.5 \times 2.75$  mm not including an awn usually 1–1.2 mm long, inner sepals slightly narrower. Sepals abaxially pubescent, hairs to c. 1.2 mm long, curved, antrorse and ascending, most prominent near outer margins; shorter hairs elsewhere, glandular hairs few and inconspicuous (or absent). Petals 5, pale pink, obovate, weakly emarginate, c.  $5 \times 3.5$  mm; expanded corolla c. 8 mm diam. Stamens 10, to c. 3.5 mm long, dehiscence lines of anther purple,

pollen pale yellow. In fruit mericarps dark brown, smooth, pubescent; rostrum to c. 13 mm (including stigmata), pubescent, those hairs greater than 0.6 mm occasionally along full length of rostrum and usually plentiful at apex. Seed globular-oblong, c.  $1.8$  mm long  $\times$   $1.3$  mm diam., dark red-brown to almost black; dorsal alveolae deep, usually 4(–6) sided c.  $0.2 \times 0.13$  mm. Chromosome number:  $n = 26_{II}$  (de Lange et al. 2004),  $2n = 52$  (P. J. de Lange & B. G. Murray unpubl. data).

RECOGNITION: Distinguished from *G. solanderi* Carolin by the cylindrical tap root, considerably less divided leaves which are pubescent above, by the long hairs of the petiole and pedicel, these being curved, retrorse, and ascending, by the smaller (<6 × 4 mm) pale pink petals, and by the seeds whose dorsal alveolae are mostly 4–6 sided and ≤0.13 diameter. In contrast *G. solanderi* sens. str. has a napiform taproot, the upper surface of the heavily divided leaves is glabrous to sparsely pubescent, except for a 1–2 mm wide marginal band of hairs, and the long hairs of the petiole and pedicel are straight, and patent. The conspicuous rose-pink petals are >7 × 4 mm. The alveolae of the seeds are mostly 5–6 sided, ± isodiametric, 0.15 mm diameter. *G. gardneri* is perhaps closer to *G. homeanum* Turcz.; the leaf hairs of *G. gardneri*, for example, are occasionally tuberculate (those of *G. homeanum* are always so). However, it differs from that species by its smaller size, leaves which are hardly (if ever) reddish purple and absence of a carrot-like odour. *G. homeanum* has median tooth lobes which are about as long as broad while the inner sepals of the mature fruit are mostly elliptic-obovate, < 3 mm wide. In New Zealand and Tasmania, *G. gardneri* is frequently sympatric with *G. homeanum*, from which it remains distinct. Based on seed morphology, Webb & Simpson (2001) noted that *G. gardneri* was most similar to *G. potentilloides* L'Hér. ex DC (see comments below).

REPRESENTATIVE SPECIMENS: NORFOLK ISLAND: *R. M. Laing*, s. loc., CHR 335869; Top of Mt Bates, *P. Ralston* 89, K. AUSTRALIA: NEW SOUTH WALES: Armidale, *R. G. Wilson* AR9, 4 Mar 1948, CANB. AUSTRALIAN CAPITAL TERRITORY: Tidbinbilla Fauna Reserve, *N. T. Burbidge* 7737, 20 Feb 1969, CANB; Brindabella Range, Five Fords, *M. Gray* 5942, 14 Apr 1966, CANB; Richmond River, *H. C. Fawcett* 193, 1876, MEL 2289239. VICTORIA: Gattamurh Gap, *J. H. Willis* s.n., 25 Feb 1962, MEL 2239238; Mt Dundas, 25 km NE of Cavendish, *I. C. Clarke* 2583, 26 Oct 1995, MEL 2028999; Wonnangatta Station, *E. A. Chesterfield* 3608, 6 Jan 1993, MEL 2018133 (duplicates in CANB, NSW); near Myrtleford, *M. Gray* 5846, 17 Dec 1965, CANB. NEW ZEALAND: THREE KINGS ISLANDS: Great Island, *G. T. S. Baylis*, 21 Feb 1934, AK 23041. NORTH ISLAND: Spirits Bay, Pandora, *H. Carse*, Dec 1926, CHR 330263; Bay of Islands, Opito Bay, *A. E. Orchard* 3486, 9 Oct 1972, AK 130776 (duplicates in AD, CHR, MO); Mahurangi Heads, *D. Petrie*, Oct 1901, WELT 30995; Auckland, *A. Sinclair*, (fl. 1841–1861), K; Auckland, near Mt Albert, *A. E. Esler*, 19 Jul 1971,

CHR 223656; Auckland, Mt Wellington, *R. O. Gardner*, 3 May 1978, AK 144048; near Thames, Rocky Point, *A. P. Druce*, Mar 1972, CHR 245656–8; Bay of Plenty, Te Teko, Tahuna Road, *P. J. de Lange* 6442 & *P. B. Cashmore*, 12 Apr 2005, AK 289787; East Cape, Hicks Bay, *M. Heginbotham*, Nov 1977, CHR 368303; Wellington, Tawa, *P. J. de Lange* 1903, 11 Dec 1992, CHR 482969. SOUTH ISLAND: Nelson, Mackay's Bluff, *R. O. Gardner* 2775, 16 Nov 1980, AK 152462; Christchurch, Port Hills, *Lothian*, Dec 1936, K.

EYMOLOGY: The epithet *gardneri* honours Rhys Owen Gardner (1949–), Research Associate, Auckland Museum Herbarium (AK), who first recognised the species, collected it widely, cultivated it, studied its reproductive behaviour and furnished the first botanical description as *G. solanderi* 'coarse hairs'.

COMMENTS: A well marked and distinctive species that was first recognised from New Zealand by Gardner (1984) who treated it informally within *Geranium solanderi* as *G. solanderi* "coarse hairs". Gardner (1984) used an informal treatment because, although it remained distinct in New Zealand, based on an assessment of Australian herbarium specimens he considered that "coarse hairs" graded into *G. solanderi* sens. str. (treated in that paper as *G. solanderi* "large petals"). A subsequent revision of the *G. solanderi* complex for the Flora of Victoria series by Smith (1994) and Smith & Walsh (1999) has shown that Australian specimens perceived by Gardner (1984) to be intermediate are additional allied entities warranting in their opinion species rank. That work, based on morphological and chemical distinctions, also recognised *G. gardneri* which was referred to as an unnamed variant, "*G. sp. 4*". Independently, an as yet unpublished analysis of nrDNA Internal Transcriber Spacer (ITS) sequences of New Zealand geraniums (*R. C. Gardner*, *D. J. Keeling*, and *P. J. de Lange* unpubl. data) determined that *G. solanderi* sens. str. (GenBank Accession number AY752467) and *G. gardneri* (as *G. solanderi* "coarse hairs", GenBank Accession Number AY752468) showed no close affinity, with *G. solanderi* sens. str. being nested within a clade involving *G. retrorsum* L'Hér. ex DC., and *G. gardneri* with *G. potentilloides*, a result which has independent support from an analysis of seed morphology (Webb & Simpson 2001). In New Zealand, as observed by Gardner (1984), *G. solanderi* sens. str. and *G. gardneri* are sympatric, though *G. gardneri* tends to occupy urban and more "weedy" sites. Artificial hybrids between *G. solanderi* sens. str. and *G. gardneri*, though freely produced, when selfed exhibited reduced fertility

(see Gardner 1984, p. 133). Excluding those intermediates recognised by Gardner (1984) from Australia and given informal species rank elsewhere (Smith 1994; Smith & Walsh 1999), there seems to be no field evidence of hybridism in Australia or New Zealand. On Norfolk I. *G. gardneri* seems to be the only species of the *G. solanderi* complex (*sensu* Smith 1994; Smith & Walsh 1999) present, and we agree with Green (1994, p. 259) that it is naturalised there. However, we dispute his statement that this species is indigenous to New Zealand. This comment may have come from statements made by Webb et al. (1988) who, following Gardner (1984), treated *G. gardneri* as *G. solanderi* “coarse hairs”, noting at the time that it was a well-marked variant within the otherwise indigenous *G. solanderi*. The first New Zealand collections were made sometime between 1841 and 1861 from the port of Auckland, after which time it remained uncommon and confined to mainly urban or recently disturbed pastoral lands of northern New Zealand until the early 1900s. Since then the species appears to have rapidly expanded its range, such that it is now widespread throughout the North Island and adjacent offshore islands, and is locally common in the northern third of the South Island from where it seems to be actively spreading south (cf. Gardner 1984, pp. 132–133).

### Reinstated name

*Nephrolepis flexuosa* Colenso, *T.N.Z.I.* 20, 231 (1888) Pop Rock fern

TYPE COLLECTION: Colenso (1888, p. 232) indicated that several collections were made from the “banks of a hot stream at Tapuaehururo, near Taupo township; and in the neighbourhood of hot springs at Wairakei, near the river Waikato, west bank; both places in the county of East Taupo; 1887: *Mr C. J. Norton*”. Furthermore Colenso (1888, p. 232) added that “My first specimens I received from the interior (exact locality unknown), in 1861”.

NEOTYPE (here designated) (Fig. 2): K!, com. *W. Colenso 5/1890*.

NOTES: As was customary of that time Colenso (1888, pp. 231–233) did not indicate a type, and because he made it clear that there were several gatherings of his new species “I have received a quantity of good specimens from Mr Norton” prior to his formal description, typification is necessary. However, despite a thorough search of Colenso’s herbarium at WELT or K, and also of those herbaria known to hold Colenso specimens (AK, BM, CHR, MEL) we have only been able to locate two suitable

collections for this purpose. The first of these at K is without collector, but is labelled in Colenso’s hand “*Nephrolepis flexuosa* Col., Trans. N.Z. Instit., vol. xx com. *W. Colenso 5/1890*”, and annotated by P. J. Brownsey “Type”, while the second, in the Colenso herbarium (WELT P3085) lacks a Colenso label but has been annotated “*Nephrolepis cordifolia* Wairakei, Taupo, *Norton*” by T. F. Cheeseman. Both specimens have their limitations; that at K, although labelled by the naming author Colenso, does not match the protologue as to date, collector, or either of the locations he specified, while WELT P3085, though matching the protologue as to collector and location, is labelled by Cheeseman, and does not match his protologue as to date or name, so we cannot be completely certain that it was handled by Colenso. Accordingly, in the absence of any clear, unambiguous choice for lectotype, we designate the specimen at K as neotype because it bears the species name “*Nephrolepis flexuosa*” in the describing author’s hand.

DESCRIPTION: Rhizomes black to coffee-brown, short, erect, densely clad in old stipe ends, stoloniferous. Stolons without tubers. The basal portions of stipes and stolons densely clad with linear-lanceolate, attenuate brown, red-brown to light brown scales; these with short basal processes and denticulate margins. Fronds pinnate, at first erect but tending to droop with age (very rarely pendulous), (0.1–)0.8–1(–1.5) m × (10–)20(–50) mm (including stipes); yellow-green to dark green, narrowly lanceolate, gradually tapering toward apex; rachis bearing subulate to linear scales with dark circular bases, margins fringed with many unevenly placed short hair-like processes. Pinnae in 50–60(–80) or more pairs, deltoid-oblong or oblong, subsessile, closely adjacent and overlapping rachis, glabrescent (rarely with a few fine hair-like scales), unequally cordate at base, often with an enlarged basal auricle. Sterile pinnae (5–)10–15(–25) × (4–)6(–10) mm; margins entire to subentire, often crenulate or very rarely serrated towards the obtuse apex. Fertile pinnae distinctly shorter, margins crenulate (rarely serrated). Sori submarginal, in regular rows on either side of the costae, indusia reniform, opening toward pinna apex. Spores (*vide* Large & Braggins 1991) monoletic, bilaterally symmetrical, polar axis (18–)22(–27) μm, equatorial axis (24–)35(–43) μm, tubercula dense, often anastomose, absent from convex area of the laesura. Chromosome number:  $n = 82_{II}$ ,  $2n = 164$  (de Lange et al. 2004, AK 282601!; P. J. de Lange unpubl. count).

REPRESENTATIVE SPECIMENS: FIJI: *B. S. Parris 12037*, AK 289583. NORFOLK ISLAND: *R. M. Laing s.n.*, 1912, CHR 335995; Pop Rock, Mt Bates, *F. C. Allen s.n.*, 1943, CHR 226371; north side of Mt Pitt, beside Duncombe Road, *W. R. Sykes Norfolk 110*, 23 Oct 1971, CHR 224269; north side of Mt Bates, *R. C. Chinnock NK 19*, 4 Dec 1971, CHR 229639; Pop Rock, Mt Pitt, *W. R. Sykes NI 935*, 1 Dec 1987, CHR 459476. LORD HOWE ISLAND: Mt Gower, *W. R. B. Oliver*, 9 Nov 1913, WELT P1123; Mt Lidgebird, *R. J. Chinnock*, 3 Dec 1968, WELTU 7780; NE side of Intermediate Hill, Blinkenthorpe Bay, Muttonbird Point, *Downs, Conn, Brown & Hutton*, 10 Nov 2000, CHR 525614. KERMADEC ISLANDS (RAOUL ISLAND): Denham Bay, *W. R. B. Oliver*, 23 Jan 1908, CHR 290970; Denham Bay, *J. H. Sorenson*, 1944, CHR 55390; Road to Fishing Rock, *R. C. Cooper*, 5 Jun 1956, AK 44243; Hutchinson's Bluff Ridge, *W. R. Sykes 422/K*, 16 Dec 1966, CHR 176148. NEW ZEALAND: Waimangu Thermal Valley, *J. M. Glime 12283 & Z. Iwatsuki*, 17 Jul 1988, AK 232904; Waikite Valley, *C. E. Ecroyd*, 31 Jul 1976, CHR 303507; Lake Rotomahana, *W. R. B. Oliver*, 23 Apr 1916, WELT P1120; Waiotapu, Otumakokori, *T. Kirk*, Mar 1872, WELT P7115; Tapuaecharuru, *A. Hamilton*, 1880, WELT P7111; Wairakei, Geysers Valley, *D. R. Given*, Jul 1976, CHR 323312; Taupo, Wairakei, Craters of the Moon (Karapiti), *C. Hills*, 24 Aug 1985, WAIK 6781; Taupo, Tokaanu, Tokaanu Geothermal Reserve, *P. J. de Lange s.n.*, 6 Jan 1987, WAIK 7203.

DISTRIBUTION: Known with certainty from Norfolk, Lord Howe, and Raoul Islands, and from the North I. of New Zealand. Also present on Fiji. In the North I. of New Zealand it is confined to geothermally active ground within the Taupo Volcanic Zone, from Kawerau and the Rotorua Lakes district south to Lake Taupo, where it reaches a world southern limit at Tokaanu.

RECOGNITION: A distinctive species that has usually been included within a broad circumscription of *Nephrolepis cordifolia* (L.) C. Presl. From *N. cordifolia*, *N. flexuosa* can be distinguished by its more gracile stature, absence of root tubers, usually smaller, narrower, straight-sided fronds, larger spores (see Large & Braggins 1991), and by its distinctive chromosome number:  $2n = 164$  in *N. flexuosa*,  $2n = 82$  in *N. cordifolia* (de Lange et al. 2004, p. 884, fig. 1D). Identification problems seem to occur when depauperate plants of *N. cordifolia* are collected, as these sometimes lack tubers. In these situations spore measurements and, if material is fresh, chromosome counts can reliably separate the two species. In New

Zealand and Norfolk Island *N. flexuosa* is sympatric with but remains distinct from *N. cordifolia* which is introduced to both locations. Outside these islands *N. flexuosa* is common on Raoul Island (Sykes & West 1996) where it is widely sympatric with *N. hirsutula*, and it is apparently the only species present on Lord Howe I. (Green 1994).

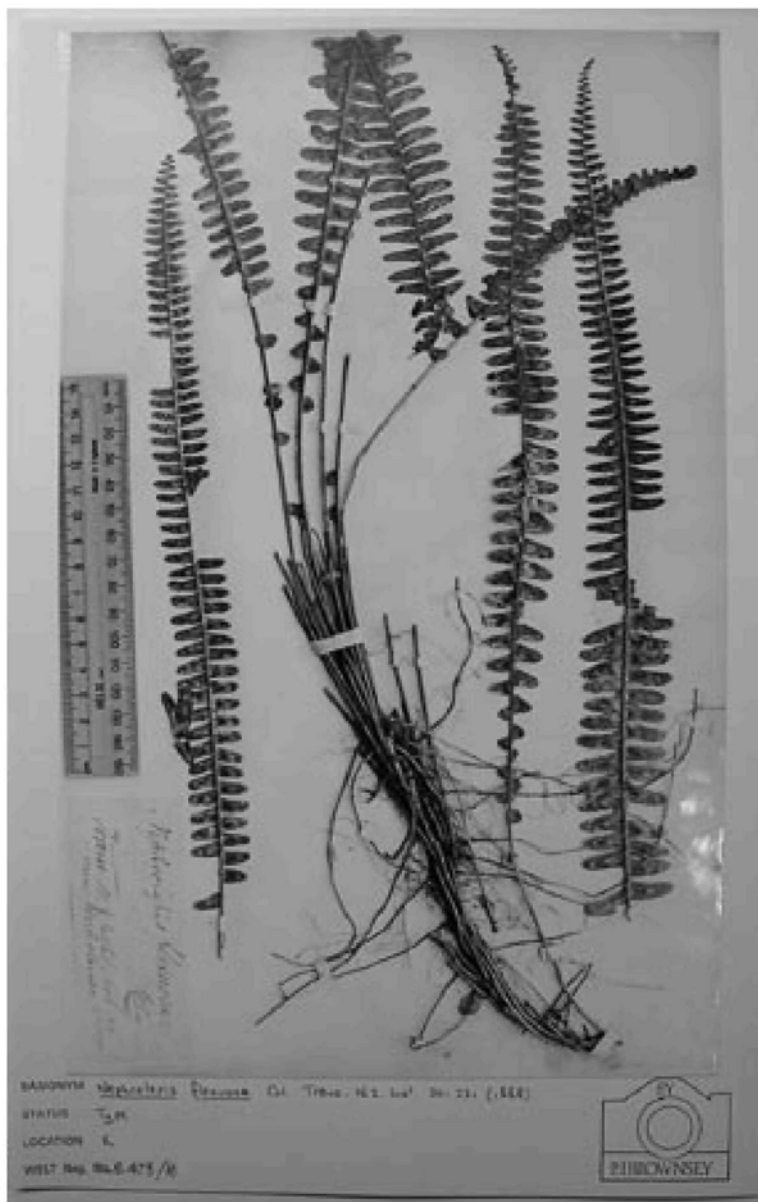
COMMENTS: Although it is possible that *N. flexuosa* is more wide ranging than indicated and so may have another earlier, legitimate name, we believe that no purpose is served by continuing to treat this fern as an unnamed segregate of *N. cordifolia*, particularly as it is so close to extinction on Norfolk I. and threatened within part of its range in New Zealand. Only a thorough worldwide revision using modern techniques could hope to resolve the morphological and nomenclature complexities of the *N. cordifolia* complex. In the meantime, the reinstatement of *N. flexuosa* may help prevent its continued relegation and, thus, potential to be overlooked from both a taxonomic and a conservation perspective within the now otherwise very widespread, weedy, and aggressive *N. cordifolia*. In light of the decision taken here, the Norfolk and Lord Howe I. treatment of *Nephrolepis* offered by Green (1994, p. 607) needs clarification. Although it would seem that Green adopted a broad circumscription of "*N. cordifolia*", his description, specimens cited, and notes suggest that he was referring to the plant we call here *N. flexuosa*. Notably, Green used the local Norfolk I. vernacular "Pop Rock fern", he considered it indigenous to both island groups, his description does not mention the diagnostic tubers of *N. cordifolia* sens. str., and he also noted that "[Sykes 1977] suggests that on Norfolk Is. the native plants differ from the naturalised plants (found near dwellings and known as fishbone fern)". His statements that "*N. cordifolia*" is local on Norfolk I. can only apply to *N. flexuosa* (which is now almost extinct there) but not for *N. cordifolia* sens. str. which is a very common and aggressive weed on that island. However, as he did not cite specimens of *N. cordifolia* sens. str., nor include a description of that species, his statement that it is naturalised on Norfolk I. is without supporting evidence. Accordingly for this paper we treat *N. cordifolia* sens. str. as a new naturalised species on that island.

### New combinations

#### *Boehmeria* Jacq.

A re-examination of specimens of the Norfolk and Kermadec islands *Boehmeria* confirms their distinctiveness below species level, though as allopatric

**Fig. 2** Neotype of *Nephrolepis flexuosa* Colenso (K).



taxa subspecific rank is now considered more appropriate. Accordingly, the Kermadec I. endemic *Boehmeria dealbata* Cheeseman, which was reduced to *B. australis* var. *dealbata* (Cheeseman) Sykes by Sykes (1977, p. 148), is here treated as subsp. *dealbata* (Cheeseman) Sykes. The table of differences set out in Sykes (1977, p. 149) where the combination at varietal level was made is here confirmed and strengthened as a result of examining additional material now available at AK. In particular, the peti-

oles of subsp. *australis* can be up to 170 mm long whereas they are at most 70 mm long in subsp. *dealbata*. Also, the indumentum on young shoots and leaves is not as dense in subsp. *australis* so the leaf lamina under surface is pale grey and not white as in subsp. *dealbata*. Contributing to this feature are the dense appressed hairs of the abaxial surface of the veins and veinlets subsp. *dealbata*. In contrast, the hairs are not appressed in subsp. *australis* so the veins and veinlets are conspicuous.



*Boehmeria australis* subsp. *dealbata* (Cheeseman) Sykes, comb. et stat. nov.

≡ *Boehmeria dealbata* Cheeseman *T.N.Z.I.* 24, 410 (1892).

≡ *Boehmeria australis* var. *dealbata* (Cheeseman) Sykes *DSIR Bulletin* 219, 148 (1977).

TYPE COLLECTIONS: *T. F. C[heeseman]*, Aug 1887, "Sunday [Raoul] Island, Kermadec Group: not uncommon in the lower portion of the island" AK 3795!, AK 210748!, AK 210749!.

LECTOTYPE (here designated) (Fig. 3): AK 210748!, *Boehmeria australis*, Aug 1887, Sunday [Raoul] Island, *T. F. C[heeseman]*.

NOTES: Allan (1961, p. 403) cited the type locality as "Sunday Id", and indicated the type in the following manner "Type: A[K], Sunday Id, Cheeseman". In the type folder at AK, there are six sheets, so Allan's action constitutes incomplete lectotypification because no particular sheet or specimen was stipulated (ICBN Art 8.1, 8.2; Greuter et al. 2000). All six sheets contain specimens and labels indicating that they were collected and labelled by Cheeseman. However, only four sheets (AK 3795, AK 210748, AK 210749, AK 210750) match the protologue as to location. So it is from these sheets that a more precise specification of lectotype is needed, and this action is taken here. Of these four sheets the specimens mounted on three, AK 3795, AK 210748, and AK 210749, with respect to foliage shape, size, and condition, appear to be from the same gathering, possibly even the same plant, though there is no annotation to indicate this. AK 210750 is an exact morphological match for AK 3796, 3797, which are undated collections made from a garden plant. This garden plant may have been derived from the seedling mentioned in the protologue by Cheeseman (1892) ["a seedling obtained from the Kermadec Islands in 1888 has stood the climate of Auckland well, and is making rapid growth..."]. AK 3796 has been labelled in pencil as "?type", probably by former AK curator Betty Molesworth, and is the specimen used to provide the illustration of *B. dealbata* in Cheeseman (1914) suggesting that it was probably collected sometime after Cheeseman had described the species, while AK 3797, labelled by Cheeseman "cultivated at Remuera", based on morphology seems to be the same plant as AK 3796. As these undated collections do not match the protologue as to location they are excluded from the type suite. The status of AK 210750 is less clear because it bears a Cheeseman Sunday [Raoul] Island label identical to one used on the other three Raoul Island gatherings (AK 3795,

AK 210748, AK 210749). Based on the specimen's morphology we suspect but cannot now prove that AK 210750 is not part of the original Raoul Island gatherings, and that it came from Cheeseman's cultivated plant. It is possible that the label and specimen have become associated by accident when, sometime after Cheeseman's death in 1923, his private and at that time unmounted herbarium was obtained, mounted, and incorporated into AK. Assuming this had happened, this leaves three Raoul Island sheets, AK 3795, AK 210748, AK 210749, from which to select a lectotype. Lectotypification is still necessary because Cheeseman did not specify a type, and although the morphology of the specimens mounted on these sheets appears identical, deficiencies in the label details and protologue mean that we cannot be certain that they came from the same individual or even that they were gathered on the same day. For this reason we select AK 210748 as lectotype. AK 3795 and AK 210749 are possibly isoelectotypes.

*Boehmeria australis* Endl. subsp. *australis*

HOLOTYPE: Norfolk I., *F. L. Bauer* W, n.v. Green (1994, p. 69) suggested that the holotype was "probably destroyed".

ISOTYPE: K. n.v.

NOTES: This autonym is automatically established by the new combination *Boehmeria australis* subsp. *dealbata*.

*Elymus* L.

A new combination at the more appropriate rank of subspecies is here made for the Norfolk Island group and Lord Howe I. *E. multiflorus* var. *kingianus* (Endl.) Connor, which is an allopatric island variant of the otherwise widespread mainly New Zealand and coastal eastern Australian *E. multiflorus* (Hook. f.) Á.Löve et Connor. At the time the combination at the rank of variety was made, Connor (1990) provided no distinguishing characters to separate this grass from *E. multiflorus* sens. str.; subsequently, Green (1994, p. 469) appeared reluctant to accept it as distinct noting that "[the Australasian *Elymus*] ... are badly in need of revision, but for the present it seems best to treat the plant on the Islands as an endemic variety". In a comprehensive treatment of the genus for New Zealand, Connor (1994, p. 137) maintained this grass's distinctiveness from *E. multiflorus* stating "the Norfolk Island endemic *E. multiflorus* var. *kingianus* Connor can be distinguished from New Zealand plants by the multiplicity of small prickly teeth on the lemmas and on the glumes. Awns approaching 17 mm are strict and

**Fig. 3** Lectotype of *Boehmeria dealbata* Cheeseman (T. F. Cheeseman, AK 210748).



about as long as in some *E. multiflorus* × *E. solandri* hybrids, although the ratio awn:lemma at 1.3–1.6 is less than in hybrids. The truncate palea apex is manifestly ciliate". In terms of its distinctiveness we agree with Connor (1994) but follow Green (1994) who accepted *E. multiflorus* subsp. *kingianus* (as var. *kingianus*) from both the Norfolk Island group and Lord Howe I.

*Elymus multiflorus* subsp. *kingianus* (Endl.) de Lange et R.O.Gardner, comb. et stat. nov.

≡ *Triticum kingianum* Endl. *Prodr. Fl. Norfolk*, 21 (1833).

≡ *Agropyron kingianum* (Endl.) Petrie, *T.N.Z.I.* 47, 18 (1915).

≡ *Elymus kingianus* (Endl.) Á.Löve *Feddes Repert.* 95, 469 (1984).

≡ *Elymus multiflorus* var. *kingianus* (Endl.) Connor, *Kew Bull.* 45, 680 (1990).

HOLOTYPE: Philip [sic] Island, 1804, F. Bauer, W, n.v. (fide Connor 1990).

***Elymus multiflorus* (Hook.f.) Á.Löve et Connor subsp. *multiflorus***

LECTOTYPE: New Zealand, Mercury Bay, *J. Banks & D. Solander* 1769, BM n.v. (*vide* Connor 1994).

NOTES: This autonym is automatically established by the new combination *Elymus multiflorus* subsp. *kingianus*.

**Additional taxonomic notes**

Arecaceae

***Rhopalostylis* H.Wendl. et Drude**

The distinction between the Norfolk I. *Rhopalostylis baueri* and Raoul I. *R. cheesemanii* was first questioned by Sykes (1977, p. 184) who provided a new combination at the rank of variety for the Raoul I. plant. Since then more observations of *Rhopalostylis* in the field on both islands, supplemented with better herbarium specimens and studies of plants cultivated in New Zealand, suggest that even the minor differences used by Sykes (1977) to separate them cannot be sustained. The main distinguishing feature stressed by Beccari (1917) was fruit shape but since 1977 occasional trees have been seen on both islands exhibiting fruit morphology diagnostic of either taxon. Thus, fruits that are globose or nearly so (a feature of *R. baueri* var. *cheesemanii*) can be found on Norfolk I., and broad ovoid ones (diagnostic of *R. baueri* var. *baueri*) occur on Raoul I. The fruit size on Raoul is a little larger than on Norfolk but there is considerable overlap. Beccari (1917) also considered there to be a big difference in the shape of the seed hilum but all specimens examined from both islands had narrow to broad linear hilums, though the Raoul samples tended to be marginally broader; nevertheless there is no clear-cut difference between seeds from either island. The extremely close relationship of both varieties was noted in a separate study by Stalker (1998), where it was concluded that var. *cheesemanii* might be better regarded as part of the natural range of variation within *R. baueri*. Accordingly we reduce *R. baueri* var. *cheesemanii* to synonymy within *R. baueri*.

***Rhopalostylis baueri* (Seem.) H.Wendl. et Drude, *Linnaea* 39, 234, t.1, f.2. (1875)**

TYPE COLLECTION: "in Horto Herrenhusano (Hort. Herrhausen) florentis [cultivated and in flower Herrhauser, Hanover, Germany]".

HOLOTYPE: Although Wendland & Drude's palm specimens were lodged at GOET, no material of *R. baueri* exists in that herbarium any longer (F. Hellwig *in litt.*). Therefore, in the absence of any specimens, the

illustration of the gynoecium provided by Wendland & Drude (1875) represents the only type material. The drawings are holotype material because they accompany the description and are directly cited by the authors.

= *Areca sapida* Sol. ex G.Forst. *pro. part., nom. nud., De Plantis Esculentis Insularum Oceani Australis Commentatio Botanica*, 66 (1786).

NOTES: Forster ascribed the name *Areca sapida* to both Norfolk I. and New Zealand entities. However, in the process Forster failed to provide a description to validate the name; thus, *Areca sapida* Sol. ex G.Forst. is a *nomen nudum* (ICBN Art 32.1(c)).

= *Areca sapida* Endl. *Prod. Fl. Norfolk*. 26 (1833).

NOTES: Endlicher (1833) gave a Latin description based on Ferdinand Bauer's drawings and herbarium specimens collected from Norfolk I. From Endlicher's description and statements it is clear he intended to include both Norfolk I. and New Zealand plants under this name. In 1838 Bauer's drawings from Norfolk I. were published as "Iconographia" separate from Endlicher's (1833) monograph. Endlicher's description is the first validly published name for the Norfolk I. taxon and indeed for any of the taxa currently included in the genus *Rhopalostylis* H.Wendl. et Drude.

HOLOTYPE: *F. Bauer*, 1804, Norfolk I. Bauer's palm herbarium specimens were held in Vienna (W) (Staffleu & Cowan 1976) but these were destroyed by fire during World War II (H. Riedl *in litt.*). However, the Bauer drawings also used by Endlicher (1833) are extant and so, in accordance with the code, now represent the only type material for *A. sapida* Endl. The drawings are Holotype material as they accompany the description and are directly cited by Endlicher (1833). Although *Areca sapida* Endl. is the earliest legitimately published name for the Norfolk palm it cannot be used for that plant within the genus *Rhopalostylis* H.Wendl. et Drude because of the later publication of the name *R. sapida* H.Wendl. et Drude for the New Zealand palm by Wendland in 1878.

≡ *Kentia sapida* (Endl.) Mart., *Historia Naturalis Palmarum III*, 312 (1837).

NOTES: *Kentia* Blume (1838) [Arecaceae] is a later homonym of *Kentia* Adanson (1763) [Fabaceae] and consequently this illegitimate generic name (ICBN Art. 53.1) cannot be used. Furthermore, because von Martius cited as a synonym Endlicher's publication of *Areca sapida* which was based solely on the Norfolk I. plant, the combination *Kentia sapida* (Endl.) Mart. must refer only to the Norfolk I. taxon.

≡ *Areca baueri* Hook.f. *nom. superfl.*, *Fl. N.Z. I*, 262 (1853) *nom. prov.*; *Curtis's Botanical Magazine* 24, t.5735 (1868).

NOTES: Hooker (1853) using the same Bauer specimens described by Endlicher (1833) furnished a new name (*Areca baueri*) and description for the plant already effectively and legitimately named *Areca sapida* Endl. Consequently, *A. baueri* Hook.f. as a later homonym is illegitimate (ICBN Art. 53.1).

≡ *Kentia baueri* Seem., *Flora Vitiensis*, 269 (1868).

NOTES: By the transferral of Hooker's illegitimate *Areca baueri* to *Kentia*, Seeman (1868) validated the name, therefore *K. baueri* Seem. must stand as the legitimate taxonomic synonym of *Rhopalostylis baueri* H.Wendl. et Drude. However, Wendland & Drude (1875) did not appear to recognise this when making their combination for *Rhopalostylis baueri*, an action which we have corrected here.

≡ *Eora baueri* (H.Wendl. et Drude) O.F.Cook *nom. superfl.*, *Journal of Heredity* 18, 409 (1927).

NOTES: *Eora* was erected by Cook (1927) due to the mistaken notion that *Euphorbia* Section *Rhopalostylis* Klotzsch ex Baill. (Euphorbiaceae) had priority over *Rhopalostylis* H.Wendl. et Drude (Arecaceae) (see Franco 1949). Accordingly, *Rhopalostylis baueri* (and the other two then accepted species of the genus) were transferred to *Eora*. The combination *Eora baueri* is thus superfluous and illegitimate (ICBN Art. 52.1).

= *R. cheesemanii* Beccari, *T.N.Z.I* 49, 47 (1917).

≡ *R. baueri* var. *cheesemanii* (Beccari) Sykes, *Kermadec Islands Flora*, *N.Z. DSIR Bulletin* 219, 184 (1977).

TYPE COLLECTION: "Kermadec Islands".

NOTES: Although Beccari (1917) provided a thorough description of *R. cheesemanii* he made it clear that his new species "differs from both *R. sapida* and *R. baueri* in the globular form of its fruit"; thus, any selection of type material must comprise fruits or fruiting material. Moore & Edgar (1970, p. 70) lectotypified the species because they indicated that type material was held at K (ICBN Art. 7.10). However, their action constitutes incomplete lectotypification because no particular sheet or specimen was stipulated (ICBN Art. 8.1, 8.2). This is because Beccari's protologue makes it clear that the material he used for his description of *R. cheesemanii* was sent to him in Florence by Thomas Cheeseman via AK and K and that this included both wild specimens and cultivated material. Therefore, a more

precise specification of lectotype is needed. In AK there are no suitable specimens but one sheet at K (H1172/96 1) is a clear choice for the type because it bears labels from Cheeseman and one in Beccari's handwriting "*Rhopalostylis cheesemanii* Becc. sp. nov. O. Becc. III. 1914". This sheet holds four specimens, comprising 13 whole and one broken fruit in an attached packet (two of these are visible in Fig. 4, the rest remain within the packet), a seedling, a subadult frond, and an adult pinnule. The sheet has also been annotated in an unknown hand "?Isotype". Of those specimens held in the Beccari herbarium at FI (Steinberg 1977) there are several sheets of *R. cheesemanii* material, including fruit. However, none of these is annotated in Beccari's hand, which suggests that they were labelled sometime after the material was received at FI following Beccari's death in 1920 (Staffleu & Cowan 1976). Accordingly they are excluded from the range of potential syntypes available. Of the specimens we have seen, the only one extant which makes clear Beccari's intent is the K specimen already referred to. Because this sheet consists of at least four specimens whose relationship is unclear (ICBN Art. 8.3) and no single specimen was stipulated in the protologue (ICBN Art 8.1, 8.2), but Beccari stressed that it was the fruits that distinguished his new species, we designate the fruits as lectotype.

LECTOTYPE (here designated) (Fig. 4): K, *T. F. Cheeseman*, Sunday [Raoul] Island, Kermadec group, Aug 1887, fruits.

Asparagaceae

*Cordyline* Comm. ex R.Br.

The Norfolk Island ti or cabbage tree was introduced to the Sydney Botanic Garden in the early 1800s from where it was taken to Edinburgh and described as *Dracaena obtecta* by Graham in 1827. In 1875 Baker transferred it to *Cordyline*. Seemingly unaware of Graham's earlier name, J. D. Hooker in 1855 provided the Norfolk I. plant with another superfluous name, *C. baueri*. This name is still widely used in horticulture throughout Australasia and Europe.

Oliver (1956) described *C. kaspar* as an endemic from the Three Kings Island group just off the northern tip of New Zealand. In his description, Oliver (1956) compared his new species with the common New Zealand endemic *C. australis* (G.Forst.) Endl. because, as he made clear, the Three Kings plant had been referred to that species by all past visitors to that island group. From *C. australis* Oliver mainly distinguished *C. kaspar* by its shorter and



**Fig. 4** Lectotype of *Rhopalostylis cheesemanii* Beccari (Fruits only) (K).

broader leaves and bracts, wider leaf vein angles, and longer flowers. At the time he made no reference to *C. obtecta*, a species with which he may not have been familiar. Some time in 1956 Oliver visited Norfolk I., where he collected at least one specimen of *C. obtecta* (WELT 74296). However, what Oliver thought of it in relation to *C. kaspar* remains unclear as Oliver died in May 1957. Since then the similarity of the Norfolk and Three Kings cabbage trees has been noted by Moore & Edgar (1970, p. 49), Green (1994, p. 526), and de Lange & Murray (2003, p. 213). These authors have all suggested the need for a proper comparison between these species.

As a result of studying the morphology from the now much larger suite of specimens than Oliver had at his disposal, lodged in AK and CHR, and the behaviour of cultivated specimens of both species, we believe that *Cordyline kaspar* should be reduced to synonymy under *C. obtecta*. The similarity of the Norfolk and Three Kings plants is shown in Table 1. The characters used include most of those that Oliver (1956) considered to be diagnostic of *C. kaspar* in relation to *C. australis*. The few features mentioned by him that are absent from the table either completely overlap or are insignificant and uncommon in the Three Kings and Norfolk specimens.

Independent, as yet unpublished investigations using nrDNA ITS sequences (R. C. Gardner, D. J. Keeling, and P. J. de Lange unpubl. data) and data obtained using the Amplified Fragment Length Polymorphism technique (AFLP) (T. T. J. B. N. Armstrong pers. comm.) firmly place *C. kaspar* within *C. obtecta* and as a single unit they remain distinct from *C. australis*.

As defined here *C. obtecta* now extends south from the Norfolk I. to northern New Zealand where it occurs mainly on the Three Kings and Poor Knights island groups (Wright 1983; Beever 1986; de Lange & Cameron 1999 as *C. kaspar*), but also as a rather local component of the vegetation on several near shore islands, and coastal headlands in eastern Te Pahi in the far north of the North Island of New Zealand (e.g., *P. J. de Lange s.n.*, AK 222936!; Wright & Cameron 1996). Within the New Zealand part of its range hybrids with *C. australis* have been recorded.

#### *Cordyline obtecta* (Graham) Baker

≡ *Dracaena obtecta* Graham, *Edinburgh New Philo. J.* 3, 175 (1827).

≡ *Cordyline baueri* Hook. f. *nom. superfl.*, *Gard. Chron.*, 792 (1860).

TYPE: Green (1994, p. 526) stated “cultivated at the Royal Botanic Gardens Edinburgh; not traced”.

= *C. kaspar* W.R.B.Oliv., *Rec. Auck. Inst. Mus.* 4, 381, t.68 (1956).

HOLOTYPE: CHR 87645, *J. Dingley*, 20 Oct 1954, ex cult. Three Kings, grown at Plant Diseases Division, Auckland.

## NEW VASCULAR PLANT RECORDS FOR NORFOLK ISLAND

### PTEROPHYTA

#### Adiantaceae

*Pellaea rotundifolia* (G.Forst.) Hook.

Green (1994, p. 566) treated as “doubtful” a Cunningham Norfolk I. collection of *Pellaea rotundifolia*, suggesting that it was possibly mislabelled as to locality. However, a recent collection from Norfolk I., AK 237733 (*P. J. de Lange NF 240 & G. M. Crowcroft*, 7 Nov 1998), from Rocky Point Reserve, supports this earlier record, and so we treat it here as a new record for the island. We consider this fern to be a scarce but genuinely indigenous species on the island.

#### Azollaceae

*Azolla pinnata* R.Br.

The first Norfolk I. record of this fern is AK 283274, *J. E. Braggins 95/401*, 4 Aug 1995, Watermill Creek, “just south of Oval, with *Typha*, and kikuyu grass [*Pennisetum clandestinum* Chiov.]”. As this species is readily dispersed by waterfowl and it is common in Australia we think it likely that it arrived from that source and that it is indigenous to Norfolk Island.

#### Dennstaedtiaceae

*Hypolepis distans* Hook.

This Australasian species was first recorded from Norfolk I. by de Lange & Christian (2000) based on a single gathering (AK 237660!, *P. J. de Lange NF 124 & M. L. Christian*). It would seem that this fern

**Table 1** Comparison of morphological characters between *Cordyline kaspar* and *C. obtecta*. Most of the characters used here include those said by Oliver (1956) to distinguish *C. kaspar* from *C. australis* (G.Forst.) Endl.

Character state	<i>Cordyline kaspar</i>	<i>Cordyline obtecta</i>
Leaves on mature plants	600–c. 730 × 40–c. 70 mm, narrowed above base into short petiole	300–c. 1000 × 25–c. 70 mm, narrowed above base into short petiole
Texture of leaves	firm or moderately firm	thin to moderately firm
Angle of leaf veins to midrib	diverging at angle of c. 10°	diverging at angle of 5–15°
Bracteoles & smallest bracts	most commonly 2–3 mm long, very broad ovate, membranous excepting more or less dark keel	most commonly 1.5–2 mm long, very broad ovate, membranous excepting more or less dark keel
Perianth	5–7 mm long, white or pale yellowish	5–6 mm long, white
Stamen filaments	connate at base only, flattened and often as wide as or slightly wider than anthers	connate at base only, flattened but not quite as wide as anthers
Fruit	c. 4 mm diameter, globose, white	4–7 mm diameter, globose, whitish to bluish purple, often white speckled blue

has been present on the island since at least the early 1990s when it appeared in and around the Forestry Nursery at Anson Bay. The plants appear to have arisen as a contaminant of peat moss imported from New Zealand (O. Evans pers. comm.; de Lange & Christian 2000).

### Gleicheniaceae

*Dicranopteris linearis* (Burm.f.) Underw. var. *linearis*

The first Norfolk I. record of this weedy pan-Pacific fern is Herb. ANPWS, *J. E. Braggins* 95/486, 14 Aug 1995, Ball Bay, Marshes Rd, "one patch on clay bank beside road". It was subsequently gathered from the same site in 1998 (AK 237689, *P. J. de Lange NF 116 & G. M. Crowcroft*). This fern is not cultivated on the island, and as it is a common fern of the tropics and subtropics, extending to New Zealand (Brownsey & Smith-Dodsworth 2000), it is most likely indigenous on Norfolk I. having arisen, we suggest, through the long-distance dispersal of spores.

### Nephrolepidaceae

*Nephrolepis cordifolia* (L.) C.Presl fishbone fern

The apparent first record of this aggressive fern seems to be CHR 224226, *W. R. Sykes Norfolk 107*, 28 Oct 1971, Mission Road, "in old garden amongst shrubs, locally abundant and spreading over a few square metres". It would seem that at the time this collection was made the species was quite local on the island. By the 1990s this situation had changed such that it is now a very widespread and common fern, frequently found on roadside banks, track sides, along grass verges, and as a forest floor dominant within indigenous vegetation. Despite its aggressive nature this fern is still commonly cultivated in gardens around Burnt Pine, perhaps because it is still widely believed to be native.

### Polypodiaceae

*Platyserium bifurcatum* (Cav.) C.Chr.  
stagshorn fern

The first record of this Australian fern wild on Norfolk I. (as a garden escape) is Herb ANPWS, *J. E. Braggins* 95/465, 12 Aug 1995, "Nature World", S of Mt Pitt, "on [Hawaiian holly] *Schinus terebinthifolius*". A second record is AK 237726, 237825, *P. J. de Lange NF 215 & G. M. Crowcroft*, 12 Nov 1998, Mt Pitt National Park, "near "Achyranthes" Gully, large patch at base of a Norfolk pine". This species is indigenous to Australia including Lord

Howe Island (Green 1994), so the possibility exists that the species might also be native to Norfolk I. However, it is a conspicuous fern, so its absence from earlier collections and the fact that it is widely cultivated on Norfolk I. suggest that it is most likely to be naturalised. Certainly the first record from "Nature World", a public visitor centre bordering the National Park, is clearly naturalised, as mature plants are grown widely in the vicinity, but the second collection from the remote and rarely visited "Achyranthes" Gully is somewhat unusual for a naturalised species.

### Pteridaceae

*Pteris vittata* Chinese brake

This species, first erroneously recorded by Green (1994, p. 609) as part of the *Blechnum procerum* (G.Forst.) Sw. agg., is now locally established in several sites on Norfolk I. This is of interest because Green (1994, p. 609) considered it to be "entirely cultivated" and thus excluded it from the flora. The first record of this sub-cosmopolitan fern wild on Norfolk I. appears to be CHR 372430, *W. R. Sykes Norfolk 613*, 15 Apr 1980, Melanesian Mission, "St Barnabas' Chapel wall"; the second is AK 202229, *R. O. Gardner 5988*, 18 Oct 1989, from the same location. A few colonies have been seen elsewhere on the island in similar base-rich habitats, e.g., the calcarenite stone walls, buildings, and cliffs at Kingston. Although this species is indigenous to the adjacent Australian coast, and so could possibly be indigenous to Norfolk I., most of the occurrences of this fern are on or around buildings, so we consider it to be naturalised on the island.

### Salviniaceae

*Salvinia molesta* D.Mitch.

The first Norfolk I. record of this weedy aquatic fern is AK 283272, *J. E. Braggins* 95/448, 9 Aug 1995, Mission Road, "in pond on the property of D. Sanderson". Evidently these plants have arisen through accidental or deliberate attempts at naturalisation.

## SPERMATOPHYTES

### DICOTYLEDONAE

### Acanthaceae

*Ruellia ciliosa* Pursh

The first record of this plant wild on Norfolk I. (as a garden escape) is AK 246885, *P. J. de Lange NF 185 & G. M. Crowcroft*, 13 Nov 1998, Kingston,

Quality Row, weed in roadside verges and cattle stops of old buildings.

### Amaranthaceae

*Achyranthes margaretarum* de Lange

Phillip Island chaffy tree

This critically endangered species, endemic to Phillip I., is a recently described segregate of *A. arborescens* R.Br. (de Lange & Murray 2001). The latter species, also threatened, is found (at least nowadays) only on Norfolk I.

*Amaranthus hybridus* L. princes feather

First records of this commonly cultivated species from Norfolk I. are CHR 371429, *W. R. Sykes Norfolk 500*, 10 Apr 1980, near Steel's Point, "arable land"; and CHR 475705, *W. R. Sykes Norfolk 1073*, 5 Dec 1987, near Stockyard Road, Cuttings Corner, "weed in vegetable garden". At the latter site it was very common over a small area.

*Amaranthus viridis* L. green amaranth

First records of this weedy species on Norfolk I. are CHR 371431, *W. R. Sykes Norfolk/489*, 10 Apr 1980, near Steel's Point, "indigenous forest remnant"; and CHR 458956, *W. R. Sykes 791/87*, 25 Nov 1987, near Emily Bay, cemetery area, "old sand dunes and waste places". At neither site was this species common, nor would it seem that at the time of these collections the species had yet to fully establish itself on the island.

*Atriplex cinerea* Poir. grey salt bush

Green (1994, p. 82) excluded *Atriplex cinerea* from the Norfolk Island group flora on the grounds that the Karl von Hügel 1834 record referred to by Aellen (1938) might have been in error for an Australian gathering, and because he could not locate that specimen the matter could not be resolved. Subsequently, de Lange et al. (1997) admitted the von Hügel record for the Norfolk Island group, basing their assessment on the species' biogeography and ecology. They pointed out that it is indigenous to Lord Howe I. and New Zealand as well as the adjacent Australian coast, and that there is suitable habitat for it on Norfolk I. Green (1994, p. 82) is correct that there are apparently no extant herbarium specimens to support the record, though the fact that the key herbaria holding von Hügel specimens were damaged by bombing during 1944–45 means that the lack of a specimen does not necessarily negate the record.

### Apiaceae

*Coriandrum sativum*

coriander

The first record of this plant wild on Norfolk I. (as a garden escape) is AK 237636, *P. J. de Lange NF 114 & G. M. Crowcroft*, 9 Nov 1998, Kingston, Quality Row, "one plant on calcarenite wall at roadside". The species is locally cultivated as a culinary herb, thus naturalisation from these sources is very likely to occur.

*Foeniculum vulgare* Mill.

fennel

The first Norfolk I. record of this weed is AK 237730, *P. J. de Lange NF 220 & G. M. Crowcroft*, 15 Nov 1998, Burnt Pine shopping centre, "common in waste places". Plants of this temperate species are reported to be grown occasionally as a culinary herb on the island, and so naturalisation from these sources would be very likely; this is happening in a similar way on Raoul I., at the same latitude, in the Kermadec Islands group.

*Petroselinum crispum* (Mill.) A.W.Hill parsley

The first record of this plant wild on Norfolk I. is AK 237701, *P. J. de Lange NF 82 & G. M. Crowcroft*, 8 Nov 1998, Cook's Monument, "occasional on ledges of sea cliff". As it is commonly grown on the island as a culinary herb, the wild plants presumably originated from that source.

### Araliaceae

*Schefflera actinophylla* (Endl.) Harms octopus tree

The first record of this plant wild on Norfolk I. (as a garden escape) is AK 237721, *P. J. de Lange NF 210 & G. M. Crowcroft*, 13 Nov 1998, Burnt Pine, "sapling growing between barbed wire fence and container on waste ground near "Foodlands". Adult trees grew in nearby gardens. Known locally as "lipstick palm" this species is commonly cultivated throughout the island. Further naturalisations are likely.

### Asteraceae

*Calendula officinalis* L.

pot marigold

The first record of this plant wild on Norfolk I. (as a garden escape) is AK 237666, *P. J. de Lange NF 222 & G. M. Crowcroft*, 13 Nov 1998, near Headstone Point, "weed in grass by rubbish tip". This wild collection (a single form with yellow ligules and disc) is possibly a reversion of the semi-double cultivar with black discs and variable ligule colour, popular in cultivation on the island during 1998.



*Carduus pycnocephalus* L. slender winged thistle

The first record of slender winged thistle on Norfolk I. would seem to be CHR 459161, *W. R. Sykes* 836/87, 27 Nov 1987, Bumbora. At this site scattered plants grew on grassy slopes near the sea.

*Euchiton sphaericus* (Willd.) Holub.

The collection [*R. O.*] *Gardner* 5917 (AK 190021!), cited by Green (1994, p. 376) as *Euchiton involucratus* (G.Forst.) Holub, is identified by us as *E. sphaericus* which we accept as indigenous. This plant currently occupies dry open ground on the summit of Mt Bates, the highest point of Norfolk I. *E. involucratus* sens. str., in contrast, is a plant of wetlands. Although we have seen no specimens of *E. involucratus* from Norfolk I., we have not seen the other collections cited by Green, and so provisionally accept that this widespread species might be there, especially as suitable wetland habitat exists for it in several places including Duncombe Bay.

*Euryops chrysanthemoides* (DC.) B.Nord.

The first records of this plant wild on Norfolk I. are AK 237889, *P. J. de Lange* NF81 & *G. M. Crowcroft*, 8 Nov 1998, Cook's Monument, "local on cliff tops near main track"; AK 237837, *P. J. de Lange* NF 213 & *G. M. Crowcroft*, 13 Nov 1998, near Botanic Gardens; and AK 237838, *P. J. de Lange* NF 212 & *G. M. Crowcroft*, 13 Nov 1998, Duncombe Road; in the last two instances this species was recorded as a "common roadside weed". The species freely regenerates from seed in New Zealand (Heenan et al. 1999).

*Erechtites hieraciifolia* (L.) DC.

American fireweed

The first gathering of American fireweed is CHR 476881, *W. R. Sykes* Norfolk 1035, 4 Dec 1987, "below Mission Road", where it grew at the base of a valley within in an old cultivation site. At the time of collection it was considered rather local, and despite its aggressive tendencies in New Zealand (Cameron & de Lange 2002) it was not seen on the island in 1989 or 1998.

*Gamochaeta calviceps* (Fern.) Cabrera

The first Norfolk I. record of this weed is AK 237676, *P. J. de Lange* NF 132 & *G. M. Crowcroft*, 11 Nov 1998, nr Selwyn Pines Access Road, "abundant on roadside bank with *Gamochaeta purpurea* (L.) Cabrera".

*Gamochaeta coarctata* (Willd.) Kerg.

The first collection of this species is CHR 459471, *W. R. Sykes* NI930, 27 Nov 1987, Bumbora Road turnoff. At this site plants were locally common within the short mown grass of a roadside verge. As this species is so easily overlooked it is probably now more widespread. The specimen cited above had been identified as *Gamochaeta spicata* (Lam.) Cabrera but we follow Pruski & Nesom (2004) who pointed out that this name (based on *Gnaphalium spicatum* Lam. 1788 non P. Miller 1768) is an illegitimate later homonym for *G. coarctata* (Willd.) Kerg.

*Montanoa hibiscifolia* (Benth.) Schult.-Bip.

tree daisy

The first collection of this species is CHR 475699, *W. R. Sykes* Norfolk 1066, 5 Dec 1987, New Cascade Road, near Evans property. It is clearly a recent escape established as isolated plants near a garden.

**Bignoniaceae***Tecomaria capensis* (Thunb.) Spach

Records of this plant wild on Norfolk I. are CHR 98342, *Somers*, Apr 1958, *n.c.d.*; CHR 477764, *W. R. Sykes* NI730, 23 Nov 1987, Upper Selwyn Pine Road, "on roadside"; and AK 237676, *P. J. de Lange* NF 139 & *G. M. Crowcroft*, 11 Nov 1998, Selwyn Pine Road (which may be from the same site as the Sykes specimen). As observed by Green (1994) this species is commonly cultivated on the island. Though we did not see any fruiting material, small prunings from hedge trimmings root freely, and the naturalisation reported here presumably resulted from the discarding of such material.

**Campanulaceae***Wahlenbergia littoricola* subsp. *vernica* (Pettersson) de Lange et Cameron

The first Norfolk I. record for this taxon is AK 237888, *P. J. de Lange* NF 229 & *G. M. Crowcroft*, 8 Nov 1998, Cook's Monument, "uncommon on eroded basalt and tuff slopes". The nominative subspecies is endemic to Australia (Smith 1992, as *W. littoricola* P.J.Smith), whilst subsp. *vernica*, though described by Pettersson (1997, as *W. vernica*) as endemic to New Zealand, was noted in that paper as possibly present on 'Eua, Tonga. Both subspecies are distinguished from others of the *W. gracilis* complex by their unique chromosome number ( $2n = 54$ ), larger campanulate flowers,

and obconic capsules (de Lange & Cameron 1999). In New Zealand *W. littoricola* subsp. *vernica* is most commonly associated with rodent-free islands dominated by burrowing sea birds (Pettersen 1997), and it is postulated that it is dispersed by these birds. Its presence on Norfolk I., along with another coastal ornithophilous New Zealand plant, the grass *Trisetum arduanum* Edgar et A.P.Druce, could, therefore, be an example of long-distance avian dispersal from New Zealand. Thus, we believe that subsp. *vernica* is most likely indigenous on Norfolk I. The relationship of subsp. *vernica* to subsp. *littoricola* and *W. insulae-howei* Lothian was discussed by de Lange & Cameron (1999).

#### *Wahlenbergia violacea* Pettersen

The first Norfolk I. record for this species is AK 237429, *P. J. de Lange NF 224 & G. M. Crowcroft NF 224*, 13 Nov 1998, Anson Bay, small patch on clay bank. *W. violacea*, also considered to be a New Zealand endemic, is in our view scarcely any different from *W. gracilis* (G.Forst.) A.DC. Pettersen (1997) separated this species from *W. gracilis* and the allied *W. marginata* mainly by the sometimes opposite leaves, and larger, campanulate-rotate corolla. However, based on seed morphology and size the species was not accepted by Webb & Simpson (2001), who preferred to treat the majority of the reinstated or new species described by Pettersen (1997) as *W. gracilis*. We maintain *W. violacea* here if only because on Norfolk I. it does seem to differ, most notably by the larger flowers, from another more widespread *Wahlenbergia* on the island which matches the interpretation of *W. gracilis* sens. str. given by Pettersen (1997). These plants are much finer and delicate and differ from *W. violacea* by their smaller, scarcely campanulate, rotate flowers, and by their apparent restriction to upland and notably less modified habitats on the island. Whether *W. violacea* reached Norfolk naturally or by human agent from New Zealand is unclear, though in that country it is not a species associated with seabird nesting grounds and is sometimes present in urban settings where it can be very weedy. Therefore, we suspect it is most likely to have been accidentally introduced to Norfolk I. by humans.

#### Convolvulaceae

##### *Dichondra micrantha* Urb.

The first Norfolk I. record for this common lawn weed is AK 190131, *R. O. Gardner 5892*, 6 Oct 1989, New Cascade Rd, at edge of frequently mown lawn. Green (1994, p. 310) listed only the rather

similar Australasian species *D. repens* J.R.Forst. et G.Forst. This is found in less modified habitats, such as the islands' coastal slopes; the earliest collection we know is *R. M. Laing 157*, Jan-Feb 1912, CHR 335904.

#### Corynocarpaceae

*Corynocarpus laevigatus* J.R.Forst. et G.Forst.

karaka

The first record of this New Zealand tree naturalised on Norfolk I. is AK 199813, *R. O. Gardner 5972*, 17 Oct 1989, Burnt Pine, Lion's Park, two old trees and a few seedlings under a hedge nearby. Despite concerns that karaka might pose an environmental threat, the potential risk to the island's forests from this species is minimal as its fruit are too large to be dispersed by any of the birds present there today.

#### Crassulaceae

*Bryophyllum delagoense* (Eckl. et Zeyh.) Schinz  
lizard plant

The first wild gathering of this species is CHR 459222, *W. R. Sykes NI866*, 28 Nov 1987, New Cascade Road, "grassy bank above road, a few plants only". This species is commonly cultivated on Norfolk I. so further naturalisations are anticipated.

*Bryophyllum pinnatum* (Lam.) Kurz air plant

First records are CHR 98332, *B. A. Somers*, Apr 1958, *n.c.d.*; and CHR 459475, *W. R. Sykes NI934*, 1 Dec 1987, Pop Rock. At Pop Rock plants grew on volcanic rock within semi-shaded crevices. As with *B. delagoense* this species is commonly cultivated on the island so further naturalisations are likely.

*Crassula multicava* Lem. subsp. *multicava*  
fairly crassula

The first record of this species naturalising is CHR 455819, *W. R. Sykes 713/87*, 22 Nov 1987, Mission Road, Botanic Gardens area. At this location plants were locally abundant on an old stone wall within a heavily modified indigenous forest remnant. This species is commonly cultivated on Norfolk I. so further naturalisations are likely.

#### Euphorbiaceae

*Breynia disticha* J.R.Forst. et G.Forst.

The first wild records for this commonly cultivated plant on Norfolk I. are CHR 455811, *W. R. Sykes NI705*, 22 Nov 1987, Mission Road; and AK 237626,

*P. J. de Lange NF 146 & G. M. Crowcroft*, 11 Nov 1998, New Cascade Road. The Sykes specimen came from a modified indigenous forest remnant while the de Lange & Crowcroft gathering was made from along a roadside.

*Euphorbia cyathophora* Murr.

First records for this commonly cultivated plant wild on Norfolk I. are CHR 371496, *W. R. Sykes Norfolk 618*, 15 Apr 1980, Melanesian Mission area, Chapel Grounds; and AK 237628, *P. J. de Lange NF 144 & G. M. Crowcroft*, 11 Nov 1998, New Cascade Road. In the latter site it was a very common weed along the roadside and under shrubs and palms in adjacent gardens.

**Fabaceae**

*Chamaecytisus palmensis* (Christ) Bisby et Nicholls tree lucerne

The first wild collection seems to be CHR 372196, *W. R. Sykes Norfolk/548*, 12 Apr 1980, Hurlstone Park, "beside grass track". Here a few saplings were established. Tree lucerne is commonly cultivated on Norfolk Island so further naturalisations are likely.

*Dipogon lignosus* (L.) Verdec. mile a minute

The first collection of this aggressive vine on Norfolk I. is CHR 459379, *W. R. Sykes NI897*, 30 Nov 1987, Anson Bay. At the time of collection only a small area of a steep grassy, south-facing slope was covered.

*Neotonia wightii* (Arn.) Lackey

The first Norfolk I. collection of this species is CHR 476886, *W. R. Sykes NI897*, 30 Nov 1987, Anson Bay. At that site only a few plants were present within a small indigenous forest remnant.

*Trifolium suffocatum* L. suffocated clover

Locally common in short mown grass within a roadside verge. The first Norfolk I. gathering seems to be CHR 459467, *W. R. Sykes NI910*, 30 Nov 1987, Bumbora Road turn off.

**Geraniaceae**

*Pelargonium panduriforme* Eckl. et Zeyh.

The first wild Norfolk I. record, as small plants growing through a shrubland dominated by naturalised species, is CHR 459217, *W. R. Sykes 861/87*, 20 Nov 1987, New Cascade Road, Merval Hoare's property.

**Lamiaceae**

*Lavandula dentata* L. toothed lavender

The first record for this plant wild on Norfolk I. (as a garden escape) is AK 237687, *P. J. de Lange NF 115 & G. M. Crowcroft*, 9 Nov 1998, Kingston, Quality Row, "one plant on calcarenite stone wall, common in garden 200 m away". This species of lavender is commonly cultivated throughout the main settlement of the island.

**Lauraceae**

*Cryptocarya triplinervis* R.Br. blackbutt

Regarding this species Green (1994, p. 45) stated that it was reported by Sykes (1980, p. 53) as wild on Norfolk I. in the Hundred Acre Reserve, but that he had "seen no specimens". Therefore, he excluded the record from his Norfolk flora. The relevant voucher for Sykes's record is CHR 372146, *W. R. Sykes NI1051*, 11 Apr 1980, and this together with the additional collections AK 190133, *R. O. Gardner 5867*, 6 Oct 1989, Rocky Point Reserve [Hundred Acre Reserve]; AK 237694, *P. J. de Lange NF70 & G. M. Crowcroft*, 7 Nov 1999, Rocky Point Reserve (100 acres) [Hundred Acre Reserve]; and AK 237468, *P. J. de Lange NF 203 & M. L. Christian*, 13 Nov 1998, Rocky Point Reserve (100 acres) [Hundred Acre Reserve], all from naturalised plants, make it clear that this species is now well established in the Hundred Acre Reserve on Norfolk I.

*Persea americana* Mill. avocado

The first records of this well-known plant wild on Norfolk I. (as minor garden escapes) seem to be CHR 459454, *W. R. Sykes NI913*, 30 Nov 1987, Mission Road, "indigenous forest remnant"; and AK 237671, *P. J. de Lange NF 138 & G. M. Crowcroft*, 11 Nov 1998, Palm Glen Track, "sapling by trackside". Presumably both gatherings are from plants that germinated from discarded seeds.

**Moraceae**

*Ficus carica* L. fig

The first record of this plant wild on Norfolk I. is AK 237629, *P. J. de Lange NF 150 & G. M. Crowcroft*, 11 Nov 1998, nr McLachlan's Lane, sapling by waterfall, in dense guava scrub. We presume that unlike in many other places the edible fig forms viable seed on Norfolk I.

**Myrtaceae**

*Metro sideros excelsa* Solander ex Gaertn.  
pohutukawa, New Zealand christmas tree

The first record of this tree wild on Norfolk I. (as a garden escape) is AK 237739, *P. J. de Lange NF 187 & G. M. Crowcroft*, 13 Nov 1998, near Kingston Wharf, “small plants near mixed-species hedge containing this species”.

*Metrosideros excelsa* × *M. kermadecensis*  
W.R.B.Oliv.

The first record of this putative hybrid wild on Norfolk I. is AK 237847, *P. J. de Lange NF 189 & G. M. Crowcroft*, 13 Nov 1998, near Kingston wharf, “occasional beneath a mixed-species hedge”. Green (1994, p. 214) recorded *Metrosideros kermadecensis* as having escaped from cultivation at Ball Bay, not far away. Spontaneous putative hybrids of *M. excelsa* × *M. kermadecensis* are also known from northern New Zealand, and occur wherever both parent species are planted together.

**Nyctaginaceae**

*Mirabilis jalapa* L. four o'clock plant

Occurring as locally common plants in front of shrubs and trees within waste land, the first Norfolk I. record seems to be CHR 475702, *W. R. Sykes Norfolk/1069*, 5 Dec 1987, New Cascade Road, Owen Evans' property. *Mirabilis* is very commonly cultivated on Norfolk I.

**Oxalidaceae**

*Oxalis corniculata* L.

Green (1994, pp. 225–256) preferred a general treatment of the *Oxalis corniculata* complex which we comment on further below (see under Additional Notes, Comments, and Redeterminations). However, of those species within the *Oxalis corniculata* complex which he accepted from the island group he did not recognise *O. corniculata* sens. str., which we record here for the first time. Our record is based on CHR 475704, *W. R. Sykes Norfolk 1071*, 5 Dec 1987, near Stockyard Road, Cuttings Corn, “vegetable garden weed”, which is apparently the first record. Although only one small population was observed there was some variation, especially with regard to capsule hairiness.

**Plantaginaceae**

*Russelia equisetiformis* Cham. et Schldtl.  
coral bush

The first undisputed wild record for this plant on Norfolk I. as a clear garden escape is AK 237664, *P. J. de Lange NF 147 & G. M. Crowcroft*, 11 Nov 1998, J. E. Road/Selwyn Pines Road junction, “on roadside bank among *Nephrolepis cordifolia* etc”. Green (1994, p. 334) noted that *R. equisetiformis* had been recorded as “semi-adventive” on Norfolk I. The relevant voucher for that comment is CHR 224365, *W. R. Sykes Norfolk 226*, 20 Oct 1971, Anson Bay Road.

**Plumbaginaceae**

*Plumbago auriculata* Lam. plumbago

The first record for this plant wild on Norfolk I. as a garden escape is AK 237648, *P. J. de Lange NF 94 & G. M. Crowcroft*, 8 Nov 1998, Melanesian Mission, “epiphytic on a camphor laurel (*Cinnamomum camphora* (L.) T.Nees et C.H.Eberm.) tree”. This species, usually still known to gardeners as *Plumbago capensis* Willd. ex Boiss, is commonly cultivated on the island. It can be easily distinguished from the indigenous *P. zeylandica* L. by its blue rather than white flowers.

**Proteaceae**

*Macadamia tetraphylla* L.Johnson  
prickly macadamia

The first record for this plant wild on Norfolk I. as a garden escape is AK 237669, *P. J. de Lange NF 140 & G. M. Crowcroft*, 11 Nov 1998, Palm Glen Track, “saplings in dense *Rhopalostylis* forest”. Green (1994, p. 197) recorded only *M. integrifolia* Maiden et Betche as being cultivated on the island. Based on our new wild record we assume that *M. tetraphylla* is cultivated there also, although we did not see it.

**Rosaceae**

*Duchesnea indica* (Andrews) Focke  
Indian strawberry

First collections of this weed on Norfolk I. are CHR 459457, *W. R. Sykes NI916*, Mission Road, “roadside grass verge”; and AK 237712, *P. J. de Lange NF 190 & G. M. Crowcroft*, 12 Nov 1998, Kingston, Quality Row, “common in shaded sites along road”. Green (1994, p. 162) described the species from Lord Howe Island as “presumably a garden escape”.

**Solanaceae**

*Lycopersicon esculentum* Mill. tomato

The first Norfolk I. record of this plant wild as a garden escape seems to be AK 237624, *P. J. de Lange NF 149 & G. M. Crowcroft*, 11 Nov 1998, Steele's Point Rd, "frequent weed of agricultural land, roadsides, weedy gardens and forest margins". Tomato is often included in *Solanum* as *S. lycopersicum* L.

**Verbenaceae**

*Duranta erecta* L. golden dewdrop

Green (1994, p. 316) described this ornamental as a common hedge plant on Norfolk I., and that it sometimes persists as a cultivation relic. We have since located indisputably wild plants, e.g., AK 237735, *P. J. de Lange NF 155 & G. M. Crowcroft*, 11 Nov 1998, near MacLachlan's Lane, "several extensive thickets in guava/olive scrub".

**Violaceae**

*Viola tricolor* L. heartsease

The first record for this plant wild on Norfolk I. as a garden escape is AK 237650, *P. J. de Lange NF 93 & G. M. Crowcroft*, 8 Nov 1998, Melanesian Mission, sporadic weed in car park and lawns. Also present as plantings within nearby cemetery. Norfolk I. plants, though very close, are probably not pure *V. tricolor* and are most likely to represent a reversion from the more commonly cultivated pansy (*V. ×wittrockiana* Gams).

**MONOCOTYLEDONAE****Agavaceae**

*Agave americana* L. century plant

First record of this plant wild on Norfolk I. (as a garden escape) are CHR 459221, *W. R. Sykes NI865*, 28 Nov 1987, New Cascade Road, "grassy bank"; and AK 237729, *P. J. de Lange NF 194 & G. M. Crowcroft*, 13 Nov 1998, Rooty Hill, "in several places along road, in the vicinity of planted adult and/or fruiting specimens of *A. americana*". Green (1994, p. 523) noted it similarly naturalised on Lord Howe Island.

*Furcraea foetida* (L.) Haw. Mauritius hemp

The first record of this plant wild on Norfolk I. (as a garden escape) is AK 237744, *P. J. de Lange NF 191 & G. M. Crowcroft*, 13 Nov 1998, Rooty Hill,

naturalised along road from adjacent hillside plantings of this species. Plants were also seen in gullies near Watermill Dam. Mauritius hemp spreads freely from inflorescence bulbils and it is surprising that it has not been recorded earlier because it is naturalised on many islands in the Pacific region. The Norfolk I. plants collected are of the smooth leaf-margined variant.

**Areceaceae**

*Howea forsteriana* (C.Moore et F.Muell.) Becc. kentia palm

A first record for this palm wild on Norfolk I. is AK 259026–27, *P. J. de Lange NF 233 & G. M. Crowcroft*, 13 Nov 1998, Bloody Bridge Stream at Cemetery Rd, "one juvenile growing in kikuyu grass". This Lord Howe I. endemic palm has long been cultivated on Norfolk I. for the seed-export trade. However, seed predation by rats on unprotected palms and any fallen seeds is very severe. Possibly the current effort to control these animals in the National Park is responsible for this new and perhaps not especially welcome naturalisation.

*Phoenix canariensis* Chabeaud

Canary Islands date palm

The first record for this palm wild on Norfolk I. as a garden escape is AK 237647, AK 238294, *P. J. de Lange NF 90 & G. M. Crowcroft*, 8 Nov 1998, Bloody Bridge, "scattered seedlings under Norfolk Island pines; cultivated in nearby garden". It is assumed that these plants were derived from the adult specimens present in that garden.

**Colchicaceae**

*Gloriosa superba* L. gloriosa lily

The first record of this lily as a clear garden escape is CHR 477475, *W. R. Sykes Norfolk 998*, 3 Dec 1987, New Cascade Road, Evans Property driveway. Only a small group of plants was observed, and these had clearly established themselves from nearby plantings.

**Commelinaceae**

*Tradescantia zebrina* Bosse silver inch plant

The first record of this potentially serious weed is CHR 455813, *W. R. Sykes NI707*, 22 Nov 1987, Mission Road, Botanic Gardens area. The plants grew within a heavily modified indigenous forest remnant, and appeared to represent a persistent cultivation escape.

**Hemerocallidaceae***Aloe maculata* All. soap aloe

The first records of this plant wild on Norfolk I. as a garden escape are CHR 459477, *W. R. Sykes NI 936*, 1 Dec 1987, Pop Rock, and AK 237844, *P. J. de Lange NF 192 & G. M. Crowcroft*, 13 Nov 1998, Rooty Hill. Green (1994, p. 522) noted it similarly naturalised on Lord Howe I. Until recently this plant was called *Aloe saponaria* (Aiton) Haw. It is commonly mistaken for the well-known *Aloe vera* (L.) Burm.f.

**Iridaceae***Tritonia crocata* (L.) Ker Gawl. blazing star

The first record of this plant as a well established wild colony growing on a roadside bank below a garden is CHR 477128, *W. R. Sykes Norfolk 1020*, 3 Dec 1987, Ball Bay Road.

**Juncaceae***Juncus australis* Hook.f.

The first record on Norfolk I. for this common Australian and New Zealand species is AK 237432, *P. J. de Lange NF 225 & G. M. Crowcroft*, 13 Nov 1998. Plants were gathered from Anson Bay, where they were an uncommon associate in a *Rubus fruticosus* vine-patch developed within a damp depression. The recent discovery of this conspicuous species and the following two *Juncus* spp., as well as their localised distribution on the island, suggests they are all probably recently introduced, possibly in footwear, clothing, and/or camping equipment.

*Juncus pallidus* R.Br.

The first record on Norfolk I. for this common Australian and New Zealand species is AK 237731, *P. J. de Lange NF 232 & G. M. Crowcroft*, 13 Nov 1998, Simon's Water. At that site a small area of *Juncus pallidus* was found in a fenced-off agricultural plot. Regarding its occurrence on Lord Howe I., Green (1994, p. 424) cited only a recent collection and believed it to be naturalised there. This seems the most likely explanation of its presence on Norfolk I. too (see *J. australis* above).

*Juncus usitatus* L.A.S.Johnson

This rush was seen growing as a weed in an ill-kept lawn near the Burnt Pine shopping complex (AK 236686, *P. J. de Lange NF 228 & G. M. Crowcroft*, 15 Nov 1998). The habitat it occupies, its weedy nature, and the fact that this very distinctive species

is not represented by any earlier collections, are sufficient reasons to regard it as naturalised on Norfolk (see comments under *J. australis* and *J. pallidus*).

**Liliaceae***Lilium formosanum* A.Wallace Formosan lily

The first record of this now thoroughly naturalised lily seems to be CHR 459215, *W. R. Sykes 859/87*, 28 Nov 1987, New Cascade Road, Merval Hoare property. At the time of this collection Formosan lily was considered to be "rare". This species is now very widespread and abundant across Norfolk I., where it may be found from sea level to the tops of Mt Bates and Mt Pitt, growing in tall rank grass and along tracksides. Green (1994, p. 513) reported this species from Lord Howe I. where he noted that it was first recorded in 1970 after which it has "rapidly invaded the native vegetation in many areas". This has also proved the case in New Zealand (Cameron 1987, 1989).

**Orchidaceae***Thelymitra longifolia* J.R.Forst. et G.Forst. agg. sun orchid

The first Norfolk I. record of this orchid is AK 236940, *P. J. de Lange NF 227 & G. M. Crowcroft*, 13 Nov 1998, Rooty Hill, "local on roadside clay bank with *Microtis unifolia* (G.Forst) Rchb.f.". The Norfolk I. plant belongs to the autogamous entity common in the cooler wetter parts of New Zealand (de Lange 1997). Whether this orchid is indigenous or naturalised on Norfolk I. is not clear. However, as only a few plants were seen in a habitat identical to that favoured in New Zealand, and growing with another orchid, *Microtis unifolia*, which is commonly associated with it in that country, we suggest that it might be a recent natural addition to the indigenous flora of Norfolk.

**Poaceae***Avena fatua* L. wild oat

The first record for wild oat on the Norfolk Island group is CHR 477472, *W. R. Sykes Norfolk/993*, 2 Dec 1987, Phillip I., "middle of island". As with New Zealand island situations plants were found in open sites within a sea bird nesting ground, the sharp seeds of oats being ideally suited to animal dispersal.

*Bromus arenarius* Labill. sand brome

The first undisputed record of this grass from Norfolk I. is AK 237665, *P. J. de Lange NF 219 &*

*G. M. Crowcroft*, 6 Nov 1998, Kingston, Cemetery Road, near Bloody Bridge, "Uncommon – amongst *Bromus willdenowii* near roadside. Also seen on dunes at Cemetery Bay". Maiden (1904, p. 752) recorded this species from Norfolk, apparently without supporting specimens. Accordingly, Green (1994, p. 466) suggested that the record might have been based on *B. catharticus* Vahl. which he considered common on the island (and specimens of which we refer to another species, *B. willdenowii* Kunth.; see under additional notes and comments below). Irrespective of what Maiden saw, we confirm *Bromus arenarius* as present in at least two locations, near Bloody Bridge and at Cemetery Bay. *Bromus arenarius* is a short-lived annual grass native to the Australasian region. Recently Edgar & Connor (2000), without explanation, treated it as naturalised to New Zealand. In New Zealand it is a scarce grass, most commonly found on remote offshore islands. We are not certain of its status on Norfolk but suggest that as the only occurrences seen were in highly modified and accessible habitats it is probably naturalised there, possibly from an Australian source.

*Cortaderia selloana* (Schult. et Schult.f.) Asch. et Graebn. pampas grass

The first Norfolk Island group record is AK 256248, *M. "Honey" McCoy*, 16 Mar 2002, Phillip I., "a single plant, male". Although we have been told that this ornamental though very invasive plant is not cultivated on the island group (O. Evans pers. comm.); we think it unlikely that it arrived on Phillip I. unaided by humans.

*Ehrharta erecta* Lam. veldt grass

The first Norfolk I. record is AK 237631, *P. J. de Lange NF 221* & *G. M. Crowcroft*, 5 Nov 1998, Captain Quintal's garden, "local weed of hedges and fence lines". This species is also a recent addition to the flora of Lord Howe Island, e.g., NSW 439779, *C. C. Ogle*, 11 Apr 2000; NSW 439778 *C. C. Ogle*, 12 Apr 2000. Every effort should be made to control its spread as it has proved a serious weed in nearby New Zealand (Ogle 1988).

*Lepturus repens* (G.Forst.) R.Br.

The first record for this widespread littoral grass of the Indian and Pacific oceans seems to be AK 289668, *P. J. de Lange NF 242* & *G. M. Crowcroft*, 6 Nov 1998, Kingston, Emily Bay, South End, "on calcarenite rock bluffs amongst *Sporobolus virginicus* (L.) Kunth". It is surprising that this common grass has not been reported from the Norfolk Island group

before, especially as the species is present on the Kermadec Island group (Sykes 1977) and on Lord Howe I. (Green 1994). Possibly it has been overlooked as fruiting material is not conspicuous and it has a superficial resemblance to sterile specimens of *Sporobolus virginicus*, so common on Norfolk I. and with which it was found growing.

*Oplismenus* P.Beauv.

Green (1994, pp. 479–480) described *Oplismenus hirtellus* (L.) P.Beauv. from Norfolk and Lord Howe Islands. He referred to variation within the species but, despite opinions to the contrary, did not accept infraspecific taxa for these islands. However, he mentioned *O. hirtellus* subsp. *imbecillus* (R.Br.) U.Scholz as the name to be recognised for this area if infraspecific taxa are recognised. In fact, we accept that both subsp. *imbecillus* and subsp. *hirtellus* are on Norfolk I. *O. hirtellus* subsp. *hirtellus* is represented by CHR 455832, *W. R. Sykes Norfolk/726*, 23 Nov 1987, King Fern Valley; and subsp. *imbecillus* by CHR 477138, *W. R. Sykes Norfolk/1030*, 4 Dec 1987, below Mission Road. Thus, the situation on Norfolk parallels that reported from Raoul I. in the Kermadec Island group by Sykes & West (1996).

*Trisetum arduanum* Edgar et A.P.Druce

The first Norfolk I. record is CHR 518002, *P. J. de Lange NF 223* & *G. M. Crowcroft*, 9 Nov 1998, Cook's Monument, at one place on a dry open sea cliff. Otherwise this grass is known only from New Zealand, where Edgar & Connor (2000) noted it as usually a coastal plant, sometimes near bird roosts on offshore islands. As earlier observed of its common New Zealand associate *Wahlenbergia littoricola* subsp. *vernica*, we suggest it likely to have also colonised Norfolk naturally by long-distance, avian dispersal. So we consider it as most likely indigenous there as stated by Edgar & Connor (2000, p. 238).

## ADDITIONAL NOTES, COMMENTS, AND REDETERMINATIONS

### PTEROPHYTA

#### Blechnaceae

*Doodia aspera* R.Br.

Although Green (1994, p. 614) provisionally accepted *D. aspera* from Norfolk I., he cited no material, observing only that both Maiden (1904, p. 733) and Laing (1915, p. 13) had recorded it from

there. A recent collection of the species (or at least of some form closely akin to it; B. S. Parris pers. comm.) is AK 237632, *P. J. de Lange NF 234* & *G. M. Crowcroft*, 9 Nov 1998, northern slopes of Mt Bates. The plant from which this specimen was gathered was, as is typical of *D. aspera* (see Parris 1998), strongly rhizomatous. Although only the one plant was found, it grew in a remote, rarely visited portion of the Mt Pitt National Park, and as the species is not known to be cultivated on the island and is very common on the adjacent Australian coast this plant is most likely to have originated by long-distance dispersal of spores from that continent.

### Pteridaceae

#### *Pteris pacifica* Hieron

This species was recorded for Norfolk I. without further comment by Kramer & McCarthy (1998). As we have not seen specimens, we queried the record with P. M. McCarthy who, *in litt.*, stated that his involvement with the *Pteris* treatment resulted from the death of K. U. Kramer, who had left an almost completed manuscript of the genus for the Australian Flora. It was this manuscript which was edited by McCarthy through to final publication. Apparently Kramer's manuscript left no indication of where supporting herbarium specimens for the Norfolk I. record for *P. pacifica* might be. Therefore, while it is possible that this species could be or have been on Norfolk, in the seeming absence of specimens we suggest it is better excluded from the current flora. Furthermore, we suggest that the record most likely stems from confusion with stunted specimens of the Norfolk endemic *P. kingiana* Endl., which in this condition can have a superficial resemblance to *P. pacifica*.

## SPERMATOPHYTA

## DICOTYLEDONAE

### Amaranthaceae

#### *Alternanthera sessilis* (L.) DC.

Green (1994, pp. 88–89) accepted this species on the basis of an observation made by Laing (1915) that was apparently unsupported by a herbarium specimen. Although we have not located any supporting Laing specimens either, we have collected *A. sessilis* sens. lat. from damp peaty ground near Kingston, e.g., AK 286091, *P. J. de Lange NF 241* & *G. M. Crowcroft*, 6 Nov 1998. Although we have followed Green's treatment of this species

as *A. sessilis*, it should be noted that although his description matches *A. sessilis* sens. str. this is probably because in the absence of *bona fide* Norfolk specimens it was drawn up from other specimens of *A. sessilis* sens. str. in the Pacific region. The Norfolk plants we collected are not that species but are most similar to the widespread New Zealand form, which differs from *A. sessilis* sens. str. by its narrower elliptic to linear leaves, leaf colour, and chromosome number ( $2n = 28$ ; cf.  $2n = 20, 34, 36, 40$ , and 96 reported for "*A. sessilis*" (Heenan & de Lange 2004; de Lange et al. 2004)). At this stage it is unclear whether it is indigenous to Norfolk I. though Heenan & de Lange (2004, p. 739) suggested that it might be.

### Asteraceae

#### *Bidens pilosa* L.

broomstick

Green (1994, p. 400) cited only an 1898 collection of this weedy tropical and subtropical American species, but we believe it has been on Norfolk I. since the earliest historical times. This observation would be in line with the evidence that it was widespread through tropical Pacific in pre-European times. Also, if the behaviour of this plant in northern New Zealand in the 19th century is any guide, its abundance in habitation sites together with the distinctiveness of its seeds could make it of considerable potential value to archaeologists in marking European settlement in the south-west Pacific Ocean region (Gardner 1985).

A possible 1795 observation of this species from Norfolk I. (Hoare 1982, p. 24) is very uncertain because of apparent confusion over a common name "cowitch", which may or may not apply to *Bidens pilosa*. A sounder basis seems to be a reference in Allan Cunningham's manuscript journal of his visit during May to September 1830 (typescript copy in possession of Norfolk Island resident Owen Evans; original at Kew). There it is stated "The following exotics were left by the original settlers [that is, in the First Penal Settlement] upon their abandonment of the Island": 21 "*Bidens tripartita* Burr Marigold (called Cowikle) ... [abundant in grass]." There appears to be no voucher specimen for this record, but almost certainly *B. pilosa* is meant as *B. frondosa* ("*B. tripartita*"), is a weed of wetlands, and is not otherwise recorded for Norfolk I.

Although Green (1994, p. 400) only cited this single specimen, *Bidens pilosa* has been collected several times in the latter half of the 20th century and is a locally abundant species on Norfolk I. Most plants have capitula lacking or with abbreviated ray





**Fig. 5** *Ipomoea cairica*. Watercolour by John Doody, c. 1791–3. (Source: Mitchell Library, State Library of New South Wales; f.26a of DLPXX1.)

florets. Green (1994, p. 400) made a similar observation in his description of the species, a comment presumably based on his observation of Lord Howe I. specimens.

*Picris burbidgeae* S.Holzappel ontongue

One of the two Norfolk I. collections cited by Green (1994, p. 370) as *Picris hieracoides*, CHR 335898, *W. Laing s.n.*, Jan–Feb 1912, has been determined by S. B. Holzappel (pers. comm.) in 1998 as *P. burbidgeae*. It is reasonable to assume that the other collection, which we have not seen, also belongs to this segregate of *P. hieracoides* L. (see Holzappel 1994), whose distribution includes eastern Australia and northern New Zealand (Holzappel 1994) but also more recently the Chatham and Hawaiian Islands (e.g., AK 227152, *P. J. de Lange CH8* & *G. M. Crowcroft*, 22 Feb 1996; AK 233967–69, *P. J. de Lange 3174* & *G. M. Crowcroft*, Mar 1996).

As in the New Zealand part of its range, *P. burbidgeae* has become rare on Norfolk I., and the only recent collection we know from the latter region is AK 237728, *P. J. de Lange NF 214* & *G. M. Crowcroft*, 13 Nov 1998, near Cook's Monument, a small patch among the carrot *Daucus gluchidiatus* on a roadside bank.

*Senecio australis* Willd.

In his treatment of Norfolk and Lord Howe Island *Senecio*, Belcher (1994, p. 392) considered that *S. australis* was endemic to the Norfolk Island group. Subsequently, that species has been discovered in New Zealand (where it is believed to be a recent natural colonist from Norfolk (de Lange & Murray 2003; de Lange et al. 2004; P. J. de Lange unpubl. data). The relevant vouchers for New Zealand are AK 256390, *P. J. de Lange 5410* & *D. A. Norton*, 7 Dec 1997, Motukino (Fanal) I. (Duplicate: K); AK 253008,

*P. Todd*, 26 Sep 2000, Motukino (Fanal) I., “the Gut”; and AK 256401 *P. J. de Lange 5459* & *D. A. Norton*, 19 Apr 2002, Great Barrier I. Therefore, this species should be removed from the list of species believed endemic to the Norfolk Island group.

*Solidago* sp.

A single gathering of vegetative material of a *Solidago* species (CHR 459156, *W. R. Sykes 831/87*, 27 Nov 1987), from a mown grass verge on the main road to Bumbora, Norfolk I., cannot be identified as to species, although because locals stated that the flowers were “yellow”, the genus must be correct. It would appear that these plants represent a then recent cultivation escape from a nearby garden. We include the record here because, although undetermined as to species, documentation of the gathering may prompt further collections, ideally of flowering material.

*Sonchus* sp.

Green (1994, p. 373) described *Sonchus oleraceus* L. but only cited one specimen from Norfolk I. that was collected in the 1960s or 1970s. However, he seems to have overlooked the mention by Captain James Cook (cited by Maiden 1904, p. 774) of “sow-thistle” among the edible coastal plants he and his men gathered on their discovery of the island in 1774. If Cook was not mistaken, the most likely candidates for this record would seem to be *S. kirkii* Hamlin (New Zealand) or *Actites (Sonchus) megalocarpus* (Hook.f.) Lander (Australia (New South Wales, Victoria, Tasmania)), the latter apparently a recent arrival on Lord Howe I.

**Convolvulaceae**

*Ipomoea cairica* (L.) Sweet

Green (1994, p. 307) cited only fairly recent specimens for this widespread species and treated it as naturalised to Norfolk I. However, if it were introduced to the islands it must have arrived there very early as it was illustrated by the convict John Doody during his confinement on the island in 1791–3 (no. 41 in ms. DL PXX1, Mitchell Library, State Library of New South Wales). The illustration here (Fig. 5) unmistakably represents this plant, which is the only member of the family on Norfolk I. with deeply divided leaves. We also accept that it is indigenous to the Kermadec Island group to the east and northern New Zealand to the south (Webb et al. 1988). Whether indigenous or not, this weedy vine is a serious threat to some stands of indigenous vegetation on Norfolk I.

**Euphorbiaceae***Homalanthus populifolius* Graham

Queensland poplar

Green (1994, p. 232) treated this small weedy tree as indigenous to Norfolk I. but cited no early collections. Maiden (1904, p. 748) stated that the species had been introduced to Norfolk I., apparently in a consignment of plants from Lord Howe Island. We consider that it is more likely to be naturalised than indigenous on Norfolk I.

**Fabaceae***Acacia paramattensis* Tindale

Parramatta green wattle

The first Norfolk I. record of this small tree is CHR 459451, *W. R. Sykes Norfolk/1041*, 30 Nov 1987, Anson Bay Road. At this location spontaneous saplings were present near a planted tree. It was subsequently collected from the same place by R. O. Gardner during October 1989 (AK 190018!), and it was this collection which was the sole one cited by Green (1994, p. 166).

*Chamaecrista rotundifolia* (Pers.) Greene

The only Norfolk I. collection of this weedy New World shrub, *R. O. Gardner 6187* (AK, K, NY), 4 Jun 1991, near Forestry Nursery, may also be the first for the South Pacific region at large. It was made in an area that had been cleared and harrowed in preparation for forestry plantings, and presumably the plants, which were quite numerous, had come up from buried seed. Green (1994, p.172) suggested that this plant may have been introduced with fodder; we think it more likely that seed came as a contaminant on vehicles and other equipment brought to the island by the USA military during World War II.

**Lauraceae***Cinnamomum camphora* (L.) T.Nees et C.H.Eberm.

camphor laurel

This was included in the main body of the text for the Norfolk I. Flora by Green (1994, p. 46) on the basis of a record of Sykes (1980, p. 53) for the Hundred Acre Reserve. The voucher CHR 224375, *W. R. Sykes Norfolk/1049*, 28 Oct 1971, substantiates this record. However, probably in error, Green (1994, p. 9) omitted this species from his Norfolk I. vascular flora list in the front of the book.

**Moraceae***Ficus* spp.

Green (1994, p. 64) recorded *Ficus prolixa* G.Forst. as having been planted on Norfolk I. This is an error for *Ficus virens* Dryand., an old tree of which stands by the graves at the Melanesian Mission Chapel (*Gardner 5912*, AK 199832!). In pasture a short way from that tree is an old planted tree of *Ficus glandifera* Summerh.; it provides the basis of the record of "*F. altissima*?" on Norfolk I. (Sykes 1980, p. 55; CHR 372163). It seems most likely that Mission people may have introduced these trees from the Solomon Islands.

**Oxalidaceae**

Green (1994, pp. 255–256) treated all the small yellow-flowered freely fruiting *Oxalis* on Norfolk and Lord Howe Islands under *O. corniculata* L. Such a broad view is not accepted here. Green (1994, pp. 255–256) acknowledged that this is a very variable complex but concluded that the apparently distinct taxa "intergrade when looked at on a world scale". However, we believe that there are taxa in the Australasian region that are distinct enough to warrant recognition at species level. Thus, we follow Lourteig (1979) and Thompson (1982) as well as later taxonomists in Australia and New Zealand in recognising several taxa within the *O. corniculata* complex. Green (1994, pp. 255–256) listed four of these Australasian "local variants" that we accept as species here. Three of them, *O. chnoodes* Lourt., *O. exilis* A.Cunn., and *O. radicata* A.Rich., certainly grow on Norfolk, but we cannot confirm the fourth, *O. perennans* Haw., as being present despite examining many specimens from there. So we exclude it from the Norfolk vascular flora.

This record of *O. perennans* is based on that of Lourteig (1979, p. 98) who cited *McComish 122*, Anson Bay, 6 Jan 1939. However, we consider that three specimens on the sheet belong to *O. chnoodes* and the fourth represents *O. radicata*. It is the last one that seems to be the reason for listing *O. perennans* because it has the stout stem and bushy habit that are so pronounced in this species; but it lacks the other *O. perennans* characteristics: antrorse pubescence except on the ovary, strongly divergent leaf lobes of fishtail appearance, and long, slender, straight or falcate capsules.

In addition to the above species we record *Oxalis corniculata* L. sens. str. on Norfolk I. as new (see under New Vascular Plant Records). The specimen on which this record is based was probably

not seen by Green because we think it unlikely he would have missed the large conspicuous stipules evident in this collection and which are diagnostic of the species, and his description of the complex says "inconspicuously auriculate-stipulate" (Green 1994, p. 256). The single gathering of *O. corniculata* seen grew in one vegetable garden and, thus, may have been a recent introduction. Also, the record of subsp. *corniculata* from Norfolk by Lourteig (1979, p. 130) based partly on a Laing specimen is very doubtful. A summary of the critical diagnostic characters of the species we recognise from Norfolk within the *Oxalis corniculata* L. complex is given in Table 2. For each of the four species confirmed a representative specimen is cited (but note that *Oxalis corniculata* as a new record for the island has been treated earlier in this paper; see New Vascular Plant Records), this being the earliest collection that we have seen in New Zealand herbaria. This is accompanied by notes that are mainly compiled from Norfolk material. Also, apart from *O. corniculata* that we accept as naturalised, the status of the other three species is less certain. Of them we believe that *O. exilis* is most likely to be indigenous because it is widespread in coastal areas,

including Phillip I., that have not been greatly modified. As *O. corniculata* var. *microphylla* Hook.f., Turner et al. (1968, p. 34) stated that it is "quite possibly native". *O. chnoodes* and *O. radicata* often grow in places quite remote from houses and plantations and *O. chnoodes*, in particular, may well have arrived independently of human beings though at this stage we prefer to treat them conservatively, as naturalised species.

*Oxalis chnoodes* Lourt.

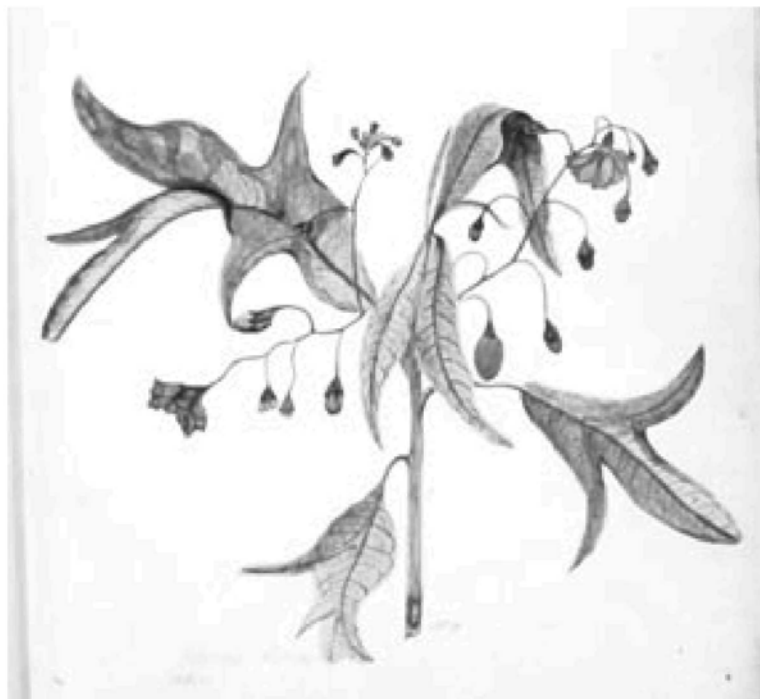
CHR 224289, *W. R. Sykes Norfolk 144*, 4 Sep 1971, Cascade, "among boulders behind beach".

This species also occurs in New Guinea, Eastern Australia, and New Zealand. It seems to be closely related to *O. radicata* but is distinguished by the densely pale grey hairiness of all the above-ground parts except inside the flowers. At least some descriptions in Australian floras state that the roots are fibrous but all the Norfolk specimens seen have an obvious woody taproot. On the island group this species is especially common on Phillip I. where it seems to be the dominant oxalis. On Norfolk I. it seems to be most abundant along the drier, northern

**Table 2** Characters separating species of the *Oxalis corniculata* group on the Norfolk Island group.

Character state	<i>O. chnoodes</i>	<i>O. corniculata</i>	<i>O. exilis</i>	<i>O. radicata</i>
Taproot	present	absent	absent	present
Plant colour and degree of investiture	plant pale grey, densely covered in hairs branchlets almost tomentose	plant green or purple-brown, and sparsely hairy	plant bright green, sparsely hairy	plant green to blue-green, sparsely to moderately hairy
Stipules	small, inconspicuous, rounded distally, usually hidden by dense web of hairs	large, conspicuous and truncate	large and conspicuous, usually truncate, sometimes tapering apically	small and inconspicuous, not obscured by hairs, shortly tapering apically
Peduncle length	usually obviously longer than leaves	much longer than leaves	equal to or a little longer than leaves	usually much longer than leaves
Flower number in inflorescence	2-4-flowered	1-3-flowered	1(-2)-flowered	1-3-flowered
Mature capsule and style length	10-15 mm, including long style	13-18 mm, including short style	4-6.5 mm including rather short style	10-17 mm, including short style
Capsule shape	± cylindric-ovoid	cylindric	± ovoid to almost conical	± broad cylindric (i.e., slightly narrower than cylindric-ovoid)
Capsule hairiness	densely retrorse pubescent	glabrous to densely retrorsely pubescent (i.e., variable even in the one small Norfolk population sampled)	glabrate	densely and ± retrorsely pubescent

**Fig. 6** *Solanum laciniatum*. Watercolour by John Doody, c. 1791–3. (Source: Mitchell Library, State Library of New South Wales. f.10 b of DLPXX1.)



side of the island where at times it is very abundant on cliff faces and associated talus and boulder fields.

*Oxalis exilis* A.Cunn.

CHR 330650, *Metcalfe s.n.*, Norfolk I. (undated).

This common species resembles the lowland and coastal plant in New Zealand and Australia in all significant characters, these also being its habitats on the Norfolk Island group. It is distinguished from the other species by its small leaves, flowers, and capsules, with only occasional small-leaved plants of *O. radicata* with which to possibly confuse it. However, unlike *O. exilis*, specimens of *O. radicata* have prominent taproots and rather long, cylindrical capsules.

*Oxalis radicata* A.Rich.

CHR 3335871, *R. Laing s.n.*, Jan-Feb 1912, Norfolk I.

A very common species on Norfolk I., at least based on the large number of specimens from there held in New Zealand herbaria. *O. radicata* is a very widespread old world species, for which the plants

on Norfolk I. most closely resemble those seen from Australia. Norfolk I. material is rather variable and some specimens have leaves as small as those of *O. exilis*.

### Pennantiaceae

*Pennantia endlicheri* Reissek

Following Gardner & de Lange (2002) and Keeling et al. (2004), *Pennantia endlicheri* is here regarded as a species separate from the Three Kings Islands endemic *P. baylisiana* (W.R.B.Oliv.) G.T.S.Baylis. Green (1994, p. 227) followed Sleumer (1970) who had treated *P. baylisiana* under *P. endlicheri*. The monotypic family Pennantiaceae has been revived by Kårehed (2001, 2003) on morphological and molecular grounds (see also Keeling et al. 2004); formerly the genus was placed in Icacinaceae.

### Piperaceae

*Macropiper excelsum* subsp. *psittacorum*  
(Endl.)Sykes pepper tree

Gardner (1997) emended the circumscription of this subspecies to exclude the plants of New Zealand's immediate offshore islands (treated there

as *M. excelsum* subsp. *peltatum* R.O.Gardner), so restricting its distribution to Lord Howe, Norfolk, and Raoul Islands.

### Solanaceae

#### *Solanum laciniatum* Aiton

Green (1994, p. 299) accepted the Australasian *S. aviculare* G.Forst. from both Lord Howe I. and Norfolk I. For Norfolk I. he listed only a single specimen (Backhouse 687, K!), although there is a further collection that we have not seen, which was accepted by Baylis (1963) as *S. aviculare*, namely that made by King in 1797 and apparently held in BM. *S. aviculare* is now considered extinct in Norfolk I., although some doubt persists as to its identity and whether *S. laciniatum* was also present or was the only species present (O. Evans pers. comm.). Therefore, we have examined the Backhouse collection and note that it was originally labelled as *S. laciniatum*, but was later redetermined by G. T. S. Baylis (10 Jul 1959) as *S. aviculare*. Although the specimen is in poor condition we agree with this determination, as the acute corolla lobes make it very clear that it is *S. aviculare*. It also appears to be this species that accompanies an illustration of the Norfolk I. kaka (*Nestor productus*) executed by Captain Hunter sometime between 1788 and 1790 (Calaby 1989), because the illustration clearly shows a plant whose flowers have acute corolla lobes. This is of interest because in the Mitchell Library (State Library of New South Wales) there is an illustration by John Doody made in 1791–3 on Norfolk I. (f.10 b of DLPXX1) (Fig. 6) which seems to represent the closely related *S. laciniatum*, since it shows the more obviously “frilled” corolla of that species (Fig. 6). Therefore, the possibility that both *S. aviculare* and *S. laciniatum* were once present on Norfolk I. cannot be entirely discounted.

## MONOCOTYLEDONAE

### Alliaceae

#### *Nothoscordum borbonicum* Kunth

According to Maiden (cited by Green 1994, p. 508) this weed was present on Norfolk I. long ago but by 1898 appeared to have been eradicated. Neither author cited a specimen, so it would appear that the first collection for the island might be a recent one, AK 237363, *P. J. de Lange NF 226* & *G. M. Crowcroft*, 13 Nov 1998, Kingston, Quality Row, “a patch under a fence at road edge”.

### Areaceae

#### *Livistona* sp.

A juvenile specimen of *Livistona*, possibly *L. australis* (R.Br.) Mart. (specimen is inadequate to allow for an accurate determination to species), was gathered wild on Norfolk I. near Bloody Bridge, “among *Tetragonia* and kikuyu grass beside a stream” (AK 237738, *P. J. de Lange NF 200* & *G. M. Crowcroft*, 13 Nov 1998). The plant is probably a garden escape, as fruiting adult palms, apparently of this species, were cultivated in a nearby garden.

### Cyperaceae

#### *Isolepis cernua* var. *setiformis* (Benth.) Muasya

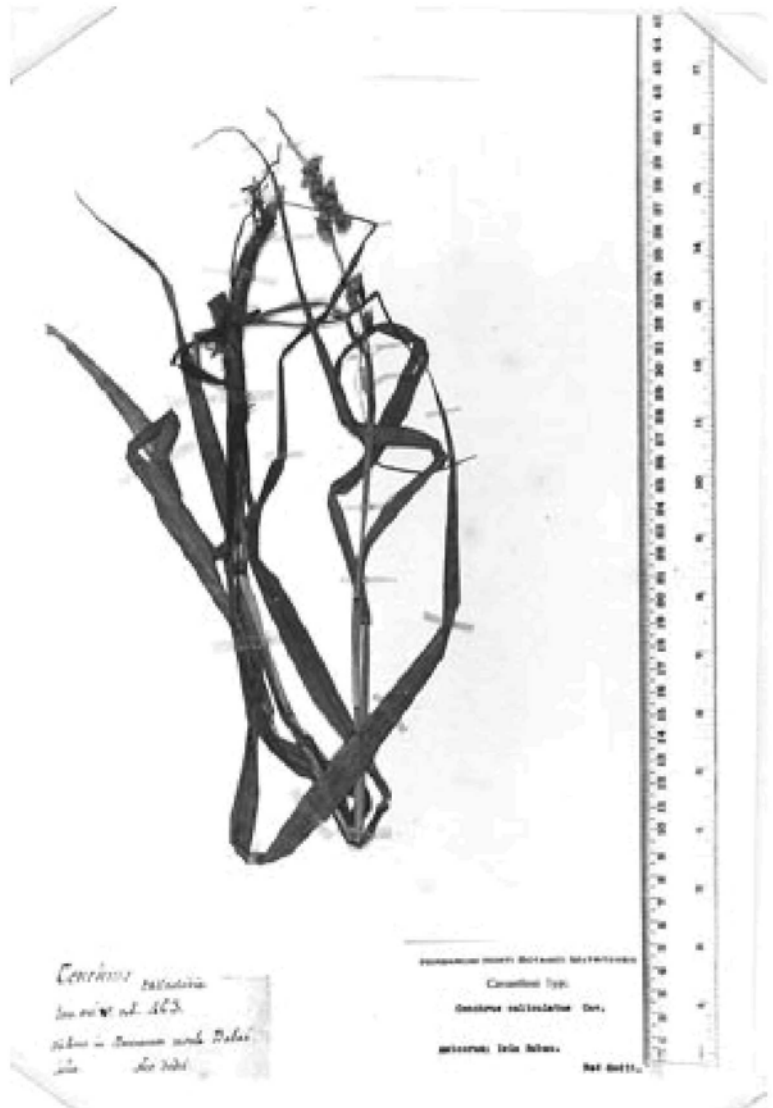
Green (1994, p. 435) reported a possibly unnamed *Isolepis* from Norfolk I., with the suggestion that it might prove endemic. His comments clearly follow the suggestion of Wilson (1981) who, though placing the Norfolk plant with *I. cernua* (Vahl.) Roem. et Schult., thought it more closely allied to *I. setiformis* (Benth.) K.L.Wilson and *I. platycarpa* (S.T.Blake) Soják, and considered that it might be a new species. We note that in a recent revision Muasya & Simpson (2002) placed the Norfolk plant (clearly citing one of the specimens noted by Green (1994, p. 435), *K. L. Wilson 6264*, K, NSW) without comment within their new combination *I. cernua* var. *setiformis*.

### Hemerocallidaceae

#### *Dianella intermedia* Endl.

Green (1994, p. 11) listed *Dianella intermedia* as endemic but then later (p. 506) treated it as endemic to both Norfolk and Lord Howe Islands. In his prelude to his species entry and description Green (1994, p. 506) observed that “populations on the two islands may represent close but different taxonomic entities but the collections and information at present available are inadequate for a firm conclusion to be reached”. These comments are accompanied by illustrations of plants from both islands, which depict some of the key differences. Subsequently, de Lange & Murray (2003) treated *D. intermedia* as a Norfolk I. endemic. To their comments we can add that Norfolk I. plants consistently differ from Lord Howe I. plants by their smaller, shortly rhizomatous, densely tufted growth form, glaucous leaves, much smaller, erect, sparingly branched inflorescence, and greenish white flowers. Plants from Lord Howe I. are much taller, distinctly long rhizomatous, and have a more open, less densely tufted growth form, with dark

**Fig. 7** Holotype of *Cenchrus caliculatus*. Herb. Cavanillesianum. Reproduced courtesy of the Madrid Herbarium.



green leaves, and pale to dark blue flowers. In an independent and as yet unpublished study, the Lord Howe I. plant is treated as a new species endemic to that island (G. Carr pers. comm.).

#### **Pandanaceae**

*Freycinetia baueriana* Endl.

mountain rush, screw palm

Green (1994, p. 413) referred the New Zealand plant to *F. baueriana* as subsp. *banksii* (A.Cunn.) B.C.Stone. We consider this treatment inappropriate

and follow the work of Huyhn (1993) who treated Norfolk I. *Freycinetia baueriana* and New Zealand *F. banksii* A.Cunn. as two distinct species. Huyhn (1993) separated both species on the basis of consistent vegetative differences, namely the  $\pm$  entire leaf margins, abundantly tessellated veins, and the lack of conspicuous pale pleats or shallow channels on the leaves of *F. baueriana*, as opposed to the  $\pm$  scabrid or  $\pm$  prickly leaf margins, the lack of or much reduced vein tessellation, and two conspicuous pleats or shallow channels on the mature upper leaf

surfaces in *F. banksii*; both species have different coloured spathes: white to purplish in *F. banksii*, and salmon pink to orange in *F. baueriana*. Furthermore,

the mature leaves of *F. baueriana* are subtly but distinctively glaucous, while those of *F. banksii* are yellow-green to dark green.

**Table 3** Endemic Norfolk Island group genera and vascular plant taxa.

Taxon	Family
<b>Endemic genera</b>	
<i>Streblorrhiza</i> Endl.	Fabaceae
<i>Ungeria</i> Schott. et Endl.	Malvaceae (Sterculiaceae)
<b>Endemic species</b>	
<i>Achyranthes arborescens</i> R.Br.	Amaranthaceae
<i>A. margaretarum</i> de Lange	
<i>Abutilon julianae</i> Endl.	Malvaceae
<i>Alyxia gynopogon</i> Roem. et Schult.	Apocynaceae
<i>Araucaria heterophylla</i> (Salisb.) Franco	Araucariaceae
<i>Asplenium dimorphum</i> Kunze	Aspleniaceae
<i>Boehmeria australis</i> Endl. subsp. <i>australis</i>	Urticaceae
<i>Calystegia affinis</i> Endl.	Convolvulaceae
<i>Capparis nobilis</i> (Endl.) F.Muell. ex Benth.	Brassicaceae (Capparaceae)
<i>Carex neesiana</i> Endl.	Cyperaceae
<i>Clematis dubia</i> (Endl.) P.S.Green	Ranunculaceae
<i>Coprosma baueri</i> Endl.	Rubiaceae
<i>C. pilosa</i> Endl.	
<i>Cyathea australis</i> subsp. <i>norfolkensis</i> Holttum	Cyatheaceae
<i>C. brownii</i> Domin	
<i>Dendrobium brachypus</i> (Endl.) Rchb.f.	Orchidaceae
<i>D. macropus</i> (Endl.) Rchb.f. ex Lindl. subsp. <i>macropus</i>	
<i>Dianella intermedia</i> Endl.	Hemerocallidaceae (Liliaceae)
<i>Elatostema montanum</i> Endl.	Urticaceae
<i>Euphorbia norfolkiana</i> Boiss.	Euphorbiaceae
<i>Freycinetia baueriana</i> Endl.	Pandanaceae
<i>Hibiscus insularis</i> Endl.	Malvaceae
<i>Korthalsella disticha</i> (Endl.) Engl.	Loranthaceae
<i>Lastreopsis calantha</i> (Endl.) Tindale	Dryopteridaceae
<i>Melicope littoralis</i> (Endl.) T.G.Hartley	Rutaceae
<i>Melictyus latifolius</i> (Endl.) P.S.Green	Violaceae
<i>M. ramiflorus</i> subsp. <i>oblongifolius</i> (A.Cunn.) P.S.Green	
<i>Melodinus baueri</i> Endl.	Apocynaceae
<i>Meryta angustifolia</i> (Endl.) Seem.	Araliaceae
<i>M. latifolia</i> (Endl.) Seem.	
<i>Myoporum obscurum</i> Endl.	Scrophulariaceae (Myoporaceae)
<i>Pennantia endlicheri</i> Reissek	Pennantiaceae
<i>Phreatia limenophylax</i> (Endl.) Benth.	Orchidaceae
<i>Pittosporum bracteolatum</i> Endl.	Pittosporaceae
<i>Pteris kingiana</i> Endl.	Pteridaceae
<i>P. zahlbruckneriana</i> Endl.	
<i>Rapanea ralstoniae</i> P.S.Green	Myrsinaceae
<i>Senecio evansianus</i> Belcher	Asteraceae
<i>S. hooglandii</i> Belcher	
<i>Solanum bauerianum</i> Endl.	Solanaceae
<i>Streblorrhiza speciosa</i> Endl.	Fabaceae
<i>Tmesipteris norfolkensis</i> P.S.Green	Psilotaceae
<i>Ungeria floribunda</i> Schott et Endl.	Malvaceae (Sterculiaceae)
<i>Wikstroemia australis</i> Endl.	Thymelaeaceae

**Poaceae**

*Bromus willdenowii* Kunth. prairie grass

Green (1994) treated specimens of the very common naturalised prairie grass on Norfolk as *Bromus catharticus*. However, we refer all the CHR Norfolk I. specimens that we have seen, including that cited by Green (1994, p. 466), *Sykes NI923* (Emily Bay, near Old Lime Kiln), to *B. willdenowii*. This species, by far the most widely naturalised brome in New Zealand (Forde & Edgar 1995; Edgar & Connor 2000) has often been confused with *B. catharticus* Vahl. From *B. catharticus*, *B. willdenowii* can be distinguished by its coarser habit, glabrous ligule 3–5 mm long and 8–15(–20) mm wide, and abaxially smooth or minutely scabrous leaf blades with the adaxial surface sparsely scattered with fine hairs. The panicle of *B. willdenowii* is larger, with more numerous spikelets, and much heavier, being typically drooping rather than semi-erect to erect, with the spikelets (20–)40(–50) mm long, elliptic-oblong to wedge-shaped, and the lemma (excluding awn) 17–23 mm long, 9–13-nerved with scabrous nerves, smooth in between. The callus is minutely hairy and the rachilla ciliate-scabrous. Most CHR specimens fit these characters, though a few have smaller spikelets and fall within the range offered for *B. catharticus* by Forde & Edgar (1995). Spikelet size in this species is somewhat plastic, being affected by habitat conditions; nevertheless, the characters of the lemma, rachilla, and leaf investiture are consistent with New Zealand and South American specimens of *B. willdenowii* that we have examined. Although we have not examined other collections cited by Green (1994) as *B. catharticus*, we think it unlikely, based on our field observations and examinations of CHR holdings, that this species is also present on Norfolk.

*Cenchrus caliculatus* Cav.

As pointed out by Gardner (2000, p. 20) the type of this Pacific Ocean species is not from the Society Islands (Green 1994, p. 493) but from Vava'u in northern Tonga where it was collected by Cavanilles "*habitat copiose in Amicorum insular Babao [≡Vava'u].....material typico*" (Garilletii 1993, p. 49) (Fig. 7). This large coastal grass has not been seen in recent years at its only known Norfolk I. locality, Anson Bay, and it may now be extinct there. This loss is of interest because based on observations made by one of us (WRS) over the last 40 years it would appear that this formerly widespread species is extinct or dying out from many of its former Pacific island haunts. The only sizeable population

known to any of us is now that on Raoul I. in the Kermadec Island group.

*Elymus scaber* (R.Br.) Á.L.Öve

Following Connor (2005) we refer the Norfolk I. specimens treated as *E. rectisetus* (Nees) Á.L.Öve et Connor to *E. scaber* which is now the correct name for this wheatgrass. This species is still considered naturalised on the island group.

*Paspalum orbiculare* ditch millet

Green (1994, p. 483) apparently saw no specimens of this widespread Pacific grass from Norfolk I. later than that of Laing in 1912. However, two specimens were collected in 1943 by F. C. Allen (CHR 226354, *F. C. Allen 371*, north western slopes of Mt Pitt; and CHR 224444, *F. C. Allen*, lacking date and locality). A recent gathering is AK 237634, *P. J. de Lange NF 111 & G. M. Crowcroft*, 9 Nov 1998, northern slope of Mt Bates, track to Duncombe Road, "locally common along track through *Olea europaea* subsp. *cuspidata* scrub on clay slope". Green (1994, p. 483) recorded ditch millet as *P. scrobiculatum* L. but we follow Edgar & Connor (2000) and do not accept this name for this plant.

**Typhaceae**

*Typha orientalis* Presl flags

There seems to be no good reason to support the suggestion by Laing (1915, p. 16) that this widely distributed and wind-dispersed species might have been introduced to Norfolk I. On this point Green (1994, p. 500) seems undecided, noting that it is "possibly an early introduction" but accepting it (Green 1994, p. 23) as indigenous in his vascular flora list for the island. We consider it to be indigenous on Norfolk I. noting that its presence on a remote island group is not that unusual; for example, it is regarded as indigenous to Raoul I. in the Kermadec Island group, which is even more remote from its main regions of distribution far to the west.

**DISCUSSION**

With some adjustment, necessitated by discrepancies between the Norfolk Island group vascular flora listing and the subsequent text, Green (1994) accepted 448 taxa, 277 of which he treated as naturalised, 124 indigenous, and 47 endemic, the last including 2 endemic genera, *Streblorrhiza* Endl. and *Ungeria* Schott et Endl. This paper adds a further 75 taxa to the vascular flora of the Norfolk Island group,



1 endemic (*Achyranthes margaretarum*) and 10 which we consider to be new indigenous records. We also consider that *Ipomoea cairica* and *Picris burbridgeae*, previously treated by Green (1994) under these names or within other broader species circumscriptions, are indigenous, while we exclude *Homalanthus populifolius* on the grounds that it appears naturalised. Three taxa, *Cordyline obtecta*, *Senecio australis*, and *Rhopalostylis baueri*, previously regarded by Green (1994) as endemic, are now considered indigenous, while *Dianella intermedia* and *Pennantia endlicheri* are considered endemic.

*Cephalomanes bauerianum* (Endl.) P.S.Green, treated as endemic to Norfolk by Green (1994, p. 13) and then noted as endemic to both Lord Howe and Norfolk Islands (Green 1994, p. 561), is excluded from the totals provided here for the Norfolk Island group endemics. We assume that its listing as a Norfolk I. endemic was accidental, as Green (1994, p. 561) cited Lord Howe I. specimens and noted it as "endemic to the islands". The unnamed and possibly endemic *Isolepis* of Green (1994) is excluded from the endemic total because it has been shown to be *I. cernua* var. *setiformis*, which we consider indigenous.

*Geranium gardneri* is a new species segregated from the *G. solanderi* complex (*sensu* Smith 1994; Smith & Walsh 1999), which, as indicated by Green (1994, p. 259, as *G. solanderi*) is naturalised on Norfolk I., while *Nephrolepis flexuosa* is reinstated for the local indigenous member of the *N. cordifolia* complex. With these amendments and additions the Norfolk vascular flora now stands at 523 taxa, of which we recognise 139 (26%) as indigenous and 44 (8%) as endemic (Table 3). As our figure for the endemic vascular taxa is two less than Green (1994, pp. 7–13) noted, and the taxa comprising the endemic vascular flora have changed, we have provided an updated list of these (Table 3).

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