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RESEARCH ARTICLE

Leptospermum hoipolloi (Myrtaceae), a new species from Aotearoa / New Zealand, segregated from *Leptospermum scoparium* s. l.

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Abstract. *Leptospermum hoipolloi* de Lange & L.M.H. Schmid sp. nov. (Myrtaceae) is segregated from *L. scoparium* J.R. Forst. & G. Forst. (sensu lato). The new species is endemic to Te Ika a Maui / North Island and the northern part of Te Wai Pounamu / South Island of Aotearoa / New Zealand. The new species is morphologically distinguished from *L. scoparium* s. str. by the distinctly sericeous, narrower, and longer (up to 30 × 6 mm) lanceolate to elliptic lanceolate leaves, larger (up to 30 mm in diameter) flowers (these white, pink-tinged, pink-streaked or red); capsules up to 15.1 × 14.1 mm (unopened) and 16.6 × 18.0 mm (opened). Three formae are recognised, f. *hoipolloi*, for those plants with shorter, narrower, glabrescent leaves, mostly white (occasionally pink tinged or red) flowers, and smaller capsules; f. *procumbens* L.M.H. Schmid & de Lange f. nov., for those plants with a decumbent / prostrate growth habit, and silver-white to silvery grey hairy leaves, larger, white, pink-tinged or pink flowers, and larger capsules; and f. *incanum* (Cockayne) de Lange & L.M.H. Schmid f. comb. & stat. nov., for those plants previously recognised as *L. scoparium* var. *incanum* Cockayne, and which have an erect shrub growth habit, with longer, often broader leaves, whose young and maturing lamina is invested in silvery-grey or grey hairs; larger white, pink-tinged or streaked, pink or red flowers and capsules. Conservation assessments using the New Zealand Threat Classification System are proposed and a revised key to the *Leptospermum* of Aotearoa / New Zealand provided.

Keywords: *Leptospermum*, *Leptospermum scoparium*, *Leptospermum hoipolloi* sp. nov., *Leptospermum hoipolloi* f. *procumbens* f. nov., *Leptospermum hoipolloi* f. *incanum* f. comb. & stat. nov., Myrtaceae, Aotearoa / New Zealand, new species, new forma, taxonomy

Introduction

It has long been recognised that the single species concept of the Aotearoa / New Zealand endemic *Leptospermum scoparium* J.R. Forst & G. Forst is untenable (see de Lange, Schmid, 2021 — and references therein). Nevertheless, despite the wealth of physiological, chemical, ecological, and morphological

evidence to support taxonomic segregation (Burrell, 1965; Porter, Wilkins, 1998; Porter et al., 1998; Bond et al., 2004; Douglas et al., 2004; Buys et al., 2019; Koot et al., 2022), a single variable species, indigenous to eastern Australia, Tasmania, Aotearoa / New Zealand, and the Cook Islands (Rarotonga) has, until recently remained unchallenged (de Lange, Schmid, 2021).

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The concept of the single variable species accepted by New Zealand botanists for much of the 20th century (de Lange, Schmid, 2021 — and references therein) began to be reconsidered following the discovery of distinct chemodemes (Porter, Wilkins, 1998; Porter et al., 1998; Douglas et al., 2004) and the recognition that the honey of *Leptospermum scoparium* s. l., has medicinal properties (Molan, Russell, 1988; Molan, 1995; McDonald et al., 2018). The variability of the species and potential for taxonomic segregation was, however, not seriously considered until myrtle rust disease, caused by the rust *Austropuccinia psidii* (G. Winter) Beenken, was detected in Aotearoa / New Zealand in 2017 (Galbraith, Large, 2017; Beresford et al., 2018; Schmid et al., 2021). Following that discovery, during their panel meetings in 2016 the New Zealand Indigenous Vascular Plant Threat Listing Panel elected to recognise morphological variation through provisional segregation of putative morphodemes using informal tag names (de Lange et al., 2018). This decision, coupled with the increasing recognition of the economic potential of a hitherto neglected, widespread, morphologically variable plant, now placed at risk by *Austropuccinia psidii* (de Lange, Schmid, 2021), also prompted several studies exploring the genetic variation in the species (Buys et al., 2019; Koot et al., 2022). Those studies have shown that *Leptospermum scoparium* s. str. is a New Zealand endemic, and further that there is well supported differentiation of the species into at least three (Buys et al., 2019) or, based on a wider sampling, and a different method of analysis (Koot et al., 2022), five clades.

Buys et al. (2019) and Koot et al. (2022) provided a phylogenetic basis for further taxonomic investigation of Aotearoa / New Zealand *Leptospermum scoparium*. Both studies whilst important had different purposes. Buys et al. (2019) sought to answer questions about the relatedness of Australia and Aotearoa / New Zealand *Leptospermum scoparium* s. l. but was limited by sample size. Their study included some of the tag named entities identified by de Lange et al. (2018). Koot et al. (2022) employed a more thorough sampling that refined and expanded on the findings of Buys et al. (2019). Their study however, whilst more comprehensive at a population sampling level, was mostly limited to Māori lands, as such it did not include the full range of diversity exhibited by Aotearoa / New Zealand *Leptospermum*, and tag name entities were not specifically identified in their sampling or included across their

range of sampling. Irrespective of the clades these authors recognised, they mostly mirror many of the informally recognised tag names proposed by de Lange et al. (2018). In part that phylogenetic evidence, along with evident morphological disparity, sympatry, syntopy and ecological differentiation were used by de Lange and Schmid (2021) to segregate *Leptospermum repo* de Lange & L.M.H. Schmid from *L. scoparium* s. l. That species is one of three tag named postulates that had been recognised by de Lange et al. (2018) (*L. aff. scoparium* (a) (AK284541; "Auckland"), *L. aff. scoparium* (b) (AK247250; "coastal silver prostrate") and *L. aff. scoparium* (c) (AK191319; "Waikato peat bog") (now *L. repo*)), and one variety, *Leptospermum scoparium* var. *incanum* Cockayne present in the northern portion of Te Ika a Maui / North Island of Aotearoa / New Zealand, that fall within a clade recognised by Buys et al. (2019) and Koot et al. (2022). These tag name entities, and *L. scoparium* var. *incanum* were briefly discussed and illustrated by de Lange and Schmid (2021).

In this paper we revisit the taxonomic status of *Leptospermum* aff. *scoparium* (a) (AK284541; "Auckland"), *L. aff. scoparium* (b) (AK247250; "coastal silver prostrate") and *Leptospermum scoparium* var. *incanum*, recognising a new species *Leptospermum hoipolloi* de Lange & L.M.H. Schmid with three formaes, f. *hoipolloi*, f. *procumbens* L.M.H. Schmid & de Lange, and f. *incanum* (Cockayne) de Lange & L.M.H. Schmid. For ease of reading these *Leptospermum* will be referred to from here on using these names: *Leptospermum hoipolloi*, *L. hoipolloi* f. *hoipolloi*, *L. hoipolloi* f. *procumbens*, *L. hoipolloi* f. *incanum*.

Materials and Methods

This article is based on the study of live plants cultivated over the last three decades in Auckland, Hamilton, and Wellington, Te Ika a Maui / North Island, Aotearoa / New Zealand by the corresponding author. Field work to examine *Leptospermum* variation, ecology, and zones of sympatry, was undertaken from throughout the northern part of Te Ika a Maui / North Island, Tairāwhiti / East Cape, Taranaki and north-west Nelson, Te Wai Pounamu / South Island. Examination of fresh specimens was complemented by study of herbarium specimens held at AK, CHR, WELT and UNITEC; herbarium acronyms follow Thiers (2008—continuously updated). Except for those measurements of stature and

branch / branchlet widths taken from live plants in the wild, dimensions have been derived from dried material held in AK and UNITEC supplemented with some measurements taken from extremes of variation in CHR and WELT.

Taxonomic Concept

Formal recognition has been influenced by investigation of the variation within *Leptospermum* found within the clades identified by Buys et al. (2019) and Koot et al. (2022), through field work, plant collection, cultivation of wild plants and herbarium-based investigations. Species rank has been conservatively accorded where tag name entities are widespread, sympatric / syntopic with accepted *Leptospermum* species, and exist as morphologically discrete, stable units. In this revision the rank of forma has been applied to syntopic putative or established taxonomic units (e.g., *L. scoparium* var. *incanum*) which differ from their parent taxon by *single, minor but consistent polymorphisms*, e.g., growth habit, indumentum, and which occur occasionally (at times locally abundantly) within a population (see the definition of "forma" in Davis, Heywood, 1963; Stuessy, 1990; Stace, 1991; Hamilton, Reichard, 1992). We have elected to use "forma" in preference to "variety" for *Leptospermum* because its definition is less ambiguous than that of variety, whose usage seems confused and multifaceted with obvious overlap with subspecies (Davis, Heywood, 1963). As such this rank is now little used in Aotearoa / New Zealand (Allan, 1961 c.f. Schönberger et al., 2022). Other interpretations are possible, but the fact remains that within the range of the Aotearoa / New Zealand endemic *Leptospermum scoparium*, distinct entities that co-habit are widespread, morphologically stable, and often chemically distinct. Little purpose is served maintaining a single variable species, while recognising within it an informal taxonomy of distinct morpho- or chemodemes of potential economic and cultural importance (Douglas et al., 2004; McDonald et al., 2018; Porter, Wilkins, 1998; Porter et al., 1998) requiring conservation management (de Lange et al., 2018).

Taxonomy

Leptospermum hoipolloi L.M.H. Schmid & de Lange sp. nov.

Type: AOTEAROA / NEW ZEALAND, Te Ika a Maui / North Island, West Auckland, Manukau

Harbour, near Huia, Spraggs Monument, 37.007904 S, 174.590001 E, 51 m a.s.l., P.J. de Lange 15067 & F.J.T. de Lange, 6 Oct 2021. Co-occurring species: *Kunzea robusta* de Lange & Toelken, *Coprosma robusta* Raoul, *Dracophyllum sinclairii* Cheeseman, and *Gleichenia dicarpa* R. Br. (habitus — <https://inaturalist.nz/observations/97306874>). **Holotype:** AK386153A (Fig. 1), AK386153B (Fig. 2), one specimen mounted on two herbarium sheets containing 13 parts of the same individual plant as follows: AK386153A — one flowering and one fruiting branch, two portions of branchlets showing bark, and AK386153B — one flowering branch. **Isotypes:** NSW, UNITEC12920.

Life Science Identifier (LSID): urn:lsid:ipni.org:names:77319002-1

Diagnosis. Distinguished from *Leptospermum scoparium* s. str. with which it often grows by the sericeous, narrower and longer (up to 30 × 6 mm) lanceolate to elliptic lanceolate leaves, larger (up to 30 mm in diameter) flowers (these white, pink-tinged, pink-streaked or red); pink, red, amber or brown (sometimes yellow-green) style up to 4.5 mm long at anthesis, elongating to 5.2 mm after anthesis; stigma flat, pink, red, dark amber-brown, up to 1.3 mm in diameter at anthesis, expanding to 1.6 mm following anthesis; capsules up to 15.1 × 14.1 mm (unopened) and 16.6 × 18.0 mm (opened).

Growth habit (Fig. 3) — trees, erect or trailing shrubs attaining heights of up to 10 m tall or, if decumbent, with prostrate trailing stems forming ± circular patches up to 6 m diameter, and 1 m tall. **Trunk** — usually unbranched at base, up to 0.3 m d.b.h., usually devoid of branches in lower 1/3 to 1/2, in decumbent plants trunk not evident. **Bark** — usually loosely attached, chartaceous to semi-coriaceous, flaking readily, shards irregular, often with sinuous margins, adaxially charcoal grey or grey, abaxially reddish. **Branches** — 3 or more, erect, semi-erect or widely spreading, young stems copiously covered in (0.20–0.35–)0.40(–0.52) mm long, white, straight to slightly flexuous, sericeous, antrorse-appressed hairs, usually but not always glabrescent with age. **Vegetative bud scales** — 3–8, mostly shedding soon after vegetative growth commences, rarely with a few persistent, (0.4–)0.8–1.0(–1.2) × (0.3–)0.6–0.7(–1.0) mm, amber to red-brown, scarious, oblong to ovoid, inner surface smooth, glossy, outer with frayed, lacerate margins or entire, basal portion densely invested in white antrorse-appressed to suberect sericeous hairs up to



Fig. 1. Holotype of *Leptospermum hoipolloi* de Lange & L.M.H. Schmid f. *hoipolloi* (AK386153A), specimen spread over two sheets AK386153A and AK386153B (Fig. 2)



Fig. 2. Holotype of *Leptospermum hoipolloi* de Lange & L.M.H. Schmid f. *hoipolloi* (AK386153A), specimen spread over two sheets AK386153A (Fig. 1) and AK386153B



Fig. 3. *Leptospermum hoipolloi* de Lange & L.M.H. Schmid f. *hoipolloi*. A: Growth habit at type locality, Spragg Monument, Kaiterakihi, near Huia, Manukau, Te Ika a Maui / North Island; B: Foliage, Fletchers Bay, Coromandel Peninsula, Te Ika a Maui / North Island; C: Mature leaves and flower bud Motatau, Northland, Te Ika a Maui / North Island; D: Flowering branchlets, Spragg Monument, Kaiterakihi, near Huia, Manukau, Te Ika a Maui / North Island; E: Flower with pink-flushed sepals and petal bases, Lake Waiparaheka, Ngawha Springs, Te Ika a Maui / North Island; F: Unopened, mature fruiting capsules, Spragg Monument, Kaiterakihi, near Huia, Manukau, Te Ika a Maui / North Island (all images: P.J. de Lange)

0.1 mm long. **Leaves** — crowded along branchlets, spicy-scented when crushed, divergent to spreading, (5.0–)9.6–17.5 (–30.0) × (2.2–)2.8(–6.0) mm, dull to semi-glossy green, dark green, sometimes glaucescent; lamina lanceolate, elliptic lanceolate, flat to weakly concave, shortly acute or sometimes acuminate, rarely cuspidate, acumen if present up to 1.2 mm long, bases cuneate to attenuate, margins minutely denticulate; surfaces on young growth sericeous either near base and along midrib, and along leaf margin, maturing ± glabrescent or with

adaxial and abaxial surfaces copiously covered with hairs, these either persisting on mature leaves or ± persisting on basal portion of leaf and along portions of leaf margin (especially toward base); oil glands numerous, more evident when dry. **Perules** — 4–6, shedding at bud burst, (0.4–)0.6–0.8(–1.2) × (0.4–)0.6–0.8(–1.0) mm, glabrous, hyaline, amber to pale red-brown, scarios, orbicular, margins usually entire or sometimes frayed, inner surface smooth, glossy. **Inflorescence** — monadic on short axillary brachyblasts or on long, 300 mm long or more,

terminal shoots. **Prophylls** — caducous, 2, 0.1–0.2 mm long, oblong, midrib scarcely developed, green to red-green when fresh, tan when dry, abaxial surface densely invested in white sericeous hairs. **Pedicels** — sessile or subsessile, 0.1–0.4 mm long at anthesis, sometimes elongating to 3.6 mm after anthesis, terete, sparsely invested with antrorse-appressed, sericeous white hairs. **Flower buds** — clavate, tholiform with calyx lobes not meeting; living flowers when fully expanded (18–)24(–30) mm in diameter. **Hypanthium** — (4.5–)6–4(–8.0) wide, by (2.3–)3.3(–4.2) mm, yellow-green, green, or pale honey-brown, obconic, obconic-funnelform, terminating in a slightly thicker rim bearing five calyx lobes; surface smooth (wrinkling in dry specimens) finely glandular punctate, glabrous. Calyx lobes 5, spreading, 2.6–2.8 × 2.6–2.8 mm, caducous, broadly deltoid to ovate, with rounded apices, glabrous or very rarely with margins sparsely ciliate, oil glands colourless. Receptacle initially pale pink (sometimes pale green / yellow green), colour usually intensifying to dark red at anthesis. **Petals** — 5(–6), spreading, 6.7–8.5(–11.0) × 4.6–10.2 mm, white, pink-tinged, pink-streaked, pink or very rarely red, orbicular, apex obtuse to rotund, margins finely crimped, oil glands not evident. **Stamens** — (18–)28(–36–40), arranged in 1(–2) whorls adnate to receptacular rim, filaments white, pink- or more rarely green-tinged (usually near base), or completely pink or carmine. Antipetalous stamens 3–4, antisepalous 4(–6). Outermost antipetalous stamens erect or weakly incurved, sometimes petaloid, on filaments (1.0–)2.3–2.8 mm long, occasional inner whorl of 2 stamens present, these erect or incurved, 1.0–1.3 mm long, positioned at base of the outermost antipetalous pair. Antisepalous stamens usually shorter than antipetalous, on filaments 1.0–1.8 mm long, incurved, erect or in mixtures of both. Anthers dorsifixed 0.3–0.5 × 0.12–0.16 mm, ovoid, latrorse, pale pink, red or dark red. Pollen white to cream. Anther connective gland 0.26 mm long, amber or pale pink, narrowly obovoid. **Ovary** — 5(–7)–locular, each loculus with 80 or more ovules, set in 8 rows on each placental lobe. Style (2.6–)3.8–4.5 mm long at anthesis, elongating to 5.2 mm after anthesis, pink, red, amber or brown (very rarely yellow green); stigma (0.60–)0.70–1.3 mm in diameter at anthesis, expanding to 1.6 mm following anthesis, flat, pink, red, dark amber brown, at

anthesis, finely papillate rugulose. **Fruits** — persistent, woody, (8.3–)10.3(–15.1) × (8.2–)14.1 mm (unopened), (8.8–)12.3(–16.6) × (9.3–)18.0 mm (opened), pale brown grey to grey, broadly obconic, turbinate, (sometimes hemispherical / globose), centre often with persistent style remnant, valves 5(–7), exerted as a dome, indented at centre, ± symmetrical with base. Valves opening on dead branches or following fire. **Seeds** — 2.4–2.6(–2.8) × 0.22–0.26 mm, linear, linear-cuneiform, curved, flexuous to sigmoid, laterally compressed or terete, 2–4-angled, apex truncate or acute, testa dull or glossy, orange-brown, glabrous, longitudinally striate. Chromosome Number: $2n = 22$, $n = 11_{II}$ (de Lange, Murray, 2004, AK284541)

Etymology. The epithet "*hoipolloi*" is the Greek term for 'the many' (derived from two Greek words 'hoi' [definite article, $\acute{o}\iota$ in Greek] and 'polloi': $\acute{o}\iota$ πολλοί) in English is usually taken to refer to 'the masses; common people' or even 'rabble' (Deverson, Kennedy, 2005: 516; Duretto, 1999). It is used here to reflect the fact that the new species, which is extremely common, has previously been regarded as part of a common, variable, species *Leptospermum scoparium*. In its English usage the epithet is plural and should be treated here as indeclinable.

Notes. Three taxa distinguished at the rank of 'forma' are here recognised within *Leptospermum hoipolloi* — f. *hoipolloi*, f. *procumbens*, f. *incanum*. These are formally described below.

Affinities. *Leptospermum hoipolloi* (f. *hoipolloi*, f. *procumbens*, f. *incanum*) and *L. repo* belong to the northern Te Ika a Maui / North Island clade of *L. scoparium* s. l. (Buys et al., 2019; de Lange, Schmid, 2021; Koot et al., 2022 (as "NNI" clade)). However, unlike f. *procumbens* and f. *incanum*, f. *hoipolloi* extends beyond the limits of other members of that clade. It was not recognised south of the northern portion of Te Ika a Maui / North Island by Buys et al. (2019) as their limited sampling necessarily precluded specimens judged to be the same entity outside that area, and it does not seem to have been included by Koot et al. (2022) in their sampling south of their NNI either based examination of relevant vouchers in CHR. *Leptospermum hoipolloi* (f. *hoipolloi*, f. *procumbens*, f. *incanum*) and *L. repo* plants differ from the type of *Leptospermum scoparium* by their consistently longer, lanceolate, elliptic-lanceolate to linear leaves, larger flowers (these often pink-tinged or pink), and larger, often globose capsules (de Lange, Schmid, 2021).

Leptospermum hoipolloi* L.M.H. Schmid & de Lange f. *hoipolloi

Growth habit (Fig. 3A–F) — shrub or tree (1–)3(–10) m tall, sometimes much reduced in extreme acid wetlands, then attaining heights of 100 mm or less. **Leaves** — (5.0–)9.6–17.5(–22.0) × (2.2–)2.8(–3.1) mm; lamina lanceolate, elliptic lanceolate; surfaces on young growth sericeous near base and along midrib, and along leaf margin, maturing ± glabrescent with hairs ± persisting on basal portion of leaf and along portions of leaf margin (especially toward base). **Flowers** — when fresh and fully expanded (18–)20(–24) mm in diameter. **Hypanthium** — (4.5–)6.4(–8.0) wide, by (2.3–)3.3(–4.2) mm. **Petals** — 5(–6), spreading, 6.7–7.3(–8.3) × 5.2–7.4 mm, white, pink-tinged, pink or very rarely red, orbicular, apex obtuse to rotund, margins finely crimped, oil glands not evident. **Fruits** — persistent, woody, (8.3–)10.3(–14.4) × (8.2–)12.2 mm (unopened), (9.2–)12.3(–16.6) × (9.3–)15.4 mm (opened). Chromosome number: $2n = 22$, $n = 11_{II}$ (de Lange & Murray 2004, AK284541)

Representative Specimens (out of 787 seen). Aotearoa / New Zealand. Manawa Tāwhi / Three Kings Islands: Manawa Tāwhi (Great Island), G.T.S. Baylis, 3 Dec 1945, AK22812; Manawa Tāwhi (Great Island), above Castaway Stream, P.J. de Lange s.n., 2 Dec 1995, AK22814. Te Ika a Maui / North Island: Mangamuka, c. 2 km north of bridge near roadside cemetery, P.J. de Lange 13192 & C.M. Beard, 22 Sep 2016, AK362918; Kāeo vicinity, at junction of Otangaroa and Taratara Roads, A.E. Orchard 3597, 14 Oct 1972, AK130897; Kaipara, near Glorit, Mataia QE II Covenant, P.J. de Lange 15046 & T.J.P. de Lange, 9 Dec 2020, UNITEC12812; West Auckland, Waitakere Ranges, Mt Zion descent to Karekare, P.J. de Lange 15556 & T.J.P. de Lange, 24 Nov 2021, UNITEC13719; South Kawhia, Taumatotara Range, Coe's Road turnoff, P.J. de Lange 15549 & L.M.H. Schmid, 12 Jan 2022, UNITEC13713; Eastern Taranaki, Tahora, Ohura Road, near Tahora Saddle, P.J. de Lange 15552 & G.M. Crowcroft, 4 Jan 2022, UNITEC13716; South Taranaki, Mangawhio, Lakes Road, Lake Mangawhio, P.J. de Lange 15388, 2 Mar 2022, UNITEC13667; Ohiwa Harbour, Wainui, P.J. de Lange 15516 & L.M. Fisher, 28 Oct 2022, UNITEC13652; Tairāwhiti (East Cape), Raukūmara Range, Takaputahi, P.J. de Lange 15512 & L.M. Fisher, 28 Oct 2022, UNITEC13648; Nūhaka — Opoutama Road, P.J. de Lange 15524 & L.M. Fisher, 1 Nov 2022, UNITEC13660; Hawke Bay, Pacific

Coast Highway (State Highway 2), Wairoa Look-out, P.J. de Lange 15523 & L.M. Fisher, 1 Nov 2022, UNITEC13659; Karori, T. Kirk s.n., 7 Jan 1889, WELT-SP044300. Te Wai Pounamu / South Island: Onetahua / Farewell Spit, near Lighthouse, M.J.A. Simpson 4563, 19 May 1965, CHR148929; Tasman Bay, Waimea Inlet, Moturoa, Bird Island (between Rough and Rabbit Islands), D.G. Drury s.n., 20 Nov 2006, CHR659360; Golden Bay, Collingwood, W.R.B. Oliver s.n., 13 Dec 1945, WELT-SP035529; North West Nelson, Kahurangi National Park, Upper Takaka River, Asbestos Mine, P.J. de Lange 15274 & D.J. Blanchon, 2 Feb 2022, UNITEC13135; Marlborough Sounds, Ship Cove, A.P. Druce s.n., 6 Dec 1953, CHR84822; Marlborough Sounds, Blackwood Bay, W.R. Philipson s.n., 10 Jun 1989, CHR397758; West Coast, near Charleston, D. & G.C. Kelly s.n., Nov 1973, CHR250127.

Distribution (Fig. 4). Endemic to Aotearoa / New Zealand where it is indigenous to Te Ika a Maui / North Island and the north-western part of Te Wai Pounamu / South Island. *Leptospermum hoipolloi* is most common in the northern part of Te Ika a Maui / North Island, ranging south from Te Paki to the lowlands of the Central Volcanic Plateau, and Taranaki / Whanganui regions. It is scarce in the east of Te Ika a Maui / North Island, though present in scattered sites from Tairāwhiti south through Hawkes Bay to the Wairarapa and Wellington regions. In Te Wai Pounamu / South Island, it is locally common in parts of north-west Nelson extending locally along the west coast to at least Charleston. It is also known from a few locations in the Marlborough Sounds, and from portions of coastline and islands within the Waimea Inlet, Tasman Bay it is otherwise seemingly absent from the rest of that island. Outside these natural occurrences, it has been planted widely throughout the main islands of Aotearoa / New Zealand for the Mānuka Honey Industry, as a horticultural subject, and as part of restoration plantings (usually known as *L. scoparium* s. l., which we now consider a name misapplied to our newly described taxon). From these sources it has often naturalised, a situation that explains its localised occurrences on Rēkohu (Chatham Island) — Ōue Creek, Waiteki / Waitangi (P.J. de Lange CH368 & J.W.D. Sawyer, AK295080), and near the Chatham Islands Airport (P.J. de Lange CH4207, UNITEC13751).

Habitats and co-associated flora species. *Leptospermum hoipolloi* f. *hoipolloi* may be found in a

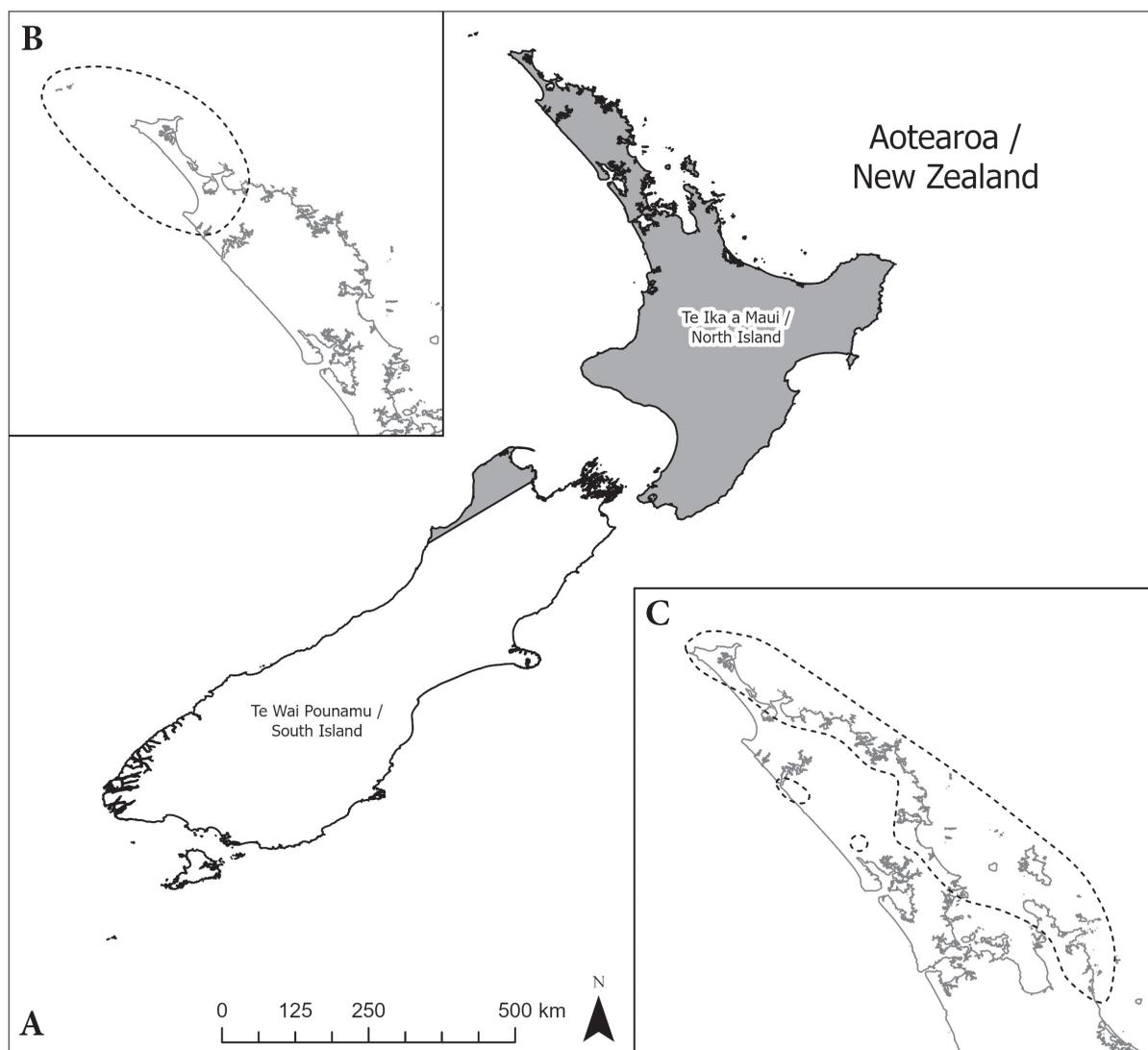


Fig. 4. Generalised distribution of *Leptospermum hoipolloi* f. *hoipolloi* (A), f. *incanum* (B) and f. *procumbens* (C), Aotearoa / New Zealand

range of habitats from the coast to subalpine (0–900 m a.s.l.) on a range of substrates including igneous, ultramafic, sedimentary rocks, mobile sand, alluvium, peat and soils derived from these. The species is most commonly found in coastal to lowland / montane areas, especially in regenerating shrubland and gumland. In the far northern part of its range, notably on the Te Aupōuri Peninsula and along the eastern coastline of Northland it is frequently sympatric with *Leptospermum hoipolloi* f. *procumbens*, *L. hoipolloi* f. *incanum*, *Kunzea amathicola* de Lange & Toelken, *K. linearis* (Kirk) de Lange & Toelken, and further south with *K. robusta* de Lange et

Toelken. In some of these locations, e.g. Kauere (34.736097 S, 173.113393 E, c. 9 m) and Takatū Peninsula (36.363678 S, 174.864887 E, c. 18 m), there is some suggestion of hybridisation between f. *hoipolloi* and f. *procumbens*. Peculiarly, throughout the peat bogs and wetlands of Te Aupōuri, Karikari Peninsula, and the Kaitia lowlands, *L. hoipolloi* f. *hoipolloi* is locally dominant (sometimes co-dominant with f. *incanum*). These are habitats which in the greater Waikato region are exclusively occupied by *L. repo* with *L. hoipolloi* f. *hoipolloi* populations in that region tending to grow on clay and other non-waterlogged soils instead (de Lange, Schmid,

2021). However, in other locations, notably on the Coromandel Peninsula, parts of the Bay of Plenty, and, at least historically, in Taranaki, *L. hoipolloi* f. *hoipolloi* co-occurs (or once did) with *Leptospermum repo*.

Throughout Te Ika a Maui / North Island but especially in locations south of the western Waikato and the Mamaku Plateau, *Leptospermum hoipolloi* f. *hoipolloi* can be found growing with *L. scoparium* s. str. (Fig. 5). Within the northern portion of the Central Volcanic Plateau it grows with other variants allied to *L. scoparium* s. str. In the southern inland portions of Tairāwhiti / East Cape, and in a few places along the coastline *L. hoipolloi* f. *hoipolloi* can be locally common, extending into the foothills of the Raukūmara Range, but in the north from near Pōtaka thence east and south to Uawa (Tolaga Bay) it is mostly replaced in coastal areas and lowlands by *Leptospermum* aff. *scoparium* (d) (AK286289; East Cape) (P.J. de Lange unpubl. data).

In Te Wai Pounamu / South Island, *Leptospermum hoipolloi* f. *hoipolloi* is mostly confined to the north-west and there it is most common in the sand country of Farewell Spit, in pockets around Whanganui Westhaven and the Wakamarama Range with sporadic occurrences as far south as Charleston at least. In these locations plants are widely sympatric with *Leptospermum scoparium* s. str.

Phenology. *Leptospermum hoipolloi* f. *hoipolloi* may be found flowering throughout the year. However, flowering often peaks in late winter to spring (August–October) sometimes with a secondary flowering peak around December–January.

Affinities. Throughout its range *Leptospermum hoipolloi* f. *hoipolloi* is sympatric with *L. scoparium* s. str. From that species *L. hoipolloi* is easily distinguished by the consistently longer, narrower, lanceolate leaves, whereas *L. scoparium* s. str. has broadly ovate, oval to orbicular, or broadly elliptic, ovate-elliptic leaves that are sharply acuminate. The mature leaves of *L. hoipolloi* f. *hoipolloi* are glabrescent though they usually retain some indumentum on their margins (especially toward the base); however, in *L. scoparium* s. str. the mature leaves tend to be completely glabrous; hairs if present are usually on the basal adaxial surface and then only sparsely so. *Leptospermum hoipolloi* f. *hoipolloi* has slightly larger flowers than *L. scoparium* (up to 24 mm diameter c.f. up to 20 mm in *L. scoparium*). As a rule, *L. scoparium* has white petals; however, pink-tinged

and completely red petals are also known in *L. scoparium* so these are not diagnostic.

Morphologically *Leptospermum hoipolloi* f. *hoipolloi* (and f. *incanum*) differs from *L. repo* by its more heavily branched growth habit and wider (2.2–3.1 mm c.f. 0.3–2.0 mm wide) lanceolate, elliptic-lanceolate, sharply acute, often distinctly acuminate leaves. When fully expanded, these are set at 60–80° rather than 85–90° to the branch axis, and due to their width, often obscure the branchlet internodes, such that the branchlets appear to be "leafier" than they really are. This contrasts with finer, more divergent leaves of *L. repo*, whose positioning exposes the branchlets internodes, imparting the impression that this species has fewer leaves than it does. The mature leaves of *Leptospermum hoipolloi* f. *hoipolloi* are also more consistently hairy, along the leaf margins, midrib and particularly near the leaf base. The leaves of *L. repo* are glabrous or nearly so. The flowers of *Leptospermum hoipolloi* f. *hoipolloi* are usually larger than those of *L. repo* (up to 24 mm diameter, as compared to 15 mm in *L. repo*), and whilst usually white, may also be pink-tinged, pink (the pink colour being more common in the northern part of the species range) or red (e.g., R.H. Matthews s.n. & H. Carse, CHR296471). Another difference is that the stamen filaments of *Leptospermum hoipolloi* f. *hoipolloi* though usually white, may be pink- or more rarely green-tinged (usually near base), or completely pink or carmine. The stigma and style of *L. hoipolloi* f. *hoipolloi* mature pink, red, amber, or brown (very rarely yellow green) rather than uniformly green in *L. repo* (de Lange, Schmid, 2021).

In the northern part of its range *L. hoipolloi* f. *hoipolloi* is found growing syntopically with f. *incanum* with no apparent ecological differentiation. Morphologically both taxa are similar except that the young emergent and maturing foliage of *L. hoipolloi* f. *incanum* is densely invested in long silvery grey appressed hairs, which in extreme examples impart a greyish appearance to the plant.

On coastal headlands, rock outcrops and open ground in Northland and the eastern Waikato *Leptospermum hoipolloi* f. *hoipolloi* is sympatric with, and commonly grows syntopically with *L. hoipolloi* f. *procumbens*. The key distinction between these two taxa is that *Leptospermum hoipolloi* f. *procumbens* has a decumbent growth habit with sprawling, prostrate stems (these often layering), pendulous branchlets, and distinctly silver hairy leaves (for other differences and a discussion on choice of rank



Fig. 5. *Leptospermum hoipolloi* f. *hoipolloi* (top plant) and *L. scoparium* s. str. (bottom) plant growing syntopically, Karekare / Mt Zion Track, Waitakere Range, West Auckland, Te Ika a Maui / North Island (image: P.J. de Lange)

see under *f. procumbens* below). This distinction whilst clear-cut in the field renders herbarium recognition problematic unless the collector has stated the growth habit.

Conservation Status. *Leptospermum hoipolloi* f. *hoipolloi*, as *Leptospermum* aff. *scoparium* (a) (AK284541; Auckland), has been listed by de Lange et al. (2018) as "Threatened / Nationally Vulnerable" qualified "DP [Data Poor]", "De [Designated]" using the New Zealand Threat Classification System (Townsend et al., 2008). No threat pathway was specified for this assessment.

This step was taken because of the perceived threat of myrtle rust disease, caused by the rust fungus *Austropuccinia psidii*. This rust was first reported from Aotearoa / New Zealand in May 2017, after which it has spread rapidly throughout the North Island and northern South Island (Galbraith, Large, 2017; Beresford et al., 2018; Schmid et al., 2021). At the time the threat listings for the New Zealand Vascular Flora was being finalised (May 2017) the detection of the rust was considered sufficient to review the threat status of all New Zealand *Myrtaceae* (see Introduction above and de Lange et al., 2018). *Leptospermum scoparium* s. l. was suspected of being susceptible on the basis of attacks on plants of this species cultivated in Australia (MPI n.d. <https://www.myrtlerust.org.nz/assets/Uploads/Suseptible-MR-Species.pdf> — accessed 25 May 2021). Subsequent research has now confirmed that *Leptospermum scoparium* s. l. is susceptible (Grant et al., 2020) though attacks on the Aotearoa / New Zealand members of this species complex outside cultivation are so far uncommon (see <https://inaturalist.nz/taxa/549208-Austropuccinia-psidii> — accessed 25 May 2021).

Whether or not the high threat listing allocated by de Lange et al. (2018) for *L. hoipolloi* f. *hoipolloi* is appropriate remains to be confirmed. In the interim between conservation assessments, *Austropuccinia* is still expanding its range and widening its host range on Aotearoa / New Zealand *Myrtaceae*; only time will tell what the full impact of this rust is on *Leptospermum*.

Therefore, pending the next national threat listing of the Aotearoa / New Zealand indigenous vascular flora (meeting held in 2022, listing in preparation due for publication in 2024), and cognisant of the ongoing spread of *Austropuccinia psidii*, the current threat status is not contested here. The only issue is that the qualifier 'DP' *sensu* Townsend et al.

(2008) had now been partitioned (Rolfe et al., 2019) such that for this species the qualifiers 'DPS' [Data Poor: Size] and 'DPT' [Data Poor: Trend] are suggested here, as there are no accurate estimates of the population size for this species, while the rate of decline is unknown, merely anticipated (hence the qualifier 'De' used by de Lange et al., 2018).

***Leptospermum hoipolloi* f. *procumbens*
L.M.H. Schmid & de Lange f. nov.**

Type: AOTEAROA / NEW ZEALAND, Te Ika a Maui / North Island, Te Aupōuri, Ōtaipango, (Henderson Bay), Kauere Road, Kauere coastal track walk. Latitude 34.735950 S, Longitude 173.113294 E. Co-occurring species: *Acacia longifolia* (Andrews) Willd. subsp. *longifolia*, *Cassitha paniculata* R. Br., *Cortaderia selleana* (Schult. & Schult. f.) Aschn. & Graebn., *Leptecophylla juniperina* (J.R. Forst. & G. Forst.) C.M. Weiller subsp. *juniperina*, *Leptospermum hoipolloi* f. *incanum*, *Leucopogon fraseri* A. Cunn., *Leucopogon fasciculatus* (G. Forst.) A. Rich., *Metrosideros excelsa* Sol. ex Gaertn., *Pteridium esculentum* (G. Forst.) Cockayne, *Schoenus brevifolius* R.Br. and *Rytidosperma racemosum* (R. Br.) Connor & Edgar (habitus — <https://inaturalist.nz/observations/34391915>). **Holotype:** P.J. de Lange & T.J.P. de Lange AK386179 (Fig. 6). **Isotypes:** NSW, UNITEC12810.

Life Science Identifier (LSID): urn:lsid:ipni.org:names:77318993-1

Diagnosis. Distinguished from *Leptospermum hoipolloi* f. *hoipolloi* and *L. hoipolloi* f. *incanum* by the procumbent growth habit.

Notes. Treating *L. hoipolloi* f. *procumbens* as a full species allied to *L. hoipolloi*, or alternatively as a sporadically occurring 'sport' within that species were both considered. Relegation to an unranked 'sport' we feel is not merited as *f. procumbens* is widespread, at times locally dominant, forms true-breeding populations, and is popular in cultivation (see below) so merits some level of taxonomic recognition. Species rank we consider inappropriate because, aside from the distinctive growth habit, we can find no other consistent morphological characters to warrant that higher rank. Therefore we have elected to use the rank of 'forma' in the sense of Garnock-Jones & Molloy (1982), Heenan (1998), and de Lange & Cameron (1999) for minor genetically fixed variation found exclusively within a larger gene pool of the same parent species, e.g., *Hebe amplexicaulis* f. *hirta* Garn.-Jones



Fig. 6. Holotype of *Leptospermum hoipolloi* f. *procumbens* L.M. Schmid & de Lange (AK386179)



Fig. 7. *Leptospermum hoipolloi* f. *procumbens* L.M.H. Schmid & de Lange – all images from the type locality, Kauere coastal track, Kauere, Ōtaipango (Henderson Bay), Te Aupōuri, Te Ika a Maui / North Island. A: Growth habit and habitat; B: Foliage; C: Flowering branchlets; D: Flowers (all images: P.J. de Lange)

& Molloy, *Mazus novaezeelandiae* f. *hirtus* Heenan and *Xeronema callistemon* f. *bracteosa* (L.B. Moore) de Lange & E.K. Cameron. This usage differs from the way Connor (1991) and Gardner (1997) applied that rank for allopatric variation in *Chionochoa* Zotov and *Macropiper* Miq. respectively but seems more consistent with that advocated for forma internationally (see Stuessy, 1990; Stace, 1991; Hamilton, Reichard, 1992; de Lange, 2012).

Growth habit (Fig. 7A–D) — trailing, silvery-grey or grey-green shrub with prostrate often interlacing branches that may layer on contact with soil, branches overlapping, forming ± circular patches up to 6 m diameter, and up to 1 m tall. **Leaves** — (5.6–)11.0–14.0(–24.0) × 2.2–2.8(–3.8)

mm, initially silver-white to silvery-grey (due to dense hair covering), maturing red-green, green or dark green; lamina broadly lanceolate to elliptic lanceolate, usually weakly concave, acute, minutely or distinctly cuspidate, bases narrowly cuneate, attenuate, margins minutely denticulate; surfaces densely sericeous, hairs white, usually persistent, rarely shedding on some specimens; oil glands numerous, more evident when dry. **Flowers** — when fully expanded (9–12–)20(–24) mm in diameter. **Hypanthium** — (4.0–)4.6(–6.0) × (1.5–)2.0(–4.4) mm. **Petals** — 5, spreading, (3.5–)4.3(–7.3) × (3.5–)5.3(–6.3) mm, usually white, sometimes pink-tinged, or pink, orbicular, apex obtuse to rotund, margins finely crimped, oil glands not

evident. **Fruits** — persistent, woody, (8.5–)10.1 × 15.1 mm (unopened), (8.8–)10.3 × 15.5(–18) mm (opened). Chromosome number: $2n = 22$, $n = 11$ (P.J. de Lange unpubl. count, UNITEC12810)

Representative Specimens (out of 65 seen).

Aotearoa / New Zealand. Te Ika a Maui / North Island: Manawa Tāwhi (Three Kings Islands), Manawa Tāwhi, 'Entomology Division' [presented G.W. Ramsay s.n.]. n.d., CHR215802; Te Paki, North Cape Scientific Reserve, North Cape Plateau, above Quarry, P.J. de Lange 9422, 17 Nov 2010, AK319498; Te Paki, Cape Rēinga, P.J. de Lange 4170, 18 Jan 2000, AK247250; Te Paki, south of Scott's Point and Ruakawa Bay, J. Collings s.n., 16 Jun 2009, AK359480; Te Aupōuri, Henderson Point, E.K. Cameron 9697, 1 Jul 1999, AK239605; Te Aupōuri, Ōtaipango (Henderson Bay), Kauere — Ōtaipango Coastal Track, P.J. de Lange 14989 & T.J.P. de Lange, 30 Sep 2019, UNITEC12430 (DUPLICATE: AK) (whole plant on sheet); Te Aupōuri, Ōtaipango (Henderson Bay), Kauere — Ōtaipango Coastal Track, P.J. de Lange 14984 & T.J.P. de Lange, 30 Sep 2019, UNITEC12430 (whole plant on sheet); Te Aupōuri, Ōtaipango (Henderson Bay), Kauere — Ōtaipango Coastal Track, P.J. de Lange 14986 & T.J.P. de Lange, 30 Sep 2019, UNITEC12427 (DUPLICATE: AK) (hermaphrodite flowering branch and vegetative branch); Te Aupōuri, Rarawa, Henderson Point, L.J. Forester s.n., 11 Oct 1996, AK294484; Te Aupōuri, Ōtaipango (Henderson Bay), Kauere — Ōtaipango Coastal Track, P.J. de Lange 14988 & T.J.P. de Lange, 30 Sep 2019, UNITEC12430 (whole plant on sheet); Te Aupōuri, Ōtaipango (Henderson Bay), Kauere — Ōtaipango Coastal Track, P.J. de Lange 14985 & T.J.P. de Lange, 30 Sep 2019, UNITEC12430 (whole juvenile plant on sheet); South of Mitimiti, L.J. Forster s.n. 11 Oct 2004, AK291098; Hokianga Harbour Mouth (south side), Outer South Head, Ārai Te Uru, P.J. de Lange 9238 & A.J. Townsend, 1 Sep 2010, AK316321; Waimamaku, Waimamaku Beach, R.C. Cooper s.n., 9 Jun 1966, AK126795; Waipoua, Kawerua, B.S. Parris s.n., Jul 1969, AK128183; Bay of Islands, Cape Brett, G.I. Collet s.n., Sep 1964, CHR153762; Aotea / Great Barrier Island, Maungapiko Summit, W.R. Sykes 290/86, 26 Nov 1986, CHR437460.

Distribution (Fig. 4). Endemic to Te Ika a Maui / North Island of Aotearoa / New Zealand where *Leptospermum hoipolloi* f. *procumbens* ranges from Te Paki south to at least Pakū Hill, Tairua, Coromandel Peninsula.

Etymology. The epithet "*procumbens*" Latin for 'prostrate', 'sprawling' (Stearn, 1992) refers to the distinct decumbent growth habit of the species, whose branches are flat and sprawling.

Habitats and co-associated flora species. *Leptospermum hoipolloi* f. *procumbens* is a mostly coastal (rarely lowland) plant that colonises open ground, coastal cliffs, and headlands. In these habitats it is widely sympatric with *Leptospermum hoipolloi* f. *hoipolloi*, and in the northern part of its range f. *incanum*. Because of its northerly distribution it is less commonly found growing with *L. scoparium* s. str. *Leptospermum hoipolloi* f. *procumbens* seems to have a naturally sparse distribution and except for North Cape it is rarely abundant over most of its range. In its preferred habitat it favours bare ground and exposed rock where it may form dense, almost impenetrable tangles up to a metre deep. Other than *Leptospermum hoipolloi* f. *hoipolloi*, common associates include *Kunzea linearis*, *K. robusta*, *Coprosma repens* A. Rich., *C. rhamnoides* A. Cunn., *C. robusta* Raoul, *Doodia australis* (Parris) Parris, *Geniostoma ligustrifolium* A. Cunn. var. *ligustrifolium*, *Veronica* L. spp., and *Pteridium esculentum*. At North Cape, on the ultramafic suite of rocks it is abundant, co-habiting with a diverse assemblage of plants, many endemic to that area (for descriptions of this see de Lange, 1997, 1998; de Lange, Heenan, 2001; de Lange et al., 2003). Elsewhere in Te Paki and on the adjoining Te Aupōuri Peninsula, *Leptospermum hoipolloi* f. *procumbens* may be found growing on consolidated sand within dune field, sandstone, and basalt rock outcrops. Further south, *L. hoipolloi* f. *procumbens* occurs in widely scattered, often small (< 20 plants) populations on coastal headlands and talus slopes where it often grows with f. *hoipolloi*.

Phenology. *Leptospermum hoipolloi* f. *procumbens* may be found flowering throughout the year. However, flowering often peaks in late winter to spring (August–October) sometimes with a secondary flowering peak around December–January.

Affinities. It is the decumbent, prostrate growth habit that separates *Leptospermum hoipolloi* f. *procumbens* from f. *hoipolloi* and f. *incanum*. We have found no other clear, consistent distinctions. As circumscribed here *Leptospermum hoipolloi* f. *procumbens* includes four races that were treated as tag names by de Lange et al. (2018): *Leptospermum* aff. *scoparium* (b) (AK247250; "coastal silver prostrate"), *Leptospermum* aff. *scoparium* (f) (AK319498;



Fig. 8. Decumbent race of *Leptospermum scoparium* s. l., Pillar Light, Pūponga, Te Wai Pounamu / South Island, which has affinities to *L. hoipolloi* f. *procumbens* but requires further investigation, including cultivation to confirm its taxonomic status (image: P.J. de Lange)



Fig. 9. Lectotype of *Leptospermum scoparium* var. *incanum* Cockayne (WELT-SP029389). A: Lectotype sheet; B: Close up of foliage showing disposition of hairs 'foliis pilosis' on the adaxial and abaxial leaf surfaces; C: Close up of portion of diagnosis written in the hand of Leonard Cockayne; D: Underside of the note (C) bearing a comment in the hand of Donald Petrie and 'L. Cockayne' written in Cockayne's hand (all images: P.J. de Lange)

North Cape), *Leptospermum* aff. *scoparium* (g) (AK319494; Surville Cliffs), and *Leptospermum* aff. *scoparium* var. *incanum* (h) (AK309827; North Cape). These three informally recognised races were provisionally recognised in the field by flower colour (pink vs white flowers) or other minor differences in leaf indumentum (leaves less hairy than other populations). When considered alongside

specimens encompassing the range of *L. hoipolloi* f. *procumbens* they form part of a continuum of subtle variation that we feel is better served by the recognition of a single taxon f. *procumbens*.

Similar plants occur in the lowlands of north-west Nelson, notably Golden Bay and Pūponga e.g., UNITEC11182, P.J. de Lange 14498 & T.J.P. de Lange (Fig. 8) that could be placed here. However,

these plants have smaller leaves and flowers, and the foliage is more consistently glabrous than *f. procumbens*; further the branches are not as long trailing, often suberect, and lack the same propensity to layer. We have not studied those plants in cultivation to exclude the possibility that their growth habit is habitat induced. These plants may be part of a separate north-western clade recognised by Koot et al. (2022). For now, we place them in *L. scoparium* s. l.

The distinctive growth habit of *Leptospermum hoipolloi* f. *procumbens* has resulted in a selection of it, reputedly from cliffs above Spirits Bay (Unuwhao), Te Pahi, that is still widely grown and sold as cv. 'Wairere' (Metcalfe, 1972, 1993). There is some field evidence of occasional putative hybrids between *L. hoipolloi* f. *procumbens* and *L. hoipolloi* f. *hoipolloi* (Kauere Coastal Track, Ōtaipango and Takatū Peninsula, Tawharanui). Such plants can be recognised by their taller shrub-growth habit with semi-erect, initially widely spreading semi-pendent branches. Putative hybrids are however extremely uncommon, those seen being restricted to track and roadsides.

In the northern part of its range *Leptospermum hoipolloi* f. *procumbens* associates with *f. hoipolloi* and *f. incanum*. It is less commonly found in association with *Leptospermum scoparium* s. str. From all these taxa it is separated by its widely spreading, decumbent, prostrate branches that often layer on contact with the soil. There are no other consistent differences evident (see comments above) though the flowers and capsules of *f. incanum* may be larger (see below).

The distinctive growth habit also serves to separate *L. hoipolloi* f. *procumbens* from *L. repo* a species with which it does not associate. Both taxa are also separated by their leaves, which in *L. repo* are narrower 0.3–2.0 mm c.f. 2.2–3.8 mm, linear, linear-lanceolate or filiform and ± glabrous (de Lange, Schmid, 2021), rather than broadly lanceolate to elliptic lanceolate, and distinctly silver-white to silvery-grey (due to dense hair covering), rather than glossy yellow-green, green to dark green.

Aside from its decumbent, prostrate growth habit *L. hoipolloi* f. *procumbens* is easily distinguished from *Leptospermum scoparium* s. str., by the more consistently hairy, longer, lanceolate leaves, and larger flowers. *Leptospermum scoparium* s. str. has smaller, broadly ovate, oval to orbicular and sharply acuminate leaves which are glabrous or nearly so when mature, and smaller flowers. The status of decumbent *Leptospermum* found on the coal measures of Westland, Te Wai Pounamu / South Island,

e.g., *W.R.B. Oliver s.n.*, Denniston Plateau, WELT-SP06718. does however need further investigation. These plants are not *Leptospermum hoipolloi* f. *procumbens*, they differ in their more open growth habit, smaller ovate to broadly but shortly lanceolate glabrescent leaves, smaller flowers and capsules.

Conservation Status. *Leptospermum hoipolloi* f. *procumbens*, as *Leptospermum* aff. *scoparium* (b) (AK247250; "coastal silver prostrate"), has been listed by de Lange et al. (2018) as "Threatened / Nationally Vulnerable" citing threat pathway E2 (Total area of occupancy ≤ 10 000 ha (100 km²), predicted decline 50–70%), qualified "DP [Data Poor]", "De [Designated]" using the New Zealand Threat Classification System (Townsend et al., 2008).

As discussed for *L. hoipolloi* f. *hoipolloi* above this step was taken because of the perceived threat of myrtle rust disease, caused by the rust fungus *Austropuccinia psidii*.

Irrespective of the potential impacts of *Austropuccinia*, *Leptospermum hoipolloi* f. *procumbens* is a naturally uncommon, biologically sparse form taxon throughout most of its range. With the exception of the serpentinite outcrops of North Cape there are very few places where *f. procumbens* is locally common and, with few exceptions, few locations are secure from invasive weeds and land development for coastal resorts.

The threat assessment allocated for *L. hoipolloi* f. *procumbens* by de Lange et al. (2018) was based on an estimated area of occupancy, and the assumption that as an uncommon plant, should *Austropuccinia* impact on it, the decline rate would be extreme. However, as there was no data to support these assumptions, and as assessment was called on as a precautionary measure, the panel elected to qualify their decisions as 'De' [Designated]. As we still have no idea what the impact of *Austropuccinia psidii* on *Leptospermum* will be, we retain the current precautionary threat listing. The only suggested change to that threat assessment is the revision of the qualifier 'DP' to 'DPS' [Data Poor: Size] and 'DPT' [Data Poor: Trend] (Rolfe et al., 2019).

***Leptospermum hoipolloi* f. *incanum* (Cockayne) de Lange & L.M.H. Schmid f. comb. et stat nov.**

= *Leptospermum scoparium* var. *incanum* Cockayne Trans. & Proc. New Zealand Inst. 49: 58 (1917)
Life Science Identifier (LSID): urn:Isid:ipni.org:names:77318841-1

Original material (according to the protologue): "North Auckland Botanical District—Common, especially in the northern part of the district, in many places forming thickets. L.C." (Cockayne, 1917).

Lectotype (here designated) (Fig. 9): WELT-SP029389!, *L. Cockayne*, 4 May 1905, labelled in pencil 'Awanui Estuary Heath [?], Leptospermum scoparium var fructo [?] rubro & foliis pilosis L. Cockayne' and annotated by Donald Petrie in Indian ink 'this seems to be the type of *L. scoparium* var. *incanum* Ckn'. **Isolectotypes:** WELT-SP029390! WELT-SP029430! AK5497!

Notes. In his protologue for *Leptospermum scoparium* var. *incanum*, Cockayne (1917 [1916]) described his new variety thus: '*Folia lanceolata vel lineari-lanceolata, circa 8mm longa, subtus praecipue juventute ± pilis sericeis albidis, obsita; flores magni petalis roseis leve tinctis. North Island: North Auckland Botanical District—Common, especially in the northern part of the district, in many places forming thickets. L.C.*' He did not specify a particular location, and his North Auckland Botanical District, defined in the same publication, comprised all that land north of '...the Auckland Isthmus (excepting the Cape Colville Peninsula and the two Barrier Islands)', a large area. However, his wording makes clear he meant the northern part of this district. WELT-SP029389 is the only collection we have seen in the 'Cockayne Herbarium' that corresponds to some of Cockayne's protologue, notably 'foliis pilosis', and is labelled in his hand '*Leptospermum scoparium* var.'. The comment by Petrie that the specimen 'seems to be the type of *L. scoparium* var. *incanum*' we also take as indicative that this is part of Cockayne's type collection for his new variety, and so we designate it here 'Lectotype'. Lectotype is chosen in preference to Holotype because Cockayne type specimens occur in a range of the world's herbaria (Thomson, 1983, 2021; P.J. de Lange unpublished data)

We have elected to treat Cockayne's variety at the rank of forma. As the time of preparing this paper for final submission we had elected to furnish this *Leptospermum* with a new epithet because of potential confusion with *Leptospermum incanum* Turcz., an Australian endemic (Turczaninow, 1852). Now that this species has been transferred to *Leptospermopsis* S. Moore as *L. incana* (Turcz.) Peter G. Wilson (Wilson, Heslewood, 2023), any potential confusion over the usage of "*incanum*" is no longer an

issue. The decision to treat this plant at the rank of forma accords with the observation that the characters that define Cockayne's variety (leaf investiture and petal colour), are either uncommon (leaf hairiness) or not unique (petal colour).

Growth habit (Fig. 10A–F) — erect silvery-grey or grey-green shrub up to 3 m tall. **Leaves** — (6.0–) 11.0–18.0(–30.0) × 4.2–4.8(–6.0) mm, initially silvery-grey or dark grey (due to dense hair covering), with age and hair loss, maturing red-green, green or dark green; lamina broadly lanceolate to elliptic lanceolate, usually weakly concave, acute, minutely or distinctly cuspidate, bases narrowly cuneate, attenuate, margins minutely denticulate; surfaces densely sericeous, hairs silvery-grey or grey, conspicuous in young emerging foliage, shedding as leaves expand and mature, with mature leaves usually sparsely to densely hairy in lower ½–⅓; oil glands obscured by hairs, more evident when dry. **Flowers** — when fully expanded (12–)24(–30) mm in diameter. **Hypanthium** — (4.0–)4.6(–6.0) × (1.5–)2.0(–4.4) mm. **Petals** — 5, spreading, (4.0–)5.3(–6.3) × (3.8–)5.2(–6.0) mm, usually white tinged pink or streaked with pink, sometimes completely pink, rarely dark red, orbicular, apex obtuse to rotund, margins finely crimped, oil glands not evident. **Fruits** — persistent, woody, (8–)12 × 15 mm (unopened), (9–)16 × 11(–18) mm (opened). Chromosome number: $2n = 22, n = 11_{II}$ (P.J. de Lange, unpublished count, UNITEC14025)

Representative Specimens (out of 215 seen). Aotearoa / New Zealand. Te Ika a Maui / North Island: Manawa Tāwhi / Three Kings Islands: Manawa Tāwhi (Great Island), Tasman Stream, P.J. de Lange 1097, 15 Oct 1991, CHR475013; Te Pahi, North Cape, North Cape Scientific Reserve, North Cape Road, Plateau area near Quarry, P.J. de Lange 9423, 17 Nov 2010, AK319499; Te Pahi, Waikukū Flats, North Cape Road, P.J. de Lange 13189 & K.A. Raharaha, 21 Sep 2016, AK362914; Te Pahi, Te Hāpua Road, R. Cooper s.n., 25 Sep 1969, AK121114; Te Aupōuri, Te Kāo, Te Ahu Road, near Te Kau Stream, P.J. de Lange 5767, Nov 2003, AK284540; Te Aupōuri, Ōtaipango, Raharaha Property, P.J. de Lange 13191 & K.A. Raharaha, 22 Sep 2016, AK362916; Te Oneroa-o-Tōhe (90 Mile Beach), H.H. Allan s.n., n.d., CHR21423, 21424; Te Aupōuri, Kaimaumu, Ranganu Harbour, R. Cooper s.n., 7 Nov 1966, AK117759; Ranganu Harbour, Walker Island, P.J.



Fig. 10. *Leptospermum hoipolloi* de Lange & L.M.H. Schmid f. *incanum*. A: Growth habit at Karikari Peninsula, Te Ika a Maui / North Island; B: Foliage, Karikari Peninsula, Te Ika a Maui / North Island; C: Flowering branches with pink-flowers (the popular concept of f. *incanum* as *Leptospermum scoparium* var. *incanum*), cultivar ‘Sheryl Lee’ a selection of f. *incanum* bought into cultivation by the late Graeme Platt from a wild plant collected from near Lake Ohia, Karikari Peninsula, Te Ika a Maui / North Island; D: Flowering branchlets (darker pink-tinged in this case), Raharaha Open Space Covenant, Ōtaipango, Ōtaipango (Henderson Bay), Te Aupōuri, Te Ika a Maui / North Island; E: Flowering branchlet with white-pink-tinged flowers, Ōtaipango (Henderson Bay), Te Aupōuri, Te Ika a Maui / North Island; F: Unopened, mature fruiting capsules, Ōtaipango (Henderson Bay), Te Aupōuri, Te Ika a Maui / North Island (images: A, B — M. Hutchison, C–F — P.J. de Lange)

de Lange 1858, 17 Nov 1992, AK211061; Karikari Peninsula, Karikari Beach, *P.J. de Lange* 1736 & *G.M. Crowcroft*, 14 Oct 1992, AK212357; Karikari

Peninsula, Lake Rotokawau, *P.J. de Lange* 573, 16 Nov 1990, AK200880; Karikari Peninsula, Lake Ohia, *R. Cooper*, Sep 1962, AK93447 (AK36093

AK226297); Awanui, Paparore Road, R. Cooper, 7 Nov 1966, AK117755; Tauroa, H. Carse s.n. & H.B. Matthews, 18 Dec 1918, CHR296312; Hokianga Harbour, 1 mile west of Kohukohu, R. Melville s.n., & L.B. Moore, 10 Nov 1961, CHR130627; Waipoua Forest 2 miles west — south west of [park] headquarters, G. Rawlings, A. Esler 3799, D. Smith & S.A. Astridge, 12 Apr 1972, CHR229015.

Distribution. Endemic to the northern most portion of Te Ika a Maui / North Island of Aotearoa / New Zealand, *Leptospermum hoipolloi* f. *incanum* co-habits with f. *hoipolloi* ranging from Manawa Tāwhi (Three Kings islands), and Te Paki south to Waipoua Forest and Whangaroa Harbour, with occurrences south of Ahipara / Mangōnui increasingly confined to coastal sites, extremely localised and sporadic. It is seemingly absent inland of those southerly locations where it is replaced by f. *hoipolloi*. Some herbarium records south of these locations probably represent garden plants or naturalisations from these e.g., CHR 296270, H. Carse s.n., from Maungatāpere, near Whangārei almost certainly came from the collectors garden.

Etymology. The epithet "*incanum*" (Latin for 'grey, hoary'; see Stearn (1992) was not explained by Cockayne (1917). However, based on his wording in his protologue it seems to have been influenced by the distinctive hairy leaves (leaves hairy with silky whitish hairs') of his new variety.

Habitats and co-associated flora species. *Leptospermum hoipolloi* f. *incanum* though widespread within its range it is only locally common to occasionally abundant in a few places within the sand country, gumland and peat bogs and coastal headlands of Te Paki and Te Aupōuri. In these habitats it co-habits with *L. hoipolloi* f. *hoipolloi*, and on coastal headlands f. *procumbens*. Other than *Leptospermum* common associates within this range, especially in gumland, include *Dracophyllum lessonianum* A. Rich., *Epacris pauciflora* A. Rich., *Kunzea linearis*. Within dune field the main associates are *Apodasmia similis* (Edgar) B.G. Briggs & L.A.S. Johnson, *Machaerina juncea* (R. Br.) T. Koyama and *Kunzea linearis*.

South, east and west of Te Aupōuri much of the habitat of *Leptospermum hoipolloi* f. *incanum* has been cleared for agriculture; however, on the extensive gumlands of the Ahipara Plateau it achieves local dominance, and there it often associates with *Kunzea amathicola*, *K. linearis* and *K. robusta*. Further south f. *incanum* is less common,

in part because of land clearance but also because increasingly it is replaced by f. *hoipolloi*.

Phenology. Although *Leptospermum hoipolloi* f. *incanum* may be found flowering throughout the year, flowering usually peaks in late winter to spring (August–October) after which flowering is uncommon.

Affinities. As noted, above *Leptospermum hoipolloi* f. *incanum* is best distinguished from all other Aotearoa / New Zealand *Leptospermum* taxa by the shrub to small-tree habit and distinctive silvery-grey to dull grey indumentum covering the emergent and maturing leaf surfaces (these features are well captured in a painting by Eagle (2006; p. 233) and in colour images in de Lange and Schmid (2021: Fig. 6)). When well-developed the indumentum imparts a distinctive silvery or greyish cast to specimens. Traditionally, f. *incanum* (as *L. scoparium* var. *incanum*) has been separated by botanists from *L. scoparium* var. *scoparium* by the pink-tinged flowers, and while pink or pink-tinged flowers are common in this taxon, this is not exclusively so. The same colour, with the current exception of *L. repo* (de Lange, Schmid, 2021) is present to varying degrees in the other Aotearoa / New Zealand *Leptospermum* though it is true that pink and pink-tinged flowers are more common in the northern part of Te Ika a Maui / North Island. Aside from leaf indumentum, f. *incanum* also appears to have the largest flower and capsule sizes of the genus in Aotearoa / New Zealand, with flowers up to 30 mm and capsules 18 mm diameter.

Along the coastal promontories of Te Paki, Te Aupōuri, Reef Point / Ahipara and Karikari Peninsula Northland *Leptospermum hoipolloi* f. *incanum* commonly associates with f. *procumbens*. In the field the distinctive decumbent, prostrate long-trailing growth habit of f. *procumbens* readily distinguishes it from the erect, shrub or small tree habit of f. *incanum*. In the herbarium, in the absence of critical collector notes on growth habits both taxa are similar, vegetatively there is no consistent difference though flowers and capsules of f. *incanum* are, as a rule, larger (which is more evident in fresh rather than dried specimens).

Leptospermum hoipolloi f. *incanum* historically associated with *L. repo* in the formerly extensive, and now completely drained peat bogs bordering Lake Tangonge, Kaitaia. Though sympatry is now probably historic, in the herbarium f. *incanum*

is distinguished from *L. repo* by the more heavily branched growth habit and wider (4.2–6.3 mm c.f. 0.3–2.0 mm wide) lanceolate, elliptic-lanceolate, sharply acute, often distinctly cuspidate copiously hairy leaves. These, due to their width, often obscure the branchlets internodes, such that the branchlets appear to be "leafier" than they are. This contrasts with finer, more divergent leaves of *L. repo*, whose positioning exposes the branchlet internodes, imparting the impression that this species has fewer leaves than it does (de Lange, Schmid, 2021). The flowers of *Leptospermum hoipolloi* f. *incanum* are larger than those of *L. repo* (up to 30 mm diameter, as compared to 15 mm in *L. repo*), and usually pink-tinged, pink-streaked, or pink, sometimes red (rarely completely white). Another difference is that the stamen filaments of f. *incanum* are usually pink-tinged, or completely pink (very rarely white), whilst the style is usually red, rather than uniformly green in *L. repo*. Finally, the capsules of *L. repo* are up to 6 mm diameter, and 18 mm in f. *incanum*.

Leptospermum hoipolloi f. *incanum* rarely associates with *L. scoparium* s. str. in the wild. However, herbarium material of f. *incanum* can be distinguished readily from *L. scoparium* s. str. by the copiously, persistently hairy, longer, broader lanceolate leaves, larger flowers, and capsules.

Conservation Status. *Leptospermum hoipolloi* f. *incanum*, as *L. scoparium* var. *incanum*, has been listed by de Lange et al. (2018) as "Threatened / Nationally Vulnerable" citing threat pathway E2 (Total area of occupancy \leq 10 000 ha (100 km²), predicted decline of 50–70%), qualified "DP [Data Poor]", "De [Designated]" using the New Zealand Threat Classification System (Townsend et al., 2008).

As discussed for the other *Leptospermum* treated here this step was taken as a precautionary measure because of the perceived threat of myrtle rust disease, caused by the rust fungus *Austropuccinia psidii*. As of 2021, *Austropuccinia psidii*, though known to infect *Leptospermum scoparium* s. l. (Grant et al., 2020) has yet to be reported from wild populations of f. *incanum* (*L. scoparium* var. *incanum*). This situation will undoubtedly change though when that rust increases its dominance in Aotearoa / New Zealand.

Although *Austropuccinia* has yet to be confirmed as a threat to f. *incanum*, that taxon has declined over most of its range through

past and ongoing land clearance. Whilst the honey industry's demand for *Leptospermum scoparium* s. l. has temporarily halted land clearance of this species complex, development of wetlands and dune field at Te Aupōuri for avocado (*Persea americana* Mill.) (Piper, 2019) has destroyed swathes of f. *incanum* through the destruction of the shrublands and wetlands north of Waiharara, across Motutangi north to at least the southern outskirts of Houhora. Habitat loss is also ongoing through invasion of the gumland and dune field habitats of f. *incanum* by a fire-adapted, invasive Australian / South African flora of *Acacia* Mill. spp., especially *A. longifolia* subsp. *longifolia*, *Banksia integrifolia* L. f., *Callistachys lanceolata* Vent., *Osteospermum moniliferum* L. subsp. *moniliferum*, *Hakea gibbosa* Cav., *H. decurrens* subsp. *physocarpa* W.R. Barker, and *Watsonia* Mill. spp. The spread of the Pampas grasses, *Cortaderia jubata* (Lemoine) Stapf. and *C. selloana* (Schult. & Schult. f.) Asch. & Graebn., into dune slacks and the margins of peat bogs is also a serious threat to *Leptospermum hoipolloi* f. *incanum*. Populations of f. *incanum* are also marginalised by the extensive pine (*Pinus radiata* D. Don) plantations along the western portion of Te Aupōuri. While plantation forestry creates the disturbance, *Leptospermum* needs to flourish, the subsequent invasion by Pampas grass reduces regeneration success, and overall f. *incanum* is now declining from those areas.

Further north, f. *incanum* though common in Te Pahi, is in gradual decline as the shrubland it grows in succeeds to taller forest. Te Pahi also is subjected to the same weed threats as adjacent Te Aupōuri.

While the historic loss of f. *incanum* habitat is unknown, some estimates are possible for Te Aupōuri, whose sandy soils and active dune fields have only sparingly been colonised by forest (Conning, Holland, 2003), and so provide ideal habitat for *Leptospermum hoipolloi* f. *hoipolloi* and f. *incanum*. Te Aupōuri, excluding harbours, occupies an area of 101254 ha of which 9113 (9%) of the original indigenous ecosystems remain (Conning, Holland, 2003). Notably this loss of habitat has occurred over the last 120 or so years, and is continuing due to changing land use, such as the expansion of avocado orchards in southern Te Aupōuri. Conning and Holland (2003) noted that 10.7% of the indigenous ecosystems of Te Aupōuri remaining are formally protected. As observed above, these ecosystems are still in decline through weed

invasion, and some, as a consequence of increased water abstraction for avocado orchards (Piper, 2019).

Te Aupōuri and Te Paki are the stronghold of *f. incanum*, south of there, the taxon is mostly present as small, remnant stands. Therefore, the historic and ongoing loss of the habitats *f. incanum* favours are, even without the presumed threat of *Austropuccinia*, sufficient cause to propose a new threat listing for the species. From our data we conservatively estimate that *f. incanum* has been lost for c. 90% of its range, acknowledging that the loss is probably more, as not all of the remaining indigenous ecosystems are suitable for this *Leptospermum*. However, we have no reliable data on population size; in places where the *f. incanum* is present, plants may number from the low 100's to the high 1000's or even more. In the absence of population size but with the impression that tens of thousands of plants remain in the wild we have taken the higher estimate for a population size of >100,000 individuals (see Townsend et al., 2008). Unfortunately, the current New Zealand Threat Classification System does not consider historical loss. In this regard, changes to the qualifiers used by (Townsend et al., 2008) were made, including the relegation of 'Relict' from the 'At Risk' category to that of a qualifier (Rolfe et al., 2019) with a new definition that recognise past loss and ongoing loss more effectively, allowing for its proposed use here.

We therefore propose a new threat status on the assumption that the total population is >100,000 individuals, and that the rate of ongoing decline in *f. incanum* through habitat loss from land clearance, weed invasion and subsequent deterioration of indigenous vegetation, is probably in the vicinity of 10% over the next three generations (Townsend et al., 2008). This would result in a proposed conservation status of 'At Risk / Declining' pathway C, Status 1, Trend 1 (Townsend et al., 2008). To this proposed listing we suggest the following qualifiers (*sensu* Rolfe et al., (2019)), 'DPS' [Data Poor: Size] because an accurate population size is unknown, 'DPT' [Data Poor: Trend], population trend is uncertain, and finally 'Rel' [Relict] because the species has been lost from at least 90% of its range, and whose remaining population is still in decline. This status remains to be ratified by the Aotearoa / New Zealand indigenous vascular plant threat assessment panel.

Key to the *Leptospermum* of Aotearoa / New Zealand

1. Trees (up to 12 m tall), shrubs or decumbent plants with glabrescent, ovate, shortly oblong (up to 6 mm long) or orbicular, sharply acute, or acuminate leaves *Leptospermum scoparium*

– Trees (up to 10 m tall), shrubs or decumbent plants with glabrescent or hairy, linear, linear-lanceolate, filiform, lanceolate, elliptic-lanceolate sometimes shortly acute or acuminate leaves (5–22 mm long)

2. Trees (up to 6 m tall) or shrubs confined to peat bogs; leaves glossy, yellow-green, green to dark green, linear, linear-lanceolate, filiform, up to 15 mm long and 2 mm wide, glabrescent; flowers white up to 15 mm diameter *Leptospermum repo*

– Trees (up to 10 m tall), shrubs or decumbent with trailing, prostrate stems, occupying successional habitats and wetlands; leaves dull to semi-glossy, red-green, green to dark green (sometimes glaucescent), lanceolate, elliptic-lanceolate, up to 30 mm long and 4 mm wide, hairy or glabrescent, flowers white, white streaked or tinged pink, pink or red up to 30 mm diameter (when fresh)

3. Trees (up to 10 m tall) or shrubs, leaves dull to semi-glossy, usually green to dark green (sometimes glaucescent), 5.0–22.0 × 2.2–3.1 mm; lamina lanceolate, elliptic lanceolate; surfaces on young growth hairy near base and along midrib, and leaf margin, maturing ± glabrescent with hairs ± persisting on basal portion of leaf and along portions of leaf margin; flowers up to 24 mm diameter (when fresh)..... *Leptospermum hoipolloi f. hoipolloi*

– Shrubs (up to 3 m tall) or decumbent with prostrate, trailing branches (often layering on contact with soil); leaves silver-white, silvery-grey, or grey, maturing red-green, green or dark green, 5.6–30.0 × 2.2–6.0 mm lamina broadly lanceolate to elliptic lanceolate, emergent and maturing leaf surfaces densely sericeous; flowers up to 30 diameter (when fresh)

4. Shrubs (up to 1 m tall), branches decumbent, prostrate, widely spreading (often laying on contact with soil), forming circular patches; leaves silver-white to silvery-grey, 5.6–24.0 × 2.2–3.8 mm; flowers up to 24 mm diameter (when fresh), usually white, sometimes pink-tinged or pink *Leptospermum hoipolloi f. procumbens*

– Shrubs (up to 3 m tall), branches erect; emergent and maturing leaves silvery-grey or dark grey, 6.0–30.0 × 4.2–6.0 mm; flowers up to 30 mm diameter (when fresh), usually white tinged or streaked pink or pink or occasionally red
*Leptospermum hoipolloi* f. *incanum*

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Ethics Declaration

The authors declare no conflict of interest.

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REFERENCES

- Allan H.H. 1961. *Flora of New Zealand*. Vol. 1. Wellington: P.D. Hasselberg, Government Printer, liv + 1083 pp.
- Beresford R.M., Turner R., Tait A., Paul V., Macara G., Yu Z.D., Martin R. 2018. Predicting the climatic risk of myrtle rust during its first year in New Zealand. *Rust Pathogens*, 71: 332–347. <https://doi.org/10.30843/nzpp.2018.71.176>
- Bond W.J., Dickinson K.J., Mark A.F. 2004. What limits the spread of fire-dependent vegetation? Evidence from geographic variation of serotiny in a New Zealand shrub. *Global Ecology and Biogeography*, 13: 115–127. <https://doi.org/10.1111/j.1466-882X.2004.00070.x>
- Burrell J. 1965. Ecology of *Leptospermum* in Otago. *New Zealand Journal of Botany*, 3: 3–16. <https://doi.org/10.1080/0028825X.1965.10428708>
- Buys M.H., Winkworth R.C., de Lange P.J., Wilson P.G., Mitchell N., Lemmon A.R., Moriarty-Lemmon E., Holland S., Cherry J.R., Kl p st  J. 2019. The phylogenomics of diversification on an island: applying anchored hybrid enrichment to New Zealand *Leptospermum scoparium* (Myrtaceae). *Botanical Journal of the Linnean Society*, 191(1): 18–29. <https://doi.org/10.1093/botlinnean/boz026>
- Cockayne L. 1917 [1916]. Art. V.—Notes on New Zealand Floristic Botany, including Descriptions of New Species, etc. (No. 2). *Transactions and Proceedings of the New Zealand Institute*, 49: 56–65.
- Conning L., Holland W. 2003. *Natural areas of Aup uri Ecological District Reconnaissance Survey Report for the Protected Natural Areas Programme*. New Zealand Protected Natural Areas Programme. Whangarei: Department of Conservation, 372 pp. Available at: <https://www.doc.govt.nz/globalassets/documents/conservation/land-and-freshwater/land-aupouri-ecological-district/aupouri-ecological-district-full-report-excl-level-1-2-sites.pdf>

- Connor H.E. 1991. *Chionochoa* Zotov (Gramineae) in New Zealand. *New Zealand Journal of Botany* 29(2): 219–283. <https://doi.org/10.1080/0028825X.1991.10416605>
- Davis P.H., Heywood V.H. 1963. *Principles of Angiosperm Taxonomy*. Edinburgh; London: Oliver & Boyd, 556 pp.
- de Lange P.J. 1997. *Hebe brevifolia* (Scrophulariaceae) — an ultramafic endemic of the Surville Cliffs, North Cape, New Zealand. *New Zealand Journal of Botany*, 35(1): 1–8. <https://doi.org/10.1080/0028825X.1997.10410668>
- de Lange P.J. 1998. *Pittosporum ellipticum* subsp. *serpentinum* (Pittosporaceae) — a new ultramafic endemic from the Surville Cliffs, North Cape, New Zealand. *New Zealand Journal of Botany*, 36(3): 389–397. <https://doi.org/10.1080/0028825X.1998.9512577>
- de Lange P.J. 2012. Taxonomic notes on the New Zealand flora: new names in *Piper* (Piperaceae). *New Zealand Journal of Botany*, 50(4): 485–487. <https://doi.org/10.1080/0028825X.2012.708904>
- de Lange P.J., Cameron E.K. 1999. The vascular flora of Aorangi Island, Poor Knights Islands, northern New Zealand. *New Zealand Journal of Botany*, 37(3): 433–468. <https://doi.org/10.1080/0028825X.1999.9512646>
- de Lange P.J., Heenan P.B. 2001. A new *Coprosma* (Rubiaceae) from the Surville Cliffs, North Cape, New Zealand. *New Zealand Journal of Botany*, 39(2): 217–223. <https://doi.org/10.1080/0028825X.2001.9512732>
- de Lange P.J., Murray B.G. 2004. Chromosome numbers in *Kunzea* (Myrtaceae). *Australian Journal of Botany*, 52: 609–617. <https://doi.org/10.1071/BT04060>
- de Lange P.J., Heenan P.B., Dawson M.I. 2003. A new species of *Leucopogon* (Ericaceae) from the Surville Cliffs, North Cape, New Zealand. *New Zealand Journal of Botany*, 41(1): 13–21. <https://doi.org/10.1080/0028825X.2003.9512829>
- de Lange P.J., Rolfe J.R., Barkla J.W., Courtney S.P., Champion P.D., Perrie L.R., Beadel S.M., Ford K.A., Breitwieser I., Schönberger I., Hindmarsh-Walls R., Heenan P.B., Ladley K. 2018. Conservation status of New Zealand indigenous vascular plants, 2017. *New Zealand Threat Classification Series*, 22, 82 pp. <https://www.doc.govt.nz/documents/science-and-technical/nztcs22entire.pdf>
- de Lange P.J., Schmid L.M.H. 2021. *Leptospermum repo* (Myrtaceae), a new species from northern Aotearoa / New Zealand peat bog habitats, segregated from *Leptospermum scoparium* s. l. *Ukrainian Botanical Journal*, 78(4): 247–265. <https://doi.org/10.15407/ukrbotj78.04.247>
- Deverson T., Kennedy G. 2005. *The New Zealand Oxford Dictionary*. Melbourne: Oxford University Press, 1355 pp.
- Douglas M.H., van Klink J.W., Smallfield B.M., Perry N.B., Anderson R.E., Johnstone P., Weavers R.T. 2004. Essential oils from New Zealand mānuka: triketone and other chemotypes of *Leptospermum scoparium*. *Phytochemistry*, 65: 1255–1264. <https://doi.org/10.1016/j.phytochem.2004.03.019>
- Duretto M.F. 1999. *Boronia* sect. *Valvatae* (Benth.) Engl. (Rutaceae) in Queensland Australia. *Austrobaileya*, 5(2): 288–291.
- Eagle A. 2006. *Eagle's trees and shrubs of New Zealand*. Revised ed. Wellington: Te Papa Press, 1114 pp.
- Galbraith M.P., Large M.F. 2017. Implications for selected indigenous fauna of Tiritiri Matangi of the establishment of *Austropuccinia psidii* (G. Winter) Beenken (myrtle rust) in northern New Zealand. *Perspectives in Biosecurity*, 2: 6–26. Available at: <https://www.unitec.ac.nz/epress/wp-content/uploads/2017/12/Implications-for-Selected-Indigenous-Fauna-of-Tiritiri-Matangi.pdf>
- Gardner R.O. 1997. *Macropiper* (Piperaceae) in the south-west Pacific. *New Zealand Journal of Botany*, 35(3): 293–307. <https://doi.org/10.1080/0028825X.1997.10410155>
- Garnock-Jones P.J., Molloy B.P.J. 1982. Polymorphism and the taxonomic status of the *Hebe amplexicaulis* complex (Scrophulariaceae). *New Zealand Journal of Botany*, 20(3): 391–399. Available at: <https://www.tandfonline.com/doi/pdf/10.1080/0028825X.1982.10428509>
- Grant R., Smith G.R., Ganley B.J., Chagné, D., Nadarajan J., Pathirana, R.N., Ryan J., Arnst E.A., Sutherland R., Soewarto J., Houliston G., Marsn A.T., Koot E., Carnegie A.J., Menzies T., Lee D.J., Shuey L.S., Pegg G.S. 2020. Resistance of New Zealand Provenance *Leptospermum scoparium*, *Kunzea robusta*, *Kunzea linearis*, and *Metrosideros excelsa* to *Austropuccinia psidii*. *Plant Disease*, 104 (6): 1771–1780. <https://doi.org/10.1094/PDIS-11-19-2302-RE>
- Hamilton C.W., Reichard S.H. 1992. Current practice in the use of subspecies, variety, and forma in the classification of wild plants. *Taxon*, 41: 485–498. <https://doi.org/10.2307/1222819>
- Heenan P.B. 1998. *Mazus novaezeelandiae* (Scrophulariaceae): taxonomy, distribution, habitats, and conservation. *New Zealand Journal of Botany*, 36: 407–416. <https://doi.org/10.1080/0028825X.1998.9512579>
- Koot E., Arnst E., Taane M., Goldsmith K., Dormont E., Hancox T., Delaporte K., Thrimawithana A., Reihana K., González-Martínez S.C., Goldsmith V., Houliston G., Chagné D. 2022. Genome-wide patterns of genetic diversity, population structure and demographic history in mānuka (*Leptospermum scoparium*) grown on indigenous Māori land. *Horticultural Research*, 9: 1–17. <https://doi.org/10.1093/hr/uhab012>
- McDonald C.M., Keeling S.E., Brewer M.J., Hathaway S.C. 2018. Using chemical and DNA marker analysis to authenticate a high-value food, mānuka honey. *Science of Food*, 2: Art. 9. <https://doi.org/10.1038/s41538-018-0016-6>
- Metcalf L.J. 1972. *The cultivation of New Zealand trees and shrubs*. Wellington: A.H. & A.W. Reed Ltd., 292 pp.
- Metcalf L.J. 1993. *The cultivation of New Zealand plants*. Auckland: Godwit Press Ltd., 260 pp.
- Molan P. 1995. The antibacterial properties of honey. *Chemistry in New Zealand*, 59(4): 10–14.
- Molan P.C., Russell K.M. 1988. Non-peroxide antibacterial activity in some New Zealand honeys. *Journal of Apicultural Research*, 27: 62–67.

- Piper D. 2019. *Rising demand for avocados could threaten water levels in Aupōuri, Northland*. Available at: <https://www.stuff.co.nz/environment/118023110/demand-for-avocados-could-threaten-water-levels-in-aupuri-northland> (Accessed 26 August 2021).
- Porter N.G., Wilkins A.L. 1998. Chemical, physical, and antimicrobial properties of essential oils of *Leptospermum scoparium* and *Kunzea ericoides*. *Phytochemistry*, 50: 407–515. [https://doi.org/10.1016/s0031-9422\(98\)00548-2](https://doi.org/10.1016/s0031-9422(98)00548-2)
- Porter N.G., Smale P.E., Nelson M.A., Hay A.J., Van Klink J.W., Dean C.M. 1998. Variability in essential oil and plant morphology within a *Leptospermum scoparium* population. *New Zealand Journal of Botany*, 36: 125–133. <https://doi.org/10.1080/0028825X.1998.9512551>
- Rolfe J.R., Makan T., Tait A. 2019. *Supplement to the New Zealand Threat Classification System manual - new qualifiers and amendments to qualifier definitions*. Available at: <https://nztc.org.nz> (Accessed 18 August 2021).
- Schönberger I., Wilton A.D., Boardman K.F., Breitwieser I., de Lange P.J., de Pauw B., Ford K.A., Gibb E.S., Glenney D.S., Greer P.A., Heenan P.B., Maule H.G., Novis P.M., Prebble J.M., Smissen R.D., Tawiri K. 2022. *Checklist of the New Zealand Flora – Seed Plants*. Lincoln, Manaaki Whenua-Landcare Research, 419 pp.
- Schmid L., Large M., Galbraith M., de Lange P. 2021. Short Communication: Observation of western honeybee (*Apis mellifera*) foraging urediniospores from myrtle-rust infected maire tawake (*Syzygium maire*), Ōwairaka/Mt Albert, Tāmaki Makaurau/Auckland, New Zealand, *Perspectives in Biosecurity*, 6: 1–7. Available at: https://www.unitec.ac.nz/epress/wp-content/uploads/2021/07/Perspectives-in-Biosecurity-6_Observation-of-western-honeybee-Apis-mellifera.pdf
- Stace C.A. 1991. *Plant taxonomy and biosystematics*, 2nd edition. Cambridge: Cambridge University Press, 272 pp.
- Stearn W.T. 1992. *Botanical Latin* (4th ed.). England: Melksham, Redwood Press Ltd, 546 pp.
- Stuessy T.F. 1990. *Plant taxonomy*. New York: Columbia University Press, 568 pp.
- Thiers B. 2008–onward. *Index Herbariorum: A global directory of public herbaria and associated staff*. New York Botanical Garden. Available at: <https://sweetgum.nybg.org/science/ih> (Accessed 11 June 2021)
- Thomson A.D. 1983. *The life and correspondence of Leonard Cockayne*. Christchurch: DSIR Botany Division, 210 pp.
- Thomson A.D. 2021. 'Cockayne, Leonard', *Dictionary of New Zealand Biography*, first published in 1996. Te Ara – the Encyclopedia of New Zealand. Available at: <https://teara.govt.nz/en/biographies/3c25/cockayne-leonard> (Accessed 25 August 2021)
- Townsend A.J., de Lange P.J., Duffy C.A.J., Miskelly C.M., Molloy J., Norton D.A. 2008. *New Zealand Threat Classification System Manual*. Wellington: Department of Conservation, 35 pp. Available at: <https://www.doc.govt.nz/Documents/science-and-technical/sap244.pdf>
- Turczaninow N.S. 1852 (15 June 1852). *Myrtaceae xerocarpicae*, in Nova Hollandia a cl. Drummond [sic; Drummond] lectae et plerumque in collectione ejus quinta distributae, determinatae et descriptae. *Bulletin de la Classe Physico-Mathématique de l'Académie Impériale des Sciences de Saint-Petersbourg*, 10(21/22): 335–346.
- Wilson P.G., Heslewood M.M. 2023. Revised taxonomy of the tribe *Leptospermeae* (*Myrtaceae*) based on morphological and DNA data. *Taxon*, 72(3): 550–571. <https://doi.org/10.1002/tax.12892>

***Leptospermum hoipolloi* (Myrtaceae), новий вид з Аотеароа / Нової Зеландії, виділений з групи *Leptospermum scoparium* s. l.**

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Реферат. *Leptospermum hoipolloi* de Lange & L.M.H. Schmid sp. nov. (*Myrtaceae*) виділено з видового комплексу *L. scoparium* J.R. Forst. & G. Forst. (sensu lato). Новий вид є ендемічним для Північного острова і північної частини Південного острова Аотеароа / Нової Зеландії. Новоописаний вид морфологічно відрізняється від *L. scoparium* s. str. виразно шовковистими, вужчими і довшими (до 30 × 6 мм) ланцетними або овально-ланцетними листками, крупнішими (до 30 мм у діам.) квітками (білими, з рожевим відтінком, смугасто-рожевими або червоними) і коробочками до 15,1 × 14,1 мм (невідкритими) та 16,6 × 18,0 мм (відкритими). Визнано три форми: f. *hoipolloi* для рослин із коротшими, вужчими гелими листками, переважно білими (зрідка з рожевим відтінком або червоними) квітками і дрібнішими коробочками; f. *procumbens* L.M.H. Schmid & de Lange f. nov. для рослин з розпростертими або висхідними пагонами, сріблясто-білими або сріблясто-сірими опушеними листками, крупнішими білими або рожевуватими чи рожевими квітками та крупнішими коробочками; і f. *incanum* (Cockayne) de Lange & L.M.H. Schmid f. comb. & stat. nov. для рослин, які раніше визнавали як *L. scoparium* var. *incanum* Cockayne, що мають вигляд прямостоячих кущів із довшими, часто ширшими, листками, в яких молоді листки вкриті сріблясто-сірими або сірими волосками, а також із крупнішими білими, з рожевим відтінком, смугастими, рожевими або червоними квітками і крупнішими коробочками. Запропоновано оцінку природоохоронного статусу згідно з класифікацією загроз, прийнятою у Новій Зеландії, та наведено ключ для визначення видів роду *Leptospermum* Аотеароа / Нової Зеландії.

Ключові слова: *Leptospermum*, *Leptospermum scoparium*, *Leptospermum hoipolloi* sp. nov., *Leptospermum hoipolloi* f. *procumbens* f. nov., *Leptospermum hoipolloi* f. *incanum* f. comb. & stat. nov., *Myrtaceae*, Аотеароа / Нова Зеландія, нова форма, новий вид, таксономія