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Front Cover picture:
Hebe 'Combe Royal' (bottom) was raised by John Luscombe of Kingsbridge, Devon, and *H.* x*franciscana* 'Lobelioides' (top) was raised by Isaac Anderson-Henry of Edinburgh. Photo P.B. Heenan. See "The Origin and Identification of *Hebe* x*franciscana* and its Cultivars (Scrophulariaceae)" by Peter B. Heenan, pp. 15–20.

Horticultural Use of Low-growing Forms of Manuka and Kanuka and a New Cultivar - *Kunzea ericoides* 'Karo Greenfingers'

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Introduction

Diversity of habit is one of the features of the three New Zealand tea trees, *Leptospermum scoparium* or manuka, *Kunzea ericoides* or kanuka, and the closely related Great Barrier Island endemic *K. sinclairii* (Harris et al., 1992). This diversity has confused the plant classifier but has provided horticultural opportunities for plant selectors. In this article I describe low-growing forms that have shown up during experimental evaluations of tea trees at Lincoln. In particular a distinctive form of *L. scoparium* from Okiwi Bay, Marlborough, is recorded, and a cultivar selected at Lincoln, *K. ericoides* 'Karo Greenfingers', is described.

Cockayne (1919) remarked that manuka presents a diversity of forms seemingly impossible to classify, some being distinct races, but most probably being unfixed hybrids between races not yet classified. Allan (1961) added that kanuka shows almost as much diversity, and that at that time the taxonomy of neither species had been critically studied below the species level. Although we have increased our knowledge about the variation of tea trees in subsequent years (Yin et al., 1984; Harris et al., 1992) they still pose problems of classification. Some of these problems may never be resolved, as the natural barriers to interbreeding of tea tree populations that led to their differentiation have been broken down by widespread clearance of native vegetation. Indeed, some of the races alluded to by Cockayne may have become extinct or have had their distinctiveness obscured by hybridisation.

The confused classification has not deterred nurserymen from making selections from this variation to provide ornamental cultivars. For manuka more than one hundred named cultivars are recorded (Harris & Heenan, 1992). By contrast, for kanuka I know of only one named cultivar, *Kunzea ericoides* 'Cerise', a dwarf prostrate form introduced by Mark and Esmé Dean, of Omahanui Nurseries, Tauranga (Anon., 1991). In its various wild forms kanuka provides a handsome shrub or tree, and this can be put to good use in gardens and landscape schemes. However, I suspect that kanuka has been used as an ornamental less than manuka because its flowers are smaller and its variation does not include the red or double flowers that feature in many manuka cultivars (Metcalf, 1987). However, habit too has attracted the attention of plant selectors looking for dwarf and prostrate forms for small gardens, rockeries, and pots, and here kanuka offers promise.

Horticultural Interest in Low-growing Tea Trees

As indicated by Hooker's (1853) description of *L. scoparium* var. *prostratum*, low-growing tea trees in the wild have always attracted attention. However, it was not possible to be certain whether their stature was caused by plant age, environmental stunting, or genetic factors (Allan, 1961; Molloy, 1975). Many people have probably taken low-growing tea trees from the wild and grown them in their gardens to see whether they retained this form. By this route several low-growing cultivars have been introduced to the garden flora. Notable examples are the dwarf 'Nanum' series named after New Zealand native birds and released by Duncan and Davies from about 1940, and the prostrate 'Wairere' (Mole, 1967).

The origin of the 'Nanum' series does not appear to have been recorded. When I visited the Duncan & Davies nursery at Waitara in February 1991, Jim Rumbal suggested that they were derived from a plant collected on the Volcanic Plateau by the late Sir Victor Davies. Certainly, what Metcalf (1987) described as the purplish-red foliage of 'Nanum' cultivars is characteristic of the widespread low-growing manuka seen on the Plateau. Interestingly the stock plants of the 'Nanum' varieties at Duncan & Davies had shoots that had reverted to a normal length. Metcalf (1987) also noted that one of the 'Nanum' cultivars, 'Weka', tended to produce vigorous reversion shoots, which flowered more freely than the dwarf shoots. The origin of *L. scoparium* 'Wairere' is documented by Mole (1967) as being from seed collected by Mr N. H. Potts in 1944 from a prostrate plant near Parengarenga Harbour, North Auckland. The more or less horizontal branches and pendulous branchlets of this cultivar inspired the choice of the name, meaning 'waterfall'.

Kunzea ericoides 'Cerise' is recorded as being "discovered on the outskirts of Taupo in the steam belt region" by Lewis Cohan; he passed it on to Esmé and Mark Dean of Omahanui Nurseries, who evaluated and marketed it (Anon., 1991). It had been described earlier as a genetic mutant that appeared to be stable, which was discovered beside a geothermal steam vent (Anon., 1987). From its habit and place of origin, *Kunzea* 'Cerise' is a variant of *K. ericoides* var. *microflora*, a depressed or straggling shrub characteristic of sites with geothermally warmed soils (Allan, 1961), where it forms a dense prostrate shrub cover (Given, 1980). This spreading prostrate branching habit has been retained in cultivation at Lincoln (see Fig. 3), although after several years some plants produce ascending branches to form taller shrubs.

The cultivar may also grow into "quite high bushes" (Anon., 1992), and *Kunzea* 'Cerise' grown at Lincoln has produced a few ascending branches. However, the cultivar has shorter internodes and consequently more densely packed small leaves than the usual form of var. *microflora*. In autumn at Lincoln the youngest leaves, particularly on their upper sides, are strongly coloured greyed-red, closest to the Royal Horticultural Society Colour Chart (1966) numbers 179 and 180. This colour continues through winter (Anon., 1991). Seasonal strengthening of anthocyanin-based pigmentation is also characteristic of manuka from the Volcanic Plateau and other cold areas of New Zealand, and may screen plants from light damage to leaf tissue when they are frozen.

Genetic and Environmental Components of Habit

Prompted by the uncertainty about how much of the variation of tea trees seen in the wild was due to genetic differences and how much to environment, I have been observing the genetically based variation of the three New Zealand tea trees and several of their Australian relatives at Lincoln. By bringing seed of different populations together, sowing them at the same time, and then growing them together in the same locality, I can be reasonably certain that

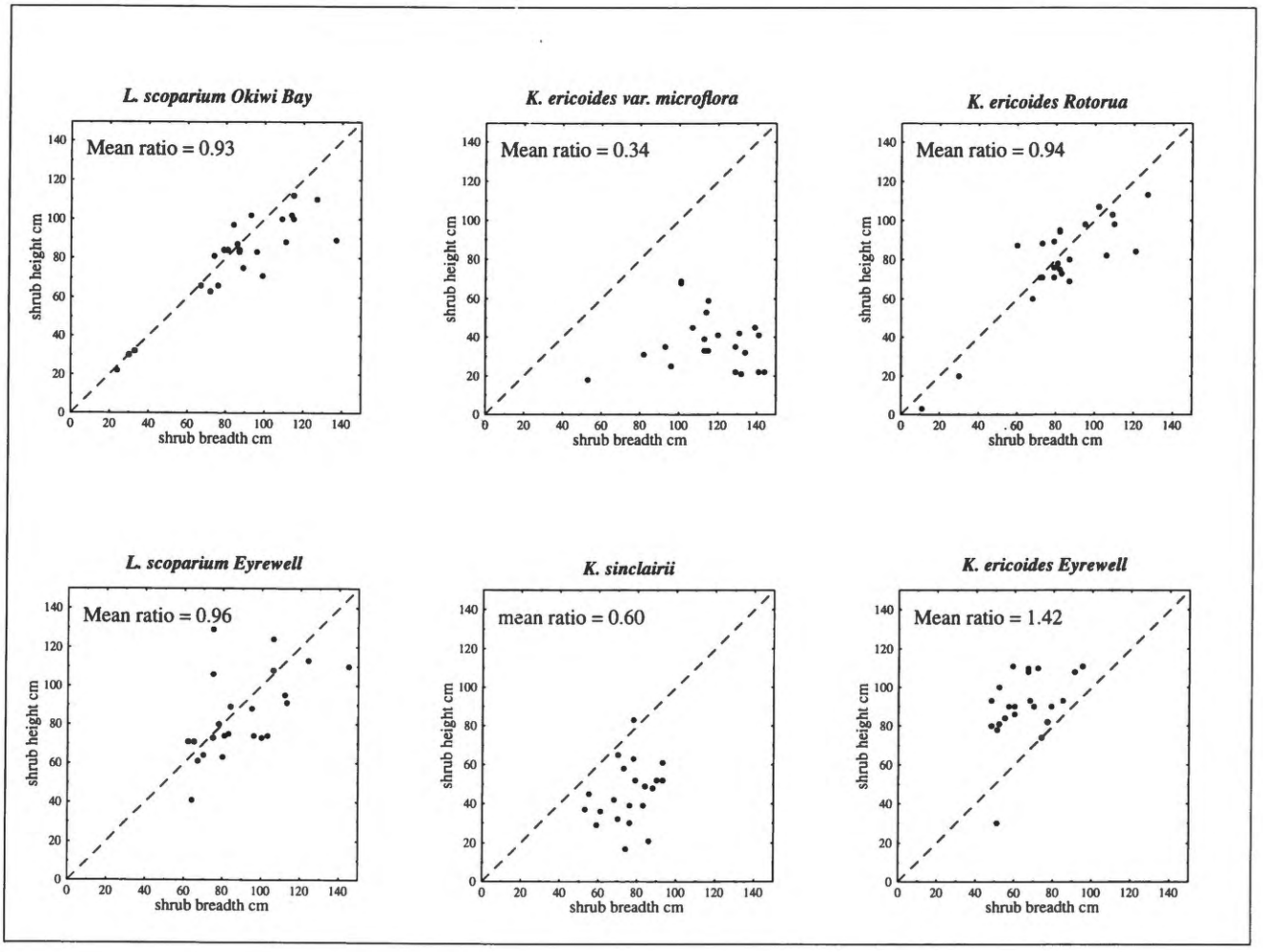

Fig. 1. Height plotted against breadth of individual shrubs in six tea tree populations 19 months after sowing. Means of the shrub height-to-breadth ratio are shown for each population. The diagonal line, the ratio of equal height and breadth, is drawn to distinguish erect (to the left of the line) and prostrate shrubs in the populations.

differences that develop between and within the populations are genetically based. However, this is their phenetic expression at Lincoln, and in another location with a different environment plants of similar genetic make-up may have quite different habits.

The first experimental planting of tea trees at Lincoln from seed sown in September 1983 compared 51 populations of *L. scoparium*, 20 populations of *K. ericoides,* and a single population of *K. sinclairii*. Twenty-four seedlings of each population were raised and planted at 1 m spacing in January 1984. During the first years this spacing allowed the shrubs to develop their different habits without crowding each other.

The shrubs in the manuka populations from Okiwi Bay on the Kaikoura coast and from the Eyrewell Scenic Reserve on the Canterbury Plains had similar height-to-breadth ratios, irrespective of their size (Fig. 1). However, three of the Okiwi Bay shrubs were much smaller than the other plants in the population, and had a quite distinct appearance amongst the 1200 manuka plants grown in the experiment.

Although all the plants in the *K. ericoides* var. *microflora* population (which came from Rainbow Mountain near Rotorua) tended to a prostrate habit by being more broad than tall, breadth varied considerably. This contrasted with the *K. sinclairii* shrubs, which although inclined to be prostrate showed greater variation in height than in breadth. Both taxonomic entities therefore provide opportunities for selection of compact or prostrate shrubs to meet particular gardening or landscaping requirements. *Kunzea* 'Cerise' has shorter internodes and is more compact than is usual for var. *microflora* shrubs, and there is also scope for selection of a compact green form of this variety. From the *K. sinclairii* population I have retained a compact floriferous shrub with large grey-green leaves, providing a clear contrast with the purer green or bronze-red foliage of most of the New Zealand tea trees.

The *K. ericoides* population from Rotorua came from the edge of a large, boiling hot pool in Kuirau Park. However, unlike the var. *microflora* population from Rainbow Mountain it was not growing on geothermally warmed soil. This population showed similar young shrub dimensions to the two *L. scoparium* populations, but two of the plants were notably dwarf. The *K. ericoides* shrubs from Eyrewell were relatively taller than the kanuka from Rotorua and the associated manuka from Eyrewell. In this population one shrub was distinctly shorter than the others.

These descriptions show different facets of variation that provide opportunities for the plant selector. First there is the average habit of a population. Thus, a plant selector seeking a prostrate form of kanuka would have a much greater probability of finding one from a sample of the Rainbow Mountain population than from the Rotorua or Eyrewell populations.

Second, each population reveals a range of variation around the average habit on which to base selection. This genetically based variation is revealed by growing shrubs under uniform conditions as described for the experiment at Lincoln. This would be beyond the scope or interest of most nurserymen. However, nurserymen who raise a large number of plants of a species from seed have the opportunity to look for forms most suited to garden use. Although selected for better ornamental form, most

Fig. 2. Five-year-old dwarf *Leptospermum scoparium* shrub from Okiwi Bay population grown in planter bag. Flowers are concealed within the shrub canopy.

of these selections should not, strictly speaking, be given a distinctive cultivar denomination because they usually fall within the normal range of variation of a species. I feel that the use of native species as ornamentals would be enhanced by a system that identified selections of this kind. Some propagators of native plants have taken steps in this direction already. Selections that are both representative of species and of good form for garden cultivation could be clonally propagated and labelled with details of their origin and habit. For example, the more compact form of *K. sinclairii* identified earlier could be propagated to ensure that gardeners were not presented with the variety of habits, many straggling, likely if the species were propagated by seed.

However, it is plants that fall outside the normal range of variation that most often catch the eye of nurserymen or plant selectors. These are usually plants that are dwarf, have variegated leaves, or have different flower colours or forms, e.g., the atypical red or double flower variants that have led to the diversification of manuka cultivars. Atypical variants of this kind have been the source of most of the cultivars of New Zealand plants, and were discovered in the wild or were plants raised from seed in nurseries. These variants may be whole plants or branch sports that can be separated out and vegetatively propagated.

Branch sports often tend to revert to the normal form. That the 'Nanum' series of cultivars revert from a dwarf habit under some conditions is interesting and deserves investigation. Although the origin of the original 'Nanum' plant is uncertain, the other cultivars in the series were probably raised from seed of crosses with the original selection. Perhaps what is being seen in their reversion is a change from a juvenile to an adult form, triggered by maturity or environmental stimulus, similar to that which occurs for species with a divaricate juvenile habit.

Okiwi Bay Manuka

When the late Andrew Purdie collected seed from mixed manuka/kanuka at Okiwi Bay on the Kaikoura coast in April 1983, he noted the presence of distinctive low-growing dwarf manuka plants. Three of the 24 plants in the population raised from the seed grown at Lincoln had this form (Fig. 1). The manuka at Okiwi Bay is exposed to the south, is markedly wind-shorn, and is probably subjected to salt spray in stormy weather. Presumably this distinctive habit is retained in the wild population as an adaptation to these exposed conditions. A second sowing of the Okiwi Bay population for an experimental planting in June 1985 also produced three dwarf plants out of 24 seedlings raised. This provides an estimate of frequency of occurrence of 12.5% for the dwarf in the population. As well as the six dwarf plants in the two experimental plantings, three further dwarf shrubs of the Okiwi Bay population were raised in planter bags for several years (Fig. 2). They were planted widely spaced in a display bed in 1989 (Fig. 3).

Although the dwarf shrubs from the first planting increased in height over four years, this was much slower than for normal shrubs in the same planting (Fig. 4). All the normal shrubs first flowered in early November 1985, little more than two years after they were sown, but the three dwarf plants never flowered. By February 1989 all the dwarf plants in the first planting were dead from a combination of the effects of manuka blight and shading by taller surrounding shrubs.

The dwarf plants raised in planter bags flowered in spring 1988 when they were five years old. Flowering was sparse compared to that of normal shrubs. Both normal and dwarf plants in the Okiwi

Fig. 3. Three eight-year-old dwarf *Leptospermum scoparium* shrubs from the Okiwi Bay population in a display bed at the Experimental Gardens, Lincoln, in 1991. Part of a free-flowering shrub of *K. ericoides* var. *microflora* is in the right foreground. The ruler is 40 cm long.

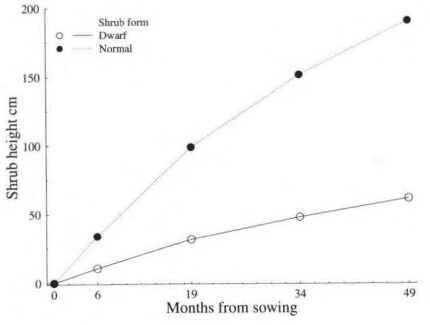

Fig. 4. Mean height growth of two normal and two dwarf shrubs of the Okiwi Bay *Leptospermum scoparium* population.

Fig. 5. Flower presentation by the Okiwi Bay dwarf *L. scoparium* shrub.

Bay population tend to conceal their flowers within the shrub canopy (Fig. 2, 5). The effect of this is more noticeable for the dwarf form because of the dense packing of the branches. The dwarf shrubs, although they vary in size, all have a short trunk bearing many thin short branches supporting a dense rounded canopy of leaves (Fig. 3). Because of this, shoot extension causes intense shading of leaves within the canopy. These shaded leaves die, so that the centre of the ball-shaped shrub is densely packed with branches, and dead leaves and twigs.

Although the Okiwi Bay dwarf plant is of horticultural interest in its own right, it would be even more striking combined with the red flowers and double petals of established manuka cultivars. Both normal and dwarf forms of the Okiwi Bay population have flowers that average 15 mm in diameter with white petals with a faint pink flush at their base, pink stamen filaments, and dark brown disks. In November 1990 pollen from the cultivar *Leptospermum* 'Big Red' was deliberately introduced to the flowers of the smallest of the dwarf plants in the display bed, but no attempt was made to exclude pollen from other sources. Seedlings raised from this open cross are all of normal habit. This suggests that the genetic determinants of the dwarf are recessive, and the possibility of the re-emergence of the dwarf characteristics will have to wait until these F1 plants set seed and the F2 progeny have grown.

Unfortunately the three dwarf shrubs in the display bed died after the wet cold winter of 1992, which appeared to aggravate the effects of manuka blight and possibly *Phytophthora*. Because of this poor history in cultivation and because the dwarf habit is an example of site-specific adaptation, it would be appropriate to ensure the conservation of the Okiwi Bay population in its wild location.

Kunzea ericoides 'Karo Greenfingers'

The dwarf forms of kanuka that occurred in the experimental planting did not survive the shading from the taller tea trees that surrounded them. However another dwarf kanuka has been propagated and evaluated for its suitability for ornamental use. This plant derives from seed collected at Price's Valley, Banks Peninsula, Canterbury and sown at the Department of Conservation Nursery, Motukarara in 1989. Seedlings were purchased by Dr Colin Meurk for use in revegetation plantings funded as part of the 1990 sesquicentennial celebrations. Colin Meurk noted one plant with a dwarf habit amongst otherwise normal tall-growing kanuka seedlings, and brought the plant to my attention.

This dwarf kanuka is distinctive, has attractive form and foliage, is readily propagated vegetatively, and is particularly suited for a rockery or small garden. Consequently it is described here as a new ornamental cultivar, *Kunzea ericoides* 'Karo Greenfingers'. "Karo", an acronym of "known and recorded origin", is used to identify ornamental plants released by Manaaki Whenua - Landcare Research (Heenan, 1992). The name "Greenfingers" refers to the short finger-like extension branches that protrude above the shrub canopy and its fresh green foliage in summer. The description made in April 1993 is based on the original plant after it had been grown outdoors in a rockery for 18 months (Fig. 6). Before that it had been grown in a container in a glasshouse. Colour descriptions are based on the 1966 Royal Horticultural Society Colour Chart (R.H.S.).

Description. Compact dwarf shrub, 12 cm tall and 35 cm wide. Internodes shortened to form a dense arrangement of short lateral branches and leaves. Extension growth raised above the hummock-like canopy of the shrub in finger-like projections. Leaves linear, 4–6–(10) mm long x 1–2 mm wide, subsessile, glabrous, patent to reflexed, distinctly apiculate but soft to touch, green to yellow green (R.H.S. 137, 147); tips, margins, and base greyed-orange (R.H.S. 174, 175). Young stems of similar greyed-orange colour variously tinged with green; developing bark layer on older stems channelled, with ridges darker orange brown. No flowers.

Representative specimen: CHR

Fig. 6. *Kunzea ericoides* 'Karo Greenfingers' grown in a rockery at the Experimental Garden at Lincoln in 1992. The label showing the garden accession number is 4 cm high.

327534 *W. Harris* 257/90, Landcare Research Gardens, Lincoln.

The key characteristic that distinguishes this plant from normal forms of *K. ericoides* is the marked shortening of the internodes, which has consequent effects on the arrangement of the branches and leaves. The extent of shortening of the internodes will vary according to growth conditions. Extension growth of branches was longer and foliage colour paler in the lower light and warmer environment of the glasshouse than when the plant was grown outdoors in the rockery. The orange pigmentation of the foliage is accentuated in cool, well lit conditions.

After four years the plant has not flowered, differing thus from low-growing forms of *K. sinclairii* and *K. ericoides* var. *microflora*, which flower in two years. However, a large proportion of normal plants of kanuka grown at Lincoln were older than five years when they first flowered (Harris et al., 1992), so *Kunzea* 'Karo Greenfingers' may yet flower. Although flowers would add interest to the plant, it is possible that the development of seed capsules might detract from the freshness of its foliage.

When its soft leaves are crushed the plant gives off the eucalyptus-like aroma characteristic of kanuka. This characteristic, together with its compact habit, will make it an interesting subject in scented gardens and as a patio plant. The aroma of *K.* ' Karo Greenfingers' grown in these ways will spark impressions or memories of New Zealand's wild landscapes for people who do not have ready access to them.

Acknowledgements

To the late Andrew Purdie for his discovery and investigation of the Okiwi Bay manuka, and to Colin Meurk for discovering the dwarf kanuka *K.* 'Karo Greenfingers'. Colin Meurk, Joanna Orwin and Peter Wardle made comments improving the text. Diane Percy and the staff of the Experimental Gardens provided the support required for the evaluations described. Publication of this work was supported by the New Zealand Foundation for Research, Science and Technology.

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Sir Victor Davies Award

The recipient of the 1993 Sir Victor Davies Award for contributions by a young horticulturist is **Andrew Steen**, of Mt Maunganui, Tauranga.

After gaining a B.Hort. from Massey University in 1989 Andrew was involved in management and other roles on kiwifruit orchards, then in 1991 was appointed horticultural consultant with Kerry Ryan and Associates. He is responsible for a wide range of consultancy services, with particular emphasis on monitoring nutritional requirements and fertiliser recommendations. His innovative ideas have resulted in the introduction of improved procedures to determine the nutritional status of vines.

Latterly Andrew has developed a special focus on subtropical fruit crops, examining management systems and trialing new crop possibilities such as cherimoya and casimiroa.

Andrew has gained growing and consultancy experience with vegetables and flower crops, and has undertaken various development projects on flower crop production. Bulb crops have received particular attention, and Andrew's work has led to the development of a new method of bulb growing based on nutrient film techniques. Articles on these investigations and on kiwifruit production have been published in various journals.

Apart from his commercial involvement Andrew maintains a personal interest in collecting and growing a wide range of plants, some rare, in his own garden.

Ferns – the Bridesmaids, Never the Bride

Raymond H. Mole

5 Cedar Drive, Paraparaumu

It is estimated that ferns came into being over five hundred million years ago, their primitive form emerging from warm, watery masses in primeval jungles. Certainly ferns have been prominent in the vegetation of this planet for millions of years. The huge coal seams laid down in the Carboniferous period are testimony to their contribution long ago.

Absent only in extremely dry or cold regions, ferns occur worldwide from sea level to about 4,500 m. Optimum conditions for their proliferation and rampant growth occur in the tropics, where they may form the major component of the vegetation.

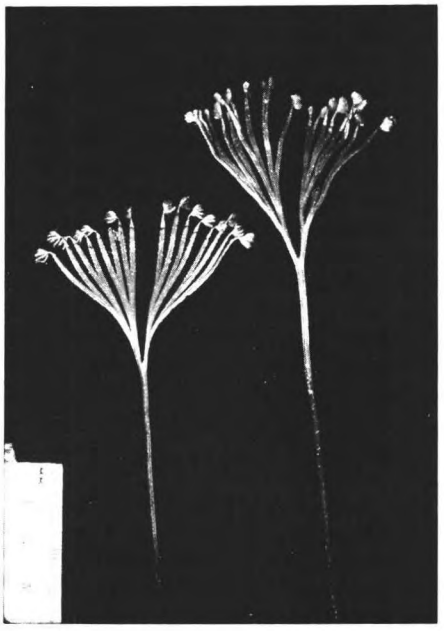
The fern group – some 230 to 250 genera and 10,000 to 12,000 species – is a comprehensive, diverse range of intricately patterned, mostly evergreen plants. Delicate, diminutive filmy ferns only a few millimetres long may go unnoticed on the trunks of tree ferns 20 m tall. Ferns' diversity of form and habit, together with their adaptability to a wide range of environmental conditions, provides a range of species suitable for different sites and different uses under cultivation.

In England their popularity reached a peak in the Victorian era, not only in gardens and Wardian cases but as motifs in decoration, appearing on china, glass, tiles, and wrought iron, to name but a few. Fern hunting in England became commonplace. Indeed, conservation had no meaning at all as avid fern collectors ravaged the English countryside in search of more booty to add to their assemblage of pteridophytes or to supply retail outlets.

'Pteridomania' peaked by 1870, but seemingly further looting in nature's realm continued to the end of the 19th century.

Victorian veneration of the values of ornamentation was evidently realised in the delicate tracery and textural contrasts seen in fern fronds. But their elegant, graceful forms are not their only attribute: emerging young fronds are often highly coloured, and several species of New Zealand fern exhibit this characteristic, e.g., rosy maidenhair (*Adiantum hispidulum*), mountain kiokio (*Blechnum* spp.), and the rasp ferns (*Doodia* spp.).

Some ferns growing in open, sunny situations, for example the exotic *Cheilanthes farinosa*, develop waxen or farinose excretions in order to conserve moisture. These deposits often produce an attractive metallic covering on emergent fronds and on the undersides of mature ones.



One of four *Schizaea* species in New Zealand, the fan fern *S. dichotoma* has an unusual growth form. Stems (stipes) are usually about 30 cm long but barely 1.5 mm in diameter, and have spore-producing bodies at the tips.

Variegation of ferns in nature is a rare occurrence, but under cultivation some variegated sports have arisen, for example, the Asian *Athyrium nipponicum* 'Pictum' with its purple-red rachis suffusing into a grey-green lamina. The widely grown *Pteris cretica* has produced several cultivars with white and green fronds.

Some ferns have scented fronds, a phenomenon evident if fronds are brushed or handled. Exotic ferns in this category include *Pittyrogramma* spp., the citrus-scented *Anetium citrifolium,* and those with a fragrance like newmown hay such as *Dryopteris aemula* and *Dennstaedtia punctiloba*. The endemic *Paesia scaberula* emits a strong scent in warm conditions, a character perhaps unwittingly appreciated by hill farmers in North Island hill country, where this species may establish at the expense of pasture. Similarly, under cultivation *Paesia* may become unwontedly aggressive.

I have always had a special feeling for New Zealand ferns. Though this country's complement is limited to 193 species and subspecies (Brownsey and Smith-Dodsworth, 1989) there are representatives of most of the world's important genera, and some 88 species are endemic to this country.

In various forms our native ferns occur on coastal cliffs, in lowland and alpine scrub, a few in scree and rock crevices in open alpine areas, but the majority within shaded moist forests.

It is within our forests that ferns flourish best and so in order to cater specifically for a wide range of native species a portion of the bush at the Otari Native Botanic Garden was laid out for a fernery. Under high shade provided mainly by tawa (*Beilschmiedia tawa*), the shrubby understorey was removed in the early 1970s. Paths 1 metre wide were formed within the approximately 0.2 ha section. Edged with trunks of old tree ferns, the informal beds thus created were filled to about 30 cm depth with a mixture of 3 parts peat to 1 part coarse river sand. About two dozen tree ferns averaging 1.5–2 m tall were present naturally in the developed area. However, many of them were subsequently beheaded, for reasons explained below.

During my time at Otari some forty-five species of fern were identified within the bush. Samples of most of these were dug out, transferred to the fernery, and labelled so that they could be readily identified by the visiting public. Other native shade-loving species were introduced from many parts of New Zealand, until, at the time of my departure in 1991, some ninety species were represented in the fernery.

Other ferns requiring more open sites were planted in the main rock garden and wild garden.

Most ferns were planted in groups of about ten. After a few years it was found that herbaceous ferns planted in groups under the existing tree ferns – mostly ponga (*Cyathea dealbata*) – were retarded somewhat in comparison with their neighbours. It was thought that this was caused by too much shade and/or drier conditions under the tree fern canopy. In latter years I wondered if their less robust performance was caused through chemical exudation from the roots of the tree ferns acting as an inhibitor to growth of the introduced species - allelopathy. It was decided to decapitate

Rarely does one see a grove of tree ferns in a small suburban garden. Here mamaku dominates, camouflaging and softening the rigid lines of houses, and providing dappled shade and coolness during hot summer days.

about 50% of the tree ferns. Rhizomatous ferns soon clothed the cut-over stumps, and the herbaceous ferns improved in their appearance.

I found that most ferns gathered from other locations were easy to grow, but there were exceptions. These included the endemic crepe fern (*Leptopteris superba*), surely one of the most attractive species in the country. Specimens from the volcanic plateau grew slowly for several years, but failed to form a trunk and reach full stature. No doubt the often drier atmosphere of summer periods together with higher soil temperatures than in their native habitats did not help their wellbeing. The dainty, rare, endemic *Lindsaea viridis* collected from south-facing dripping roadside banks was happy only when transferred to damp rocks in shade beside a stream. The endemic umbrella fern *Sticherus cunninghamii* proved difficult to transplant and, even when this operation was successful, plants failed to thrive. Most ferns have a fibrous root system which assists transplanting; the umbrella fern had thick, fleshy roots few in number.

I am pleased to say that, overall, failures were few, and most species introduced to the fernery grew well – especially those of lowland northern origin. Of note in this regard were king fern (*Marattia salicina*), the extremely rare giant maidenhair (*Adiantum formosum*), the endemic *Asplenium lamprophyllum*, *Blechnum fraseri*, the attractive rare and endemic *Loxsoma cunninghamii* (found from Kaitaia to Thames), and *Todea barbara* (North Cape to Poor Knights Islands), which all adapted well to the cooler conditions of a Wellington fernery.

In more open areas the coastal endemics *Blechnum banksii* and *B. durum* grew with ease. Maidenhair spleenwort (*Asplenium trichomanes*) was very much at home in a gritty rooting medium in the main rock garden. Its rather delicate appearance belied its tough constitution. *Cheilanthes distans* and *C. humilis* both proved easy in austere sites in the rock garden. From a damp crevice in the same habitat the creeping *Blechnum penna-marina* spread widely through the 3 cm deep stone mulch. Rasp fern (*Doodia media*) presented no problems, and in full sun provided a conspicuous display of tufted, pink young fronds in spring.

Adding interest to the cultivation of New Zealand ferns are those species which differ from the conventional in form. Top of my list in this regard is parsley fern (*Botrychium australe*). Summer green, and even then producing only one main stalked, dissected, sterile frond no more than 15 cm high and wide, it has a most unfernlike appearance. A slender, shorter fertile frond develops from the base of the sterile one. Unlike all other New Zealand ferns the pair of fronds are not tightly coiled during emergence. When grown in sandy loam in semi-shade, the parsley fern presented no difficulties in cultivation. It just seemed strange that after fifteen years growth only one sterile frond appeared each year.

Another unusual species is the aquatic fern *Azolla filiculoides*. This dainty fern has specialised small, hairy, reddish-green fronds which float on still water, its fine roots dangling down below. It has been present in the Otari fish pond for over thirty years, never needing attention except to reduce its spread on occasion, to offer visitors a better view of the fish below.

New Zealand has many ferns that creep over the bush floor, becoming climbers when tree trunks are encountered. Common in this respect is *Blechnum filiforme*, the only climber in the *Blechnum* genus. Another different type of climber was introduced to the fernery many years ago from a northern habitat. This was the endemic mangemange (*Lygodium articulatum*), New Zealand's only twisting and climbing fern, the fronds of which are of indefinite length and twirl around branches and branchlets. A slender 5 m ramarama tree was almost completely hidden by the highly dichotomous branching habit of the fresh green fern fronds. Mangemange is easy to grow and fascinatingly different to observe.

Less spectacular, but quite different in appearance from any other fern is adder's tongue (*Ophioglossum coriaceum*). Of the same primitive family as parsley fern (Ophioglossaceae), adder's tongue dies down over winter. In spring the unfurling of the small, sterile, undivided frond (about 4 cm x 1 cm) takes place laterally from the centre, not lengthways as with most ferns. The frond may be sessile or have a short stalk; then, in the manner of flowering culms of grasses, the stalked fertile spike arises from the base of the frond. It extends up to about 12 cm, ending in a 1.5 cm narrow tongue of paired sporangia. The adder's tongue appeared adventitiously in an exposed position in the rock garden, on a grit-'enriched' clay soil.

The fernery needed little attention. The main jobs included watering during dry periods, occasional organic mulching around tufted species, and the removal of old decrepit fronds. Pest and disease troubles were few, except for an outbreak of eelworm one year in *Asplenium oblongifolium*. This necessitated the removal of all such infested plants. I thought at the time how fortunate it was that the eelworm confined itself to one species only!

It was necessary on occasion to propagate stock, especially in instances where only one or two specimens existed of introduced species. Vegetative methods were used:

- division of the crown of tufted species, e.g., hen and chickens fern (*Asplenium bulbiferum*);
- removal of about 30 cm of growing tip from rhizomatous species, e.g., *Davallia tasmanii*, which is endemic to the Three Kings Islands.

As an experiment bulbils from the hen and chickens ferns were sown when about to fall off the plant. They proved easy to grow on in thumb pots.

Also as an experiment heads of decapitated tree ferns with trunks about 1 m

long were inserted into equal parts of river sand and peat to about half their length. Results were inconclusive, though I understand rooting will occur in some instances. The most reliable tree fern for trunk rooting is the wheki (*Dicksonia squarrosa*).

The experience of growing native ferns over a period of about twenty years proved that the majority are amenable to cultivation, at any rate under Wellington conditions. A factor essential to success is to be aware of the conditions in which they grow naturally, and to simulate these as far as is practicable. For the majority of species their need for some shade, a moist atmosphere, wind protection, plus a humus-based, well drained soil can best be achieved under natural outdoor conditions such as obtained at Otari. Alternatively, the provision of a shade house can prove a useful amenity for fern culture. Inside, the provision of borders may be limited, the majority of plants being containerised. Wooden (or wire) baskets are ideal for rhizomatous species, and I felt that results were better with traditional clay pots than with rigid plastic ones. Pots inserted into damp, sandy peat – a cooler rooting medium – are certainly better if of a porous nature.

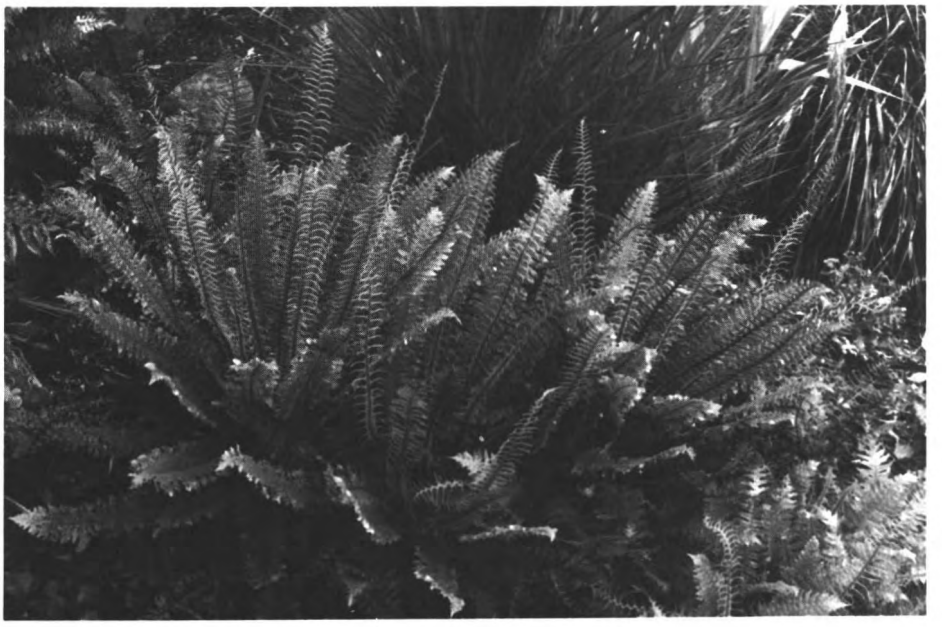
A good potting mix for most ferns is:

- 3 parts (by volume) peat moss
- 2 parts coarse river sand
- 1 part loam

The application of an organic liquid feed once every ten days proved most beneficial to native and exotic ferns alike.

Whilst the creation of outdoor ferneries and/or provision of shade houses may be expected within the confines of botanical gardens, parks, and reserves, these are rare in home gardens. Few home gardeners seem interested in growing ferns, and there are any of several reasons why this is so. Conditions in many home gardens are unsuitable for growing many of the shade-loving species; limited space may prohibit the erection of plant houses, whilst their cost may be another consideration. Perhaps it would be true to say the most common ferns seen in home gardens are tree ferns.

The absence of showy flowers and fruits no doubt contributes also to the lack of interest in fern culture. Another factor is their general unavailability through the trade. There are potted specimens of mostly maidenhair ferns, but I was amazed at the small numbers of other material on display when hunting for exotic species to start the exotic fernery in the Wellington Botanical Garden in 1990. The position does not appear to have changed much in subsequent years. Of course, if there is little demand for certain plants, you cannot expect the trade to provide them on the off-chance that they might sell. This applies especially to ferns, the qualities of which are quiet and subtle, and less noticeable than most other groups.



Piupiu or crown fern (*Blechnum discolor*) is found throughout New Zealand in forested areas. It becomes quite attractive when its central whorls of rust-coloured female fronds are seen against the pale green of sterile ones.

But specialist nurserymen still exist. Perhaps the largest stockist of native and exotic ferns is Mr Crump of Whenuapai, Auckland. There are at least two fern societies in New Zealand, one in Nelson, the other in Hamilton. I have little doubt that exchange of ferns would be commonplace among keen members of these gatherings.

At least seven botanical societies exist throughout New Zealand. These societies often have a primary interest in native plants, with regular field trips. Keen fern growers would thus be able to note the habitats of ferns. Spore propagation offers an interesting and easy means of raising plants from field specimens, although it is a slow process.

All things considered, it is likely that New Zealand ferns will always play a minor role in home garden planting schemes. Like certain other groups (e.g., alpines, grasses, orchids), ferns will be grown mainly by specialist retail growers, plant connoisseurs, local authorities, government institutions, and universities where the natural sciences are taught.

The home gardener with a glasshouse may well have ferns to act as a balance perhaps for the more colourful subjects, or provide foil in vases of cut flowers, or fill under-bench space. In nature it may be said that ferns act as foil in forests, where they fill the gap between shrubs and the bush floor. Their presence, then, often enhances a bush scene or display house, but they are rarely the focal point. They are always, as it were, 'the bridesmaids, never the bride'.

I would like to think that home gardeners with bush on their property would take advantage of its presence to extend the range of interesting and attractive ferns which are so much a part of New Zealand forests. By so doing they will perhaps experience a feeling enjoyed by me and by visitors alike when in the Otari fernery on a still day. Standing still and looking over the motionless green and graceful forms, accentuated by shafts of sunlight penetrating the tree canopy, tended to have a soothing effect on the mind, giving a feeling of wellbeing and contentment. That ferns can induce such a desirable mood – an attribute perhaps less apparent in any other group of plants – deserves our gratitude and consideration.

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Rhododendron Research: Classification, Anatomy, History

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At the symposium held to mark the retirement of Mr Bill Sykes from Landcare Research (formerly Botany Division, DSIR) we were invited to give an account of our researches on the genus *Rhododendron*. This was appropriate, as Bill had taken part in two botanical expeditions in Nepal, in rich *Rhododendron* country, and for many years has been intimately concerned with horticulture in New Zealand.

We have been interested in growing species of *Rhododendron* since the mid fifties, especially the smaller kinds which could take their place among the other alpine plants in our rock garden. There are about nine hundred species in the genus, and since we were keen to understand the differences between them and particularly the way in which they could be placed into related groups, one of us (M.N.P.) spent several weeks in 1968 at the Royal Botanic Garden, Edinburgh, absorbing information from H.H. Davidian. It was during this visit that the Keeper, Regius Professor Harold Fletcher, suggested that we prepare a revision of the numerous and very poorly understood group of mostly subalpine species known as the *Lapponicum* Series.

For the next five years we spent most of our spare time studying specimens of *Lapponicum* collected together from all the major herbaria in the Western world – at that time loans from China were not available. Included were collections made by Farrer, Rock, Kingdon Ward, Forrest, Wilson, the early French missionaries, and many others. The several thousand specimens represented practically all the material available, including virtually all the type specimens on which the original authors had based the sixty-six species then recognised and their numerous synonyms.

Eventually we published a revision, reducing the number of species recognised to twenty-six, redescribing them, preparing a key for their identification, listing the collections, mapping their distribution, and illustrating many features – especially scales and calyx lobes, characters we had found particularly useful in defining the species (Philipson & Philipson, 1975).

On a subsequent visit to Britain a former colleague, Sir George Taylor, then Director of Kew Gardens, invited us to name their living collection of *Lapponicum* rhododendrons, and a similar request was made by Mr John Bond, whose collection at the Saville Garden at Windsor was exceptionally complete. At this time we also named the plants at Edinburgh Royal Botanic Garden and at the Royal Horticultural Society's garden, Wisley, then under the direction of Mr Frank Knight. By visiting private gardens and nurseries we familiarised ourselves with the species in general cultivation, and also with the names under which they were available. Two outstanding private gardens were those at Bodnant, where Mr Charles Puddle was in charge, and at Ascreavie, where our friend Major George Sherriff and his wife Betty had created a garden rich in *Primula* species and many other rare alpines. As regards alpine nurseries the most outstanding was in the Highlands at Inshriach, where Mr Jack Drake was growing many fine examples of *Lapponicum* rhododendrons in a climate well suited to them.

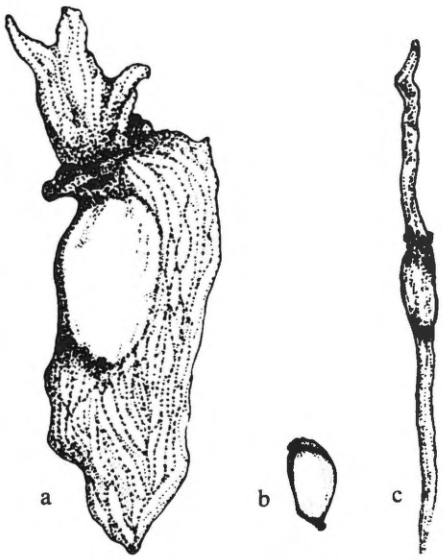

Fig. 1. Seeds of *Rhododendron*: a, Subg. *Hymenanthes*; b & c, Subg. *Rhododendron*, Section *Rhododendron* (b) and Section *Vireya* (c).

Our revision of the *Lapponicum* species was the first of those issued from the Edinburgh Botanic Garden, and was later incorporated into Dr James Cullen's revision of the lepidote rhododendrons (Cullen, 1980). Dr David Chamberlain's revision of subgenus *Hymenanthes* followed (Chamberlain, 1982) and then we contributed a synopsis of the remaining groups (Philipson & Philipson, 1982) and a full revision of the smaller subgenera *Azaleastrum, Mumeazalea, Candidastrum,* and *Therorhodion* (Philipson & Philipson, 1986).

Meanwhile we had become interested in the various features which earlier workers had found useful for defining the groups into which the many hundreds of *Rhododendron* species are classified. Those especially important are the different types of hairs (including scales), the appendages present on seeds (Fig. 1), and the distribution of flowering and leaf buds, together with the way the leaves are folded in the buds. We are both botanists, one (M.N.P.) having worked at Botany Division, DSIR (now part of Landcare Research), the other (W.R.P.) at the University of Canterbury, so it was natural that we should decide to seek other characters that might confirm or modify the classification.

The first character we looked at was the pattern of conducting strands entering each leaf from the stem, a subject known as nodal anatomy. We did not have great expectations because it is well known that most of the Ericaceae, to which family *Rhododendron* belongs, have only a single strand in their leafstalk. But a quick examination under the microscope of hand-cut sections taken from some species in our garden at once showed that, while some species did have leaves of this simple type, others had remarkably complex nodes. For the next three months we examined the nodes of 264 species, many from authentic examples sent to us from the Royal Botanic Gardens at Edinburgh and Kew, the Saville Gardens at Windsor, the Arnold Arboretum, the Botanic Garden at Singapore, and many private gardens in Britain and America, as well as here in New Zealand. When we could not obtain living material we used herbarium specimens, visiting Edinburgh to complete our study of the less accessible Sections *Choniastrum* and *Azaleastrum*. An account published in the Journal of the Arnold Arboretum (Philipson & Philipson, 1968) showed that the two main subgenera – *Hymenanthes* and *Rhododendron* – have most distinctive nodes, the former complex (Fig. 2a) and the

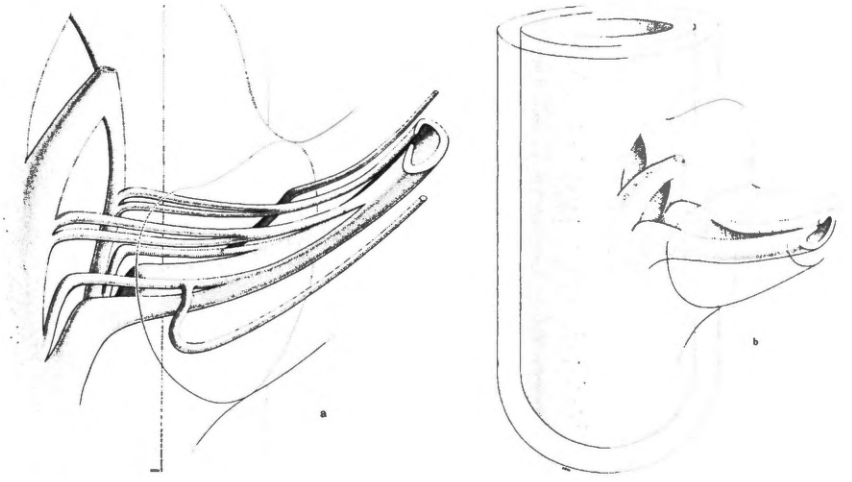

Fig. 2. Nodal anatomy of *Rhododendron*: a, Subg. *Hymenanthes*; b, Subg. *Rhododendron*.

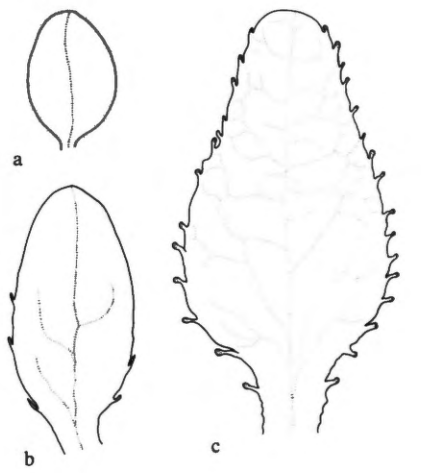

Fig. 3. Cotyledons of *Rhododendron*: a, Subg. *Rhododendron*; b, Subg. *Hymenanthes*; c, Section *Sciadorhodion*.

latter simple (Fig. 2b). Simple nodes characterised all other groups (e.g. deciduous and evergreen azaleas), only the Section *Choniastrum* having nodal anatomy intermediate between these two types.

In raising rhododendrons from seed, one of us (M.N.P.) noticed interesting differences between the seedlings. This led to a systematic comparison of the seedling leaves (cotyledons) of 157 species representing all the subdivisions of the genus (except for Section *Choniastrum*, at that time unavailable to us) (Philipson, 1970). The characters recorded included the incidence of side veins and their abundance, as well as the size and shape of the cotyledons. Subgenera *Hymenanthes* and *Rhododendron* are again clearly distinguishable by their seedlings. The cotyledons of the former bear marginal hairs of a distinctive type, and lateral veins are present (Fig. 3b), whereas in the latter neither hairs or lateral veins occur (Fig. 3a), though some scales may be borne on the margins or surfaces. The state of affairs in the other smaller sections of the genus is rather too complex to be described here, but one result has proved of lasting value. The cotyledons of two species at that time placed in Section *Rhodora*, namely the two Japanese members, *R. albrechtii* and *R. pentaphyllum*, and of two species of Section *Brachycalyx*, namely *R. schlippenbachii* and *R. quinquefolium*, were found to be alike and so different from other species that their close relationship was suspected (Fig. 3c). At a later date we proposed their formal union into Section *Sciadorhodion*, a proposition now generally accepted.

Continuing our search for characters, we turned our interest in the embryology of plants to include *Rhododendron*, hoping to find differences between the groups in the development of the embryo plant within the seed. Our initial study was carried out with *R. yunnanense* from the grounds at Ilam, because this species proved less difficult than others to section for examination under the microscope. We obtained a useful series at all stages of development, including union of the male and female cells to form the fertilised egg. This series formed the basis of our first embryological study of *Rhododendron,* to which the development of other species could be compared. We were now joined in this research by Professor Barbara Palser, an American authority on the embryology of the Ericaceae (who had not yet ventured into *Rhododendron* because of its complex taxonomy). In all, the embryology of 177 species was investigated, the three authors each responsible for one-third of this number (Palser et al., 1971, 1985, 1991). The results are too detailed to be described here, but it can be said that, despite great variability, all essential features were similar throughout, confirming the unity of all sections of the genus. One interesting finding was the numerous striking differences between Section *Vireya*, the tropical branch of *Rhododendron*, and the other sections of the lepidote species. These differences are so marked that it might be advisable to raise the vireyas to the rank of a separate subgenus.

International Rhododendron Conferences are held every few years, the first in 1978 at the New York Botanical Garden. We were both invited to attend, and spoke about the characters of the cotyledons (M. Philipson, 1980) and explained our ideas about the grouping of the various sections of azaleas (W. Philipson, 1980). The resolutions adopted at the final session began "The system of Sleumer, as modified by Cullen and Chamberlain and the Philipsons provides a useful framework for the taxonomic organisation of *Rhododendron* at the level of sections and subgenera." We were also invited to the second International Conference, held at Edinburgh in 1983, when we spoke on the nature of the nectaries in the different groups of *Rhododendron* (M. Philipson, 1985) and on the various growth patterns found in the genus (W. Philipson, 1985). This included a comparison of the floral and leaf buds of *R. camtschaticum* with those of other species, it being concluded that this species and its relatives should be retained within the genus.

In a former position at the British Museum in London, one of us (W.R.P.) had worked alongside such eminent plant hunters as Frank Kingdon Ward, Frank Ludlow, and George Sherriff as they identified their finds between expeditions. This stimulated an already keen appetite for plant collecting, and although this was at first directed towards the West Indies and South America, where *Rhododendron* is replaced by *Befaria*, we were later able to travel in several regions where rhododendrons occur in the wild, though access to their heartland in China was at that time impossible. We know the species of the European Alps, and have seen several in the eastern and western United States, including *R. lapponicum* on Mt Washington. We have visited only the fringes of the Himalayas, so encountered few species there, and in Java met the vireyas *R. javanicum* and *R. retusum* in the forest above the mountain garden of Tjibodas. Only in New Guinea have we spent time among an abundance of species, ranging from lowland forest epiphytes to scrub on high peaks. Several of these we brought back to New Zealand as cuttings, which became established in gardens here.

The history of the genus has always fascinated us. We have followed it from the times of Linnaeus through the ideas of Don and Maximovicz to the contributions of Hooker, Wilson, Balfour,

Hutchinson, and the more recent studies of Sleumer. One of our earliest articles was an historical review in the Notes from the Royal Botanic Garden, Edinburgh (Philipson & Philipson, 1974), and we summarised what was then known about the classification of the genus in the Rhododendron and Camellia Year Book for 1971, published by the Royal Horticultural Society in England (Philipson & Philipson, 1970). The Rhododendron group of that Society plans to publish a book on the genus to mark the Golden Jubilee of their first Year Book, and we have been invited to write a chapter on the history of classification for this volume.

We have kept in close touch with growers and their gardens, and have written numerous articles for horticultural publications such as the Quarterly Bulletin of the American Society, the Bulletin of the New Zealand Rhododendron Association, the Bulletin of the Dunedin Rhododendron Group, The New Zealand Gardener, and New Zealand's Nature Heritage.

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Book Review

Native Forest Restoration: a practical guide for landowners by Tim Porteous. Queen Eizabeth II National Trust, P.O. Box 3341, Wellington, N.Z., 1993. ISBN 0-908671-46-6. Spiral bound, $29.95.

A useful and well produced book for those interested in restoration of derelict forest areas and re-establishment of native forest from bare ground. From the introduction, which outlines the values of forest remnants and why they should be protected, through to chapters on weed and animal control, propagation, and planting, it is a mine of useful information. Chapter and section headings are clearly set out, making it easy to find information required.

The chapters on managing forest remnants and animal control are excellent. The first clearly discusses the reasons for management and the factors involved in implementing it, while the second is very practical and quite the best exposition I have seen about animal control.

It is difficult to be as enthusiastic about the chapter on weed control. Although the illustrations of different weeds are excellent, and details on chemical control are clearly laid out, this section occupies one-third of the book – a disproportionate amount. And the choice of species could be improved. Perhaps the best approach would have been to give detailed information only on the really serious weeds (about 55% of those described) and then list others which could be troublesome in certain localities or under certain conditions. The inclusion of *Muehlenbeckia australis* is strange, and the question has to be asked, "Can an indigenous species growing in its own habitat be a weed?"

This chapter could be improved by combining the chemical treatment of weeds into condensed tabular form, putting two each of the photographs and descriptions of serious weeds on one page, and listing brief details of other weeds in a table.

The section on nurse crops is important, and it is good that the author has not restricted himself to native nurse species when an exotic will do the job better. However, because they grow into large trees, which will be difficult to remove without serious damage to desired natives, I have some qualms about the use of *Pinus radiata* and *Eucalyptus* as nurse species. Better exotics for this purpose are some of the *Acacia* and *Alnus* species. Both have the added advantage of being nitrogen fixers.

The sections on propagation, planting, and after-care are excellent but do suffer from some minor imperfections and errors. In table 2 it is stated that good kauri seed is "flat and firm." Flat kauri seed is infertile, and this should read 'fat and firm.' The section would be more useful if details were given on which species are best propagated from seed and which from cuttings.

The flow charts outlining processes for planting under different cover types are a useful innovation and help people – especially if not experienced in revegetation work – to make better decisions.

The information on different plants in the appendices is very important, but might have been expanded and better presented if combined into one large table with an alphabetical list of species and columns giving details about each.

Overall a useful and informative book which has been well presented. It deserves to be widely used by all who are interested in the preservation of indigenous forest areas and the propagation of native plants.

Ian Barton

The Banks Memorial Lecture 1993: Trekking after Rhododendrons in Sikkim

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Sikkim is small state of India located north of Calcutta and between Nepal, Tibet, Bhutan, and West Bengal, the last being one of the larger states of India. Access is through Bagdogra, 55 minutes by Indian Airlines north from Calcutta, or approximately two hours by the same airline east from New Delhi. From Bagdogra the bus ride to Gangtok, Sikkim over an excellent paved highway requires approximately four and one-half hours. Gangtok is a city of approximately 50,000 population, offering attractive accommodation with a choice of five modern hotels. This report is of a trip by a group of 19 members taken in 1992 as well as an individual trip in 1990, including a short visit to extreme southwest Sikkim at that time.

Sikkim was closed to tourism until 1974, when a group of members of the American Rhododendron Society from the United States and western Canada trekked from Sandakphu, out of Darjeeling, to Hilley via Phalut. The trekkers then travelled by bus to Gangtok. At the same time, part of that group who felt themselves incapable of trekking went by bus from Darjeeling to Gangtok, and thence by bus north to Mangan. They returned to Gangtok, where the entire group assembled. Satisfactory experiences with that 1974 group provided the government in New Delhi with enough confidence to gradually open access to the Sikkim area. In 1992 trekkers were allowed to travel by bus from Gangtok to Yuksom, near the western border, and to trek from there north to Dzongri. Then, by very special permission from New Delhi, that group was permitted to travel from Gangtok by bus north to Yumthong, and from Fangtok east to Chhanggu. Chhanggu is a very beautiful lake at 12,000 feet elevation and near the eastern border of Sikkim and Nathu La, the pass at the border. Photographs are not permitted at Chhanggu, but are permitted at Kyongnosla, the rhododendron preserve approximately five miles west of Chhanggu and perhaps 2,000 feel lower.

Travel from Gangtok to Hilley in southwest Sikkim is over good, paved roads through beautiful hill country. The route is through Namchi, Naya Bazar, and Sombare. Most of the area is forested. There are great views down river valleys, the largest being the Rangit River valley. At one point the view is over a gently sloping triangular area of perhaps 80 to 100 acres, probably the largest such area in Sikkim. Nearby one sees terraced land which is so steep that it seems almost impossible to traverse. At one point one can see Darjeeling to the south, up on a ridge. Between Sombare and Hilley, in a forested area, the road leads through a dense and extensive undergrowth of *Rhododendron griffithianum*, seen in 1990 in full bloom and displaying show-quality flowers.

Fig. 1 A striking bloom of *R. hodgsonii*.

Two miles from Hilley, over a gently undulating trail, is the Barse Forest Rest House, with great views of the snow-covered mountains to the north, and even the tip of Mt Everest. A dam to form a large lake for recreation and irrigation was under construction there, and nearby is a rhododendron jungle and numerous large plants of *R. grande*, some with rich yellow flowers. Others were not in bloom during the 1990 visit.

On the second morning of the 1992 visit the trekking group left Gangtok in two Sikkim Transport buses to go to western Sikkim via Singtam, Legship, and Yuksom. On the way, at a lunch stop in a park, the group was watched with great interest by children from a nearby school, also out for lunch.

The road ends at Yuksom, so there was an overnight stay at the Forest Rest House, with about half the group sleeping in tents and half inside. Visible 'snows' the next morning brought out all photographers; a hearty breakfast was then served, and members of the group started up the trail before 07:30. The trail is steep and climbs relentlessly upward, except for three equally steep descents to suspension bridges across streams. Even on the way we had seen *R. dalhousiae* growing near the road at 6,000 feet, and also a pretty white and fragrant orchid, probably *Coelogyne mossiae*, growing epiphytically in the trees.

For lunch the group stopped at approximately 8,000 feet for an amazing hot meal prepared over an open fire in a small forest clearing. After a short rest the trek was resumed, taking us soon to *R. arboreum*, then *R. falconeri* trees. Along the trail there were strawberries and *Arisaema*. Late in the afternoon we arrived at the Tsoka Forest Rest House. This provided a large assembly room, one bedroom where two or three slept, and a storage room. Adjacent was the kitchen building where food is prepared over an open fire, probably burning rhododendron wood! A few feet away is a more than ample level area where most slept in tents. We had walked approximately 10 miles, measured horizontally, and had at the same time climbed from 6,000 feet to 10,000 feet, so it was very quiet around there within a short time after dinner was eaten.

The following morning at sunup came the shout "The snows are out" and the almost simultaneous, polite, quiet question "Bed tea, sir?" Next came the really substantial trekkers' breakfast, and then onto the trail by 07:30. Not more than 200 yards up the trail stood the subject we had been eyeing since our arrival the previous afternoon – a tree of *R. arboreum* some 30 feet tall beside the trail, in copious full bloom in the wonderful flaming red of that species. In a short distance we were looking straight down on Tsoka. The trail soon took us through a stand of *R. hodgsonii* of varying colour. Scattered through the trees were specimens of *R. campylocarpum*, *R. thomsonii*, and *R. wightii*, and one of the guides found *R. lanatum*. The day ended at the Forest Rest House at Dzongri (13,200 feet elevation) in a cold rain that turned to hail, and finally pellet snow. All came in wet and cold, so the assembly room

Fig. 2 The road near Legship traverses rugged terrain.

Fig. 3 *R. thompsonii* photographed at Kyongnosla.

looked like a Sikkim laundry with clothes hanging to dry from every useable support. The little stove tried valiantly, but could only warm the room enough to enable trekkers to get warm in their dry clothes.

By the next morning the approximately two inches of snow was at least half gone, much to everyone's relief, because it was quickly obvious that the best view would be from the top of an isolated ridge with a peak rising about 1,000 feet above the surrounds. Among those in the line up the ridge was George Muller who, at age 83, is said to be oldest one to have made the climb to the top. All felt happy for him, and joined him in feasting on the view. In an almost 180 degree panorama there are six mountains from 18,000 feet to more than 28,000 feet high, and several more that were snow-covered and only a little lower.

The slopes of this ridge were clothed with *R. setosum* and *R. lepidotum* trees not yet in bloom, and some *R. anthopogon* just coming into bloom. One *R. fulgens* tree was found, and there were acres of head-high *R. campanulatum* trees mostly not yet in bloom.

After breakfast, following the trip up the ridge, the group divided, some remaining at Dzongri for a day of rest and half going further north to Thangsing. Along the way the latter group found more of each species previously found on the trek, with the exception of *R. cinnabarinum.*

On the fourth day of trekking the divided group reunited on their return to Tsoka. The group from Thangsing dallied along the way listening to and watching birds, arriving late and causing some concern. On the fifth day the whole party walked to Yuksom, arriving there in a drenching, cold rain which started after morning tea. All dried out the best they could in the Forest Rest House, and boarded the waiting buses for the journey to Pemayangtse and a good hotel, the Mt Pandim Hotel, for a welcome dinner, a warm shower, and rest in a dry, warm bed.

After an overnight stop in Gangtok we were off, by bus again, this time to Yumthang in northern Sikkim. We were excited because ours was the first outside group to have been admitted. The lunch stop was at Lachung, original home of Sonam Lachungpa and source of his name. A very high waterfall, or series of waterfalls, is a notable feature of this town. In 1990 Sonam showed us a remarkably beautiful specimen of *R. glaucophyllum*, nearby a tree of *R. pendulum*, and across the valley a large *R. griffithianum* specimen white with flowers.

But on we went to Yaktse, where we stayed in a private lodge guarded by a great golden dragon on a large rock. At this altitude of 11,000 feet *R. niveum* grows naturally, and numerous other rhododendrons have been gathered around the lodge. We stayed three nights, and were taken daily northward to Yumthang and the Shingba Rhododendron Sanctuary, now of approximately 10,000 acres. The rhododendron population is large and diversified. The group found and photographed *R. niveum, R. thomsonii, R. campanulatum, R. cinnabarinum, R. arboreum, R. campylocarpum, R. ciliatum, R. glaucophyllum, R. baileyi, R. falconeri, R. wightii, R. setosum, R. anthopogon,* and *R. hodgsonii*. Probably others are here, though not found by the group. There is also a group of plants currently called *R. sikkimense* which may be a cross between *R. thomsonii* and *R. arboreum*, but which has identifying characteristics which may qualify it for designation as a new species. As well, the area displays a wonderful assortment of *Primula, Arisaema, Meconopsis, Enkianthis,* heather, and other horticulturally desirable plants. Fantastic views of mountains up to 20,000 feel altitude are obtained, all visible virtually from the bus.

But now it is back to Gangtok, and thence to Chhanggu and the Kyongnosla Rhododendron Sanctuary. Kyongnosla is home for a notable diversity of floriferous *R. thomsonii* trees. There are also specimens of *R. hodgsonii, R. arboreum, R. barbatum,* and *R. smithii*. All these were in bloom at the time of the 1990 visit, but unfortunately this was not so during the 1992 visit. Paths are being constructed on the steep hillside, so this beautiful 9,000 acre area will be a spectacular tourist destination when it is finally opened.

Probably the scenic beauty, the biological diversity, and the friendliness of the populace of Sikkim are unsurpassed anywhere in the world. With growing outside interest in the area and increasing freedom of the government to 'open' it to tourism, it is to be expected that many more people will come to know Sikkim as a wonderful place to visit. Once or twice, or even five times, is not enough ... George Muller says that Himalayan Fever is very contagious!

The Origin and Identification of *Hebe* x*franciscana* and its Cultivars (Scrophulariaceae)

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Introduction

Hebe x*franciscana* is the collective name for a group of hybrids that are commonly cultivated in Britain and New Zealand. Included in this group are some of the first *Hebe* hybrids and cultivars to be selected and named. The putative parents of *H.* x*franciscana* are generally accepted as *Hebe elliptica* and *H. speciosa* (Souster, 1956; Metcalf, 1987; Chalk, 1988). Chalk (1988) has provided a chronological account of the history of this hybrid group. Both he and Metcalf (1987) noted that further research could perhaps contribute to the clarification of several problems. The questions raised by these two authors prompted the present study, which seeks to clarify the taxonomic status and nomenclature of *Hebe* x*franciscana*, *H.* 'Blue Gem', *H.* 'Devoniana', *H.* 'Franciscana', *H.* 'Lobelioides', and *H.* 'Variegata'.

Chalk (1988) included *Hebe* 'Lavender Queen', *H.* 'Sarnia', and *H.* 'White Gem' in *H.* x*franciscana*. However, my study is restricted to cultivars that were raised about the late 1850s, and does not include these three cultivars, which are of more recent origin.

Fig. 1. Herbarium specimens of *Hebe elliptica* x *H. speciosa* which were sent to the Royal Botanic Gardens, Kew, by Isaac Anderson-Henry in 1862.

Research Methods

This study was conducted at the Missouri Botanical Garden, St Louis, using living and herbarium material of all the older *Hebe* x*franciscana* cultivars grown in New Zealand and Britain. This material was used for detailed morphological examination, chromosome counts, and two-dimensional paper chromatography (2D PC) of phenolic compounds.

The morphological examination particularly emphasised stomata morphology, which proved to be a useful character for distinguishing between cultivars and for assessing the putative parentage. The stomate morphology was initially assessed using the methods of Sinclair and Dunn (1961). It indicated that the stomata would be of diagnostic value, so a scanning electron microscope (SEM) examination was completed.

The methods of Sinclair and Dunn (1961) can be summarised as follows. Dried leaves were soaked overnight in cold water with a trace of glycerol added. They were then dried, flooded with toluene, and a thin smear of Archer's liquid plastic was applied. When the Archer's liquid plastic had dried (15–60 minutes) it was peeled off, and a small square was cut out and mounted face down on a slide. This specimen was examined under a Zeiss Universal light microscope. For the SEM a small section of leaf from a dried herbarium specimen was mounted on a stub, sputter coated with gold, and then examined.

Information obtained from chromosome counts and 2D PC was of limited value so the methods used for these procedures are not described here; they can be found in Heenan (1993a). Flower colour for the cultivar descriptions was characterised using the Royal Horticultural Society Colour Chart.

Accepted Cultivars

Four cultivars have been recognised in this revision, but only *Hebe* x*franciscana* 'Lobelioides' and its variegated sport *H.* x*franciscana* 'Maryfield' are accepted as having a putative parentage of *H. elliptica* and *H. speciosa*. The other two cultivars, *H.* 'Combe Royal' and *H.* 'Silver Queen', are excluded from *H.* x*franciscana* as they appear to have a complex parentage that includes *H. elliptica*, *H. speciosa*, and a third, unidentified species.

Because of the previous taxonomic and nomenclatural confusion involving *H.* x*franciscana*, descriptions are provided for all cultivars. *Hebe* x*franciscana* 'Maryfield' and *H.* 'Combe Royal' are new cultivar names, and *H.* 'Silver Queen' is an early name that is reinstated as it has priority over several more recent names.

***Hebe* x*franciscana* (Eastw.) Souster**, *J. Roy. Hort. Soc. 81*, 519–521 (1956).

Basionym: *Veronica franciscana* Eastw., *Leafl. West. Bot. 3*, 220–222 (1943).

Holotype: CAS 20685!, *A. Eastwood*, October 1913, cultivated Golden Gate Park.

Parentage: *Hebe elliptica* (G.Forst.) Pennell x *Hebe speciosa* (A.Cunn.) Cockayne et Allan.

***Hebe* x*franciscana* 'Lobelioides'** (Gardener, *Garden [London] 6*, 328, 1874, as *Veronica lobelioides.*)

Synonym: *Hebe* 'Blue Gem' hort., in part.

Parentage: *Hebe elliptica* (G.Forst.) Pennell x *Hebe speciosa* (A.Cunn.) Cockayne et Allan.

Description: Branchlets bifariously pubescent, terete, green; internode length 5–6x stem diameter; stem diameter between 5th and 6th pair of leaves (2.1)–2.9–3.5–(4.4) mm. Leaves 38–50–(59) x 17–23–(27) mm; petiole c. 4 mm long, elliptic to obovate, coriaceous; apex subacute to obtuse; margins sparsely ciliolate when young; leaf bud with lanceolate sinus. Inflorescence a lateral raceme, (33)–39–63–(96) mm long, with c. 50 flowers. Bracts 2–2.5 mm long, ovate to lanceolate; margin ciliolate; apex acute, occasionally acuminate. Peduncle 9–15–(30) mm long; pedicel 3–5 mm long; peduncle, pedicel and rachis with a covering of eglandular hairs. Calyx c. 2–2.5 mm long; lobes free, ovate to elliptic; apex subacute to obtuse; margins ciliolate with mostly glandular hairs, occasionally rose colour when in bud. Corolla 12–14 mm diameter, violet-blue (90a), violet-blue (94a) when dried; lobes spreading; tube narrow, white, 2–2.5 mm long, calyx; posterior lobe 5.5 x 4.5 mm; anterior lobe 7 x 3.5 mm. Capsule pale brown, latiseptate, ellipsoid, 5.5–6.5 x 4–5 mm. Seeds flattened, pale brown,

1.1–1.5 x 0.7–0.9 mm. 2n = 40 (CHR 471143).

Representative specimens: K!, *I. Anderson-Henry*, April 1862, cultivated Edinburgh (Fig. 1); AK 8442!, *T. Cheeseman*, cultivated Wellington; CHR 471140!, *P.B. Heenan*, April 1992, cultivated Burnside Park, Christchurch, New Zealand; CHR 471143!, *P.B. Heenan*, April 1992, cultivated Lincoln University, New Zealand; CHR 471139!, *P.B. Heenan*, May 1992, cultivated University of California – Santa Cruz Arboretum, California, U.S.A.

***Hebe* x*franciscana* 'Maryfield'** *cultivar nov.*

Synonym: *H.* 'Variegata' hort., in part.

Parentage: A variegated branch sport from *H.* x*franciscana* 'Lobelioides'.

Description: As for *H.* 'Lobelioides' except the leaves have a green central area and are variegated with pale green-yellow around the margin.

Representative specimen: CHR 471147!, *P.B. Heenan*, October 1993, cultivated in a private garden, Christchurch, New Zealand.

***Hebe* 'Combe Royal'** *cultivar nov.*

Synonyms: *Hebe* 'Blue Gem' hort., in part; *H.* 'Franciscana' (D. Chalk, *Hebes and Parahebes*, 1988); (?) *H.* 'Multiflora' (Anon., *Fl. World* 8, 91–92, 1865); (?) *H.* 'Devoniana Caerulea Multiflora' (Anon., *Fl. World* 8, 91–92, 1865).

Parentage: *Hebe elliptica* (G.Forst.) Pennell x (*Hebe speciosa* (A.Cunn) Cockayne et Allan x *Hebe* unknown).

Description: Branchlets bifariously pubescent, terete, green; base of petiole flushed red; internode length 4–6x stem diameter; stem diameter between 5th and 6th pair of leaves 3.0–3.8–(4.3) mm. Leaves 33–40–(44) x 16–22 mm, elliptic to obovate, coriaceous; petiole c. 4 mm long; apex obtuse; margins sparsely ciliolate; leaf bud with sinus. Inflorescence a lateral raceme, (40)–46–61–(76) mm long, with c. 50 flowers. Bracts 1.5–2 mm long, ovate to lanceolate; margin ciliolate; apex acute. Peduncle 11.5–16.5 mm long; pedicel 3–5 mm long. Peduncle, pedicel, and rachis with a sparse covering of eglandular hairs. Calyx c. 2 mm long, occasionally flushed rose colour in bud; lobes free, ovate to elliptic; margins ciliolate; apex subacute, occasionally obtuse. Corolla 15 mm diameter, violet-purple (80a), violet (90a) when dried; lobes spreading; tube broad, white, 2–2.5 mm long, calyx; posterior lobe 7.5 x 5.5 mm; anterior lobe 5.5 x 4.5 mm. Capsule brown, latiseptate, ellipsoid, 6–8 x 4–5 mm. Seeds flattened, pale brown, 1–1.5 x 0.75–1 mm. 2n = 40 (CHR 471144).

Representative specimens: CHR 471144!, *P.B. Heenan*, April 1992, cultivated Linwood Nursery, Christchurch, New Zealand; CHR 471145!, *P.B. Heenan*, May 1992, cultivated Crail, Scotland.

***Hebe* 'Silver Queen'**

(W. Cutbush, *Gard. Mag. (London)* 54, 819–820, 1911, as *Veronica* Silver Queen.)

Synonyms: *Veronica elliptica* 'Blue Gem Variegata' (*Hillier Nurs. cat.*, 90, 1950–51); *Hebe* 'Variegata' (*Hillier Nurs. cat.*, 61, 1964); *H.* 'Waireka' (*Duncan and Davies Nurs. cat.*, 190, 1963); *H.* x*franciscana* 'Waireka' ([*Duncan and Davies*] Metcalf, L. J., *The cultivation of New Zealand trees and shrubs*, 269, 1972).

Parentage: A variegated sport from *Hebe* 'Combe Royal'.

Description: As for *Hebe* 'Combe Royal', except the leaves have a green central area and are variegated with creamy yellow around the margin. *Hebe* 'Silver Queen' is somewhat unstable and regularly reverts to entirely green leaves.

Representative specimen: CHR 471146!, *P.B. Heenan*, October 1993, cultivated in a private garden, Christchurch, New Zealand.

Discussion

Isaac Anderson-Henry of Edinburgh, Scotland, raised *Hebe* 'Lobelioides' from a deliberate cross made between *H. elliptica* from the Falkland Islands and *H. speciosa* from New Zealand (Anderson-Henry, 1868). *Hebe speciosa* was the pollen parent and *H. elliptica* the maternal parent (Lindsay, 1894). Unfortunately no herbarium specimens exist to confirm the authenticity of the putative parents. The exact date of this cross and when the plant was raised are not recorded, but it was before April 1862, the date of the first herbarium specimens at Kew.

Anderson-Henry sent two specimens of this hybrid to Kew and one specimen, dated November 1862, is named "*V. lobeliodes*" (sic). It appears that this name was applied by Anderson-Henry as it is written on a plant tag that was probably sent with the specimen to Kew. It is unusual that Anderson-Henry did not publish this name, as he did for *Hebe* 'Andersonii', when he described his hybridisation experiments (Anderson-Henry 1868, 1872). The first published reference to *H.* 'Lobelioides' is by Gardener (1874), 12 years after the name was recorded at the Kew herbarium.

Herbarium specimens at Kew indicate that two other seedlings from the same batch as *Hebe* 'Lobelioides' were distributed by Anderson-Henry, one being sent to J.D. Hooker, Director of the Royal Botanic Garden at Kew, and another to Veitch's nursery. The fate of these plants is not recorded, but two herbarium specimens at Kew may represent the plant sent to Hooker.

The first specimen is labelled "*V. speciosa* R. Cunn. var.", and is from Hooker's garden at Sunningdale; the second specimen was collected from the Temperate House at Kew in 1906. These two specimens are similar in having uniformly smaller leaves than is typical for all the other Kew herbarium specimens of *Hebe* x*franciscana*, and they may be from the same clone. It would be expected that a plant of *H.* 'Lobelioides', when grown in the warm conditions of the Temperate House at Kew, would have larger leaves than those collected from plants cultivated outdoors, but this is not the case. This smaller-leaved plant may be the clone that Anderson-Henry sent to Hooker. Further support for this suggestion is the possibility that when Hooker received the plant from Anderson-Henry he planted it in the garden of his private residence at Sunningdale. Hooker (1864) states "I have a cultivated hybrid between this (*V. speciosa*) and *V. elliptica* . . . raised by I.A. Henry." This implies that he was growing the hybrid, but it is uncertain as to whether it is the plant he had received from Anderson-Henry. In contrast, Souster (1956) regarded the specimen from Hooker's garden as being identical to the commonly cultivated *H.* 'Lobelioides'. The fate of the plant sent to Veitch's nursery is unknown, and Souster (1956) reports that a search of early Veitch nursery catalogues failed to locate any reference to *Hebe* 'Blue Gem' or *H.* 'Lobelioides'. However, the Veitch Nursery catalogue for 1880 does list H. 'Blue Gem'.

T. Kirk recorded on an undated herbarium specimen (AK 8442) at the Auckland Institute and Museum that *Hebe* 'Lobelioides' was introduced to New Zealand from Australia before 1868. An examination of New Zealand nursery catalogues dating from the early 1900s indicates that *H.* 'Lobelioides' was widely cultivated in New Zealand until as recently as the late 1960s (Appendix 1), but at about this time the name *Hebe* 'Lobelioides' is replaced by *H.* 'Blue Gem'. The reason for this is likely to be the acceptance of H. 'Blue Gem' by Souster (1956) and Metcalf (1972). Nevertheless, this history of the cultivation of *H.* 'Lobelioides' indicates that in New Zealand plants of this cultivar are likely to be authentic material that dates from the original pre-1868 introduction.

Hebe x*franciscana* (Eastwood) Souster is accepted as the interspecific epithet for hybrids between *H. elliptica* and *H. speciosa*. Eastwood (1943) provided this name for a plant growing at San Francisco, California, that lacked a name and did not fit the available descriptions. An examination of the type specimen indicates that the plant Eastwood described is likely to be the cultivar *H.* 'Lobelioides'. Although *H.* 'Lobeli-

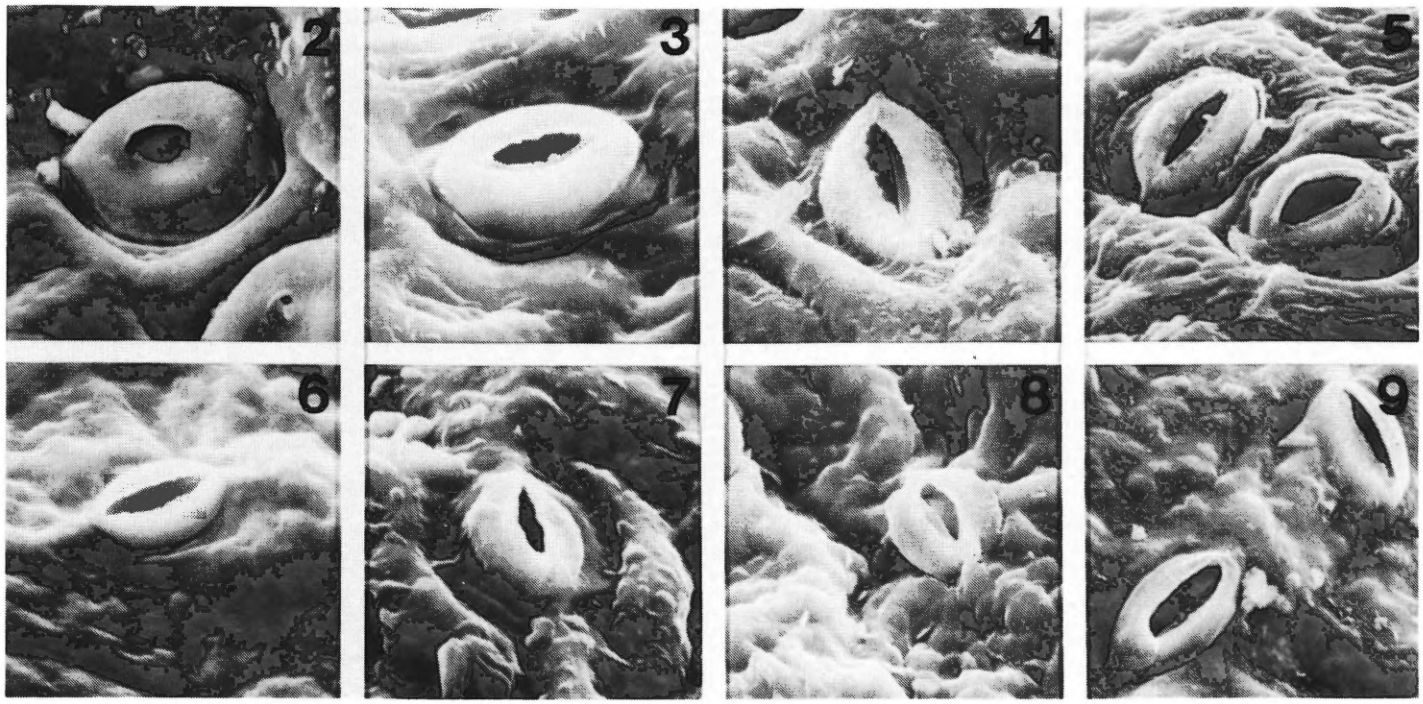

Fig. 2–9. *Hebe* stomata (1–5, 7, and 8, x1200; 6 x2000). 2, *H. elliptica*; 3, *H. speciosa*; 4, *H.* x*franciscana* 'Lobelioides'; 5, *H.* x*franciscana* (Eastw.) Souster, holotype; 6, *H.* 'Combe Royal'; 7, *H. stricta*; 8, *H. salicifolia*; 9, *H.* x*andersonii* 'Andersonii'.

oides' was published before *H.* x*franciscana* it cannot be accepted as an interspecific epithet (Green 1973), but it is acceptable as a cultivar name.

Although the *Hebe* breeding efforts of Anderson-Henry are well known, the first reference to artificial hybridisation between *Hebe elliptica* (as *V. decussata*) and *H. speciosa* was by John Luscombe, writing under the pseudonym "A Devonian" (Heenan 1993b). Luscombe observed that a "distinct race might be originated between *V. speciosa* and *V. decussata*" and that he had "been seeking in vain for a stray flower or two with which to make the experiment" (Devonian 1850). Devonian (1856) reported the successful cross "between *V. decussata* and a seedling from *V. speciosa*", a plant from which was described as having the habit of *H. elliptica* and a lilac flower colour. Devonian (1859) again reported this hybrid, describing it as being a neat evergreen shrub, 4 feet high and about 22 feet in circumference, and with deep lilac, violet-tinged blossoms. No further references to this plant have been located, and an examination of the literature (Heenan and Heenan, in prep.) indicates that it is without a name after about 140 years of being cultivated. The main reason for this appears to be that it was not properly named and described when it was introduced to cultivation, and for many years it was grown as *H.* 'Blue Gem' and perhaps *H.* 'Lobelioides'. I therefore give this hybrid the cultivar name *H.* 'Combe Royal', which is the name of John Luscombe's estate in Kingsbridge, Devon (Heenan, 1993b). Chalk (1988) recognised that this Luscombe hybrid did not have a name so he called it *H.* x 'Franciscana'. This cultivar name is in Latin, and is illegitimate under the International Code of Nomenclature for Cultivated Plants, Article 27 (Brickell et al., 1980).

Anon. (1865) and Anon. (1877) describe *Veronica* 'Devoniana Caerulea Multiflora' and *V.* 'Multiflora' as having "dark violet and white" flowers. Although conclusive evidence is lacking, it is possible that these names refer to the plant raised by Luscombe (Heenan, 1993b). The use of "Devoniana" could be a connection to Luscombe's pseudonym Devonian. Likewise, the word "Caerulea" could be interpreted as being similar to the dark violet flower colour given by Devonian (1856, 1859). The name *V.* 'Multiflora' has an identical description to that of *V.* 'Devoniana Caerulea Multiflora', and would appear to be an abbreviation for the latter cultivar. Because of the uncertainty in establishing a connection between these cultivar names and the hybrid raised by Luscombe they will not be applied to the Luscombe plant.

Hebe 'Combe Royal' and *H.* x*franciscana* 'Lobelioides' have very similar foliage and are difficult to tell apart when not in flower. However, *Hebe* 'Combe Royal' is distinguished from *H.* 'Lobelioides' in having stouter branchlets, a larger flower, a broader corolla tube, a larger bud immediately before the corolla lobes open out, a greater diameter between the lateral corolla lobes on fully opened flowers, and a flower colour of violet-purple as compared to violet-blue (see cover plate).

A further significant distinguishing character is the level of resistance to being infected with downy mildew (*Peronospora grisea*). When plants in the Missouri Botanical Garden research glasshouse were examined on 25 November 1992, *H.* 'Lobelioides' had suffered only a mild infection, whereas *H.* 'Combe Royal' and *H.* 'Silver Queen' were severely infected with downy mildew.

The stomata (Fig. 2–9) are an important character that distinguishes between the cultivars and provides information on their putative parentage. For *Hebe elliptica* (Fig. 2) the outer stomate ledges are round, c. 25 x 25 µm, situated in a pit on the leaf surface, and surrounded by a raised epidermal lip, the round to elliptic pore is situated on the flat surface of the ledge, and the wax sculpturing of the leaf epidermis comprises a series of interconnecting ridges separated by shallow to deep pits. In *H. speciosa* (Fig. 3) the stomate ledge is c. 27 x 12 µm, elliptic to somewhat rounded in shape, situated in a pit on the leaf surface, and surrounded by a raised epidermal lip. The linear pore is situated on a raised central ridge, and the wax sculpturing of the leaf epidermis is gently undulating and shallowly ridged.

In *Hebe* 'Lobelioides' (Fig. 4) the stomate ledge is c. 15 x 13 µm, elliptic, situated in a pit on the leaf surface, surrounded by a raised epidermal lip, and the broad elliptic pore is situated on a weak ridge. These characters are intermediate between *H. elliptica and H. speciosa* and consistent with their putative parentage. The wax sculpturing is

almost identical to that of *H. speciosa*. The stomate ledge of *H.* x*franciscana* Eastwood (Fig. 5) is c. 15 x 10 µm, elliptic, situated in a pit on the leaf surface, and surrounded by a raised epidermal lip; the pore is elliptic and situated on a weak ridge. These characters are intermediate between the putative parents *H. elliptica* and *H. speciosa*, and very similar to *H.* 'Lobelioides'. However, the wax sculpturing is different between *H.* 'Lobelioides' and *H.* x*franciscana* Eastwood, being much more textured on the latter specimen. The reason for this is unknown but it could be due to age differences between the individual leaves examined or between the Eastwood herbarium specimen and the fresh material of *H.* 'Lobelioides'. Alternatively, the similarity between the stomate ledges of the two specimens examined suggests that they share the common putative parentage of *H. elliptica* and *H. speciosa*, but that they are different clones of that cross.

The stomate ledge of *Hebe* 'Combe Royal' (Fig. 6) is very different in size, shape, and position from *H.*x*franciscana* Eastwood and *H.* 'Lobelioides'. It is c. 13 x 9 µm, elliptic, and situated on the leaf surface, and the wax sculpturing of the leaf epidermis is undulating and coarsely textured. The stomate ledge of *H.* 'Combe Royal' is very similar to that of *H. stricta* (Fig. 7), *H. salicifolia* (Fig. 8), and *H.* x*andersonii* 'Andersonii' (Fig. 9). This is particularly instructive as it indicates that this cultivar is almost certain to be a hybrid involving a parent other than, or in addition to, *H. elliptica* and *H. speciosa*. Although this examination is limited to only three species, the stomate morphology of *H.* 'Combe Royal' indicates that *H. stricta* or *H. salicifolia* may be a parent. Both species were in cultivation in Britain at the time Luscombe made his cross.

An examination of the early literature gives additional information which, when considered with the stomate morphology described above, provided evidence for the parentage and origin of *H.* 'Combe Royal'. Of particular interest is that Luscombe raised this hybrid from a cross "between *V. decussata* and a seedling from *V. speciosa*" (Devonian, 1856). That Luscombe used a *Hebe speciosa* seedling clearly indicates that a third species could be involved in this hybrid. This seedling would most likely have had *H. speciosa* as the female parent and an unknown species as the male parent. The presence of the *H. stricta* and *H. salicifolia* type of stomata in *H.* 'Combe Royal' suggests that either may be the other parent. It is therefore very likely, but unfortunately difficult to confirm by the methods used in this study, that *H.* 'Combe Royal' is a hybrid of *H. elliptica*, *H. speciosa*, and either *H. stricta* var. *stricta* or *H. salicifolia*.

Luscombe had already raised *H.* 'Kermesina', which was stated to be a seedling from *H. speciosa* (Devonian, 1850). The early descriptions of this cultivar indicate that *H.* 'Kermesina' is a hybrid with *H. speciosa* as most likely the female parent and another species as the male parent. Therefore, it is very probable that a further cultivar raised by Luscombe would have a complex parentage involving three parents.

John Luscombe raised another plant, *Veronica decussata* var. *devoniana,* which was illustrated by Anon. (1857) and Planche (1858) and described by Williams (1869). Heenan (1993b) has treated this cultivar as a selection of *H. elliptica*. It is certainly not the *H. elliptica* x *speciosa* hybrid with violet flowers referred to by Devonian (1856, 1859). This is important, as Metcalf (1987) and Chalk (1988) imply that *H.* 'Devoniana' may refer to Luscombe's *H. elliptica* x *H. speciosa* seedling.

Another plant with an apparent connection to Devon, Luscombe's home county, is *Hebe* 'Devonensis', which was distributed by Veitch's nursery about the 1870s (V., 1879). Its status is uncertain, but several authors treated it as a horticultural synonym of *H. traversii* (Appendix 2). Summerhayes (1927) treated the cultivated *Veronica traversii* as *H. brachysiphon*. Therefore, it seems that *H.* 'Devonensis' should be treated as a horticultural synonym of *H. brachysiphon*.

Chalk (1988) suggested that Luscombe had used New Zealand *Hebe elliptica* in his cross with the *H. speciosa* seedling, but this conclusion appears to lack any substantive evidence. Luscombe referred to the *H. elliptica* that he cultivated as "Botany Bay Myrtle" or *Veronica decussata* (Devonian, 1850). *Veronica decussata* Solander is based on plants from Tierra del Fuego, and *Veronica elliptica* Forst.f. is based on plants from New Zealand. Today, *Hebe elliptica* (= *Veronica elliptica*) is the accepted name for plants from both places. The use of *Veronica decussata* suggests that the plant cultivated by Luscombe could have been from South America, but in conflict with this suggestion is the reference to Botany Bay. However, this could be misleading as the well known Botany Bay is in Australia, and this place name has not been used anywhere in New Zealand (Department of Lands and Survey, 1968).

If Luscombe had been cultivating *Veronica elliptica* from New Zealand it is logical to assume that he would have called it *V. elliptica* rather than *V. decussata*. Implicit in this suggestion is that cultivated plants from New Zealand were called *V. elliptica*, and those from South America were referred to as *V. decussata*. It may be that horticulturists in the early to mid eighteenth century referred to all *V. elliptica* that was cultivated as *V. decussata*, as has been indicated by Anderson-Henry (1868) when he refers to the Falkland Island plants that he used for hybridising as "*Veronica decussata* (*V. elliptica* Hook.)". However, in the standard botanical treatment of the New Zealand flora at that time, Hooker (1864) accepts *V. elliptica* and treats *V. decussata* as a synonym. Further research is needed to understand variation in the *H. elliptica* complex and the differences between the South American and New Zealand populations. Without this increased understanding it is very difficult to establish from where the *H. elliptica* used by Anderson-Henry and Luscombe originated.

Metcalf (1987) outlined the history of the variegated *Hebe* x*franciscana* cultivar that is grown in New Zealand, and concluded that the plant cultivated in New Zealand as *H.* 'Waireka' is identical to the British *H.* 'Variegata'. Metcalf (1987) accepted *H.* 'Variegata' as the legitimate name, as it was published first in the Hillier Nursery catalogue of 1964.

However, a search of the available literature (Heenan and Heenan, in prep.) indicated that *Hebe* 'Silver Queen', which was shown by Messrs Wm. Cutbush and Son, of Highgate, at a RHS show on 24 October 1911 (Anon., 1911), is an earlier name. Fortunately, this cultivar was illustrated in the *Gardeners' Magazine* (Cutbush, 1911), and it is evident from this that it is identical to *H.* 'Variegata'. *Hebe* 'Silver Queen' does not appear to have become an established name as there are very few later references to it (Heenan and Heenan, in prep.).

Another plant with a similar description and an even earlier name is *Hebe* 'Silver Star'. This plant was shown by Veitch Nursery on 12 October 1897 at an RHS show, where it won an Award of Merit (Anon., 1897a). It is variously described as follows: "very dwarf, compact, free-growing variety with thick, ovate, pale green leaves, broadly margined with creamy-yellow" (Anon., 1897a); "the predominating colours are silvery white and creamy yellow, the silvery suffusion appearing upon a pale green ground" (Anon., 1897b); and "the variegation is of a creamy tint, but it ultimately becomes silvery white" (Anon., 1897c). These descriptions could apply to *H.* 'Silver Queen', but because this cannot be confirmed with certainty *H.* 'Silver Star' is not accepted in this treatment.

Metcalf (1987) has pointed out that there are two variegated *H.* x*franciscana* clones grown in New Zealand. The second is a sport from *H.* 'Lobelioides' and is apparently without a name. It is possible that this unnamed cultivar is *H.* 'Silver Star', but further research would be needed to establish this connection. As it is desirable to give this cultivar a name I here call it *H.* 'Maryfield', after

the Edinburgh suburb in which Anderson-Henry lived (Lindsay, 1895).

Because of the recent name changes to these variegated cultivars it is recommended that the International Registrar for *Hebe* conserve the name *H.* 'Silver Queen' to provide stability and to prevent further changes if earlier and different names are located (International Code of Nomenclature for Cultivated Plants Article 46 – Brickell *et al.* 1980).

As part of this revision the most important herbarium specimens of *Hebe* x*franciscana* were examined, including specimens from the original Anderson-Henry *Hebe elliptica* x *H. speciosa* (Fig. 1), an early Kirk specimen of *H.* 'Lobelioides' from New Zealand, the type specimen for *H.* x*franciscana*, and a suite of Kew specimens studied by J. Fraser. Unfortunately these specimens were of only limited diagnostic value because of similar vegetative and floral characters among the cultivars, loss of colour from the flowers and leaves, and shrinkage which had altered the shape and size of the flowers. Therefore, it was not possible to distinguish with certainty any different cultivars from among the herbarium specimens.

An important conclusion of this revision is that the name *H.* 'Blue Gem' has not been accepted. I now present the reasons for this, as "Blue Gem" has been the most frequently used name for over 100 years in *H.* x*franciscana*. *Hebe* 'Blue Gem' dates from 1869 and refers to a plant that was raised by the nurseryman H.W. Warren of Salisbury, Hampshire (Anon., 1869; D., 1869). This cultivar was widely cultivated in the years immediately following its introduction (Oubridge, 1872; Bradbury, 1874; T., 1893; Anon., 1898; Anon., 1899), but authentic references have not been located beyond 1899. The general description usually provided for this cultivar is of a small plant with pale blue flowers (Appendix 3).

Dating from 1877, *Hebe* 'Blue Gem' (of horticulture) was often described as being 5–6 feet in height with blue flowers (Appendix 4). These descriptions, which I consider to apply to plants still in cultivation today as *H.* 'Blue Gem' (of horticulture), differ significantly from the original and subsequent descriptions for *H.* 'Blue Gem' (of Warren – Anon., 1869; D., 1869), and it is evident that there are two distinct cultivars with the same name. The original description and use of the name *H.* 'Blue Gem' in reference to the plant selected by Warren has priority over subsequent applications of that name to other plants (International Code of Nomenclature for Cultivated Plants - Brickell *et al.*, 1980). Therefore *H.* 'Blue Gem' (Warren) has been incorrectly used in reference to the hybrids raised by both Anderson-Henry and Luscombe, which are here accepted as *H.* 'Lobelioides' and *H.* 'Combe Royal' respectively.

Given that *Hebe* 'Blue Gem' (of Warren) was cultivated until the late 1890s, it is possible that it is still cultivated today, perhaps without a name or with another name. One plant that is similar to the description of *H.* 'Blue Gem' (of Warren) is *H.* 'Boscawenii', described by Chalk (1988). The growth habit, flower colour, phenology, and unknown origin would be in keeping with *H.* 'Boscawenii' being a more recent name for *H.* 'Blue Gem' (of Warren). It appears that *H.* 'Blue Gem' (of Warren) had virtually disappeared from common cultivation about 1915, when J. Fraser was researching the *H.* x*franciscana* group, as he makes no reference to it in his annotations on herbarium specimens at Kew. In contrast, the use of the name *H.* 'Blue Gem' (of horticulture) was well established at that time.

It is reasonable to surmise that the original *Hebe* 'Blue Gem' (of Warren) was found growing sometime after 1900 and was then renamed *H.* 'Boscawenii' either by, or after, the Boscawens of Cornwall. Boscawen (1923) makes no reference to either raising or naming any *Hebe* cultivars, and further research would be needed to establish this connection.

Hebe 'Rotundifolia' is another plant listed in the early horticultural literature, and from the descriptions it appears to be very similar to *H.* 'Lobelioides' or *H.* 'Combe Royal'. The first reference to it (Hinds, 1880) described it as having "flowers purple or bluish-purple". Further descriptions have been provided by Murphy (1887): "V. rotundifolia (round or obtuse foliage), 'Blue Gem' of some catalogues" and "five years (old), and was four feet through."

The most descriptive and informative reference is provided by Jolliffe (1924), who lists both *Hebe* 'Blue Gem' and *H.* 'Rotundifolia' in the same article. He describes *H.* 'Blue Gem' as "growing 6ft high with fine blue flowers" and *H.* 'Rotundifolia' as being "a very thick bush, about 3ft high, with fine blue flowers." It is evident from these descriptions that *H.* 'Blue Gem' and *H.* 'Rotundifolia' are very similar, but may be distinct enough to be separate cultivars. Because of the uncertainty surrounding this name I give it no formal status in this treatment.

The 2D PC did not distinguish between cultivars but it did indicate that *H.* 'Combe Royal' may have more than two species involved in its parentage. The limited usefulness of the phenolic data is in contrast to the 2D PC analysis for *H.* x*andersonii*, which supported a putative parentage of *H. stricta* var. *stricta* and *H. speciosa* (Heenan, 1994).

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V., 1879: *Veronica traversii*. *Garden, an illustrated weekly journal of gardening in all its branches* 16: 191.

W., E.H., 1877: Roses and veronicas in November. *Garden, an illustrated weekly journal of gardening in all its branches* 12: 510.

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Appendices

Appendix 1. Selected references to *Hebe* 'Lobelioides' in New Zealand nursery catalogues.

Nairn and Sons catalogue, 1906–07
Nairn's Nursery catalogue, 1938
Anderson's Nursery catalogue, 1939
B.H. Just Nursery catalogue, 1949
Wilson's Nurseries catalogue, 1951–52
Awamuri Nursery catalogue, 1960
Leslie D. Foote catalogue, 1964–68
Wilson's Tree catalogue, 1964, 1968, 1969

Appendix 2. Selected references to *Hebe* 'Devonensis'.

P., 1873: General description and cultivation notes

J., 1879: "*Veronica traversii* (syn. devonensis)"

G., 1879. "*V. traversii*, known in some gardens as *Devonensis*"

V., 1879: "*Veronica traversii* . . . was sent out some years ago as *V. devonensis* by Messrs Veitch"

Anon., 1881: "*Veronica* devonensis, so called by nurserymen, but which I have been given to understand is more correctly *V. traversii*"

G. 1883: "*Veronica traversii* . . . there is a *Veronica* called *V.* Devonensis in commerce; but this is only a synonym, as I can see no difference between the two"

Appendix 3. Descriptions of *Hebe* 'Blue Gem' raised by H.W. Warren of Salisbury.

D., 1869: "pale blue . . . very compact in habit, and remarkably free blooming"

Anon., 1869: "dwarf and compact, and it produces an abundance of rich blue flowers"

Oubridge, 1872: "light blue, very dwarf in growth . . . blooms continuously throughout the summer"

Bradbury, 1874: "miniature with wiry habit, small leaves, and pretty smallish spikes of light blue flowers"

Baines, 1885: "A dwarf growing, pretty, blue-flowered variety; a profuse bloomer"

T., 1893: "blue blossoms . . . forming a little dense box-like bush . . . hardly ever without flowers"

Anon., 1898: "a very dwarf variety, with pale blue blossoms"

Anon., 1899: "light blue"

Appendix 4. Descriptions of *Hebe* 'Blue Gem' (hort.).

W., 1877: "5 or 6ft high, and as much through"

Jolliffe, 1924: "6ft high with blue flowers"

The Origin and Identification of *Hebe* x*andersonii* and its Cultivars (Scrophulariaceae)

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Introduction

Hebe x*andersonii* 'Andersonii' is regarded as the first artificial hybrid to be raised between two New Zealand plant species (Metcalf, 1987). It was bred in 1848 by Isaac Anderson-Henry of Maryfield, near Edinburgh, Scotland (Anon., 1851; D., 1887), and was first exhibited by nurseryman E.G. Henderson at a meeting of the Royal Horticultural Society on 6 November 1849, where it was awarded a Certificate of Merit (Anon., 1850). The putative parents have long been accepted as *H. salicifolia* (female) and *H. speciosa* (male) (Lindley and Paxton, 1851; Anderson-Henry, 1868, 1872; Cockayne, 1929; Souster, 1962; Metcalf, 1987; Chalk, 1988). The female plant used by Anderson-Henry was *Veronica lindleyana* Paxton but this has been treated as a horticultural synonym of *H. salicifolia* (Lindley and Paxton, 1851; Cockayne, 1929).

Upon being introduced to cultivation in Britain *Hebe* x*andersonii* 'Andersonii' became well known as a valuable garden plant in mild climates and as a conservatory plant in more harsh climates. Its popularity is evidenced by a variety of writings: a bibliographic list of *Hebe* species and cultivar names (Heenan and Heenan, in prep.) includes 104 references to *H.* x*andersonii* before 1900.

The year *Hebe* 'Andersonii' was introduced to New Zealand is not recorded, but the first reference to it is in the nursery catalogues of *D. Hay and Son's Montpellier Nursery* (1865) and *William Hales list of fruit and forest trees, flowering shrubs* (1865). Metcalf (1987) has observed that there could be more than one clone cultivated under the name *H.* 'Andersonii', as there are differences in the flower colour between plants from Britain and New Zealand. This observation prompted the present study, which aims to identify and resolve any taxonomic and nomenclatural problems in *H.* x*andersonii*. More recently Hutchins (1992) has raised doubts about the accepted putative parentage of *H. salicifolia* and *H. speciosa* for *H.* x*andersonii*. He suggested that *H. stricta* could be the female parent, and that there is little evidence for *H. speciosa* being the male parent.

Several other named cultivars are often placed in *Hebe* x*andersonii* (Souster, 1962; Metcalf, 1987, 1991; Chalk, 1988), but limited availability of plant material of these has restricted this study to cultivars derived from the 1848 Anderson-Henry cross.

A search of gardening and horticultural literature up to 1900 (Heenan and Heenan, in prep.) provided evidence that a second cultivar, *Hebe* 'Hendersonii', is likely to be grown in New Zealand. In contrast to *H.* 'Andersonii', this cultivar is not very well known in the horticultural literature; it has an obscure origin and an apparently brief history of cultivation. The discussion that follows outlines the known history of *H.* 'Hendersonii' and suggests a possible origin. Unfortunately, as is often the problem with older cultivars and garden hybrids, my conclusions are in a large part based on inference from the available facts rather than on definitive empirical and historical evidence.

Review of History of *Hebe* 'Hendersonii'

When Anderson-Henry raised the seedlings from his cross between *Veronica lindleyana* and *V. speciosa* he selected at least one other besides *H.* 'Andersonii', as it is recorded that he gave another plant "to a friend" (Anderson-Henry, 1872). Moreover, Anderson-Henry (1872) recorded that another plant was raised from that given to the friend. The identity of the friend is unknown, but it was possibly E.G. Henderson (c. 1782–1876), a nurseryman of London, who first displayed *H.* 'Andersonii' in 1849 (Anon., 1850). If Henderson was the friend it is reasonable to assume that he could have named after himself, or had named in his honour, either the plant he received from Anderson-Henry or the F2 seedling that was raised. The year in which *Hebe* 'Hendersonii' was raised is not known, but the first references to it are in *Revue Horticole* by Naudin (1851) and Beauluère (1851). Seven years later it was being cultivated in America (Anon., 1858).

An examination of nursery catalogues suggests that *Hebe* 'Hendersonii' was cultivated in New Zealand earlier than *H.* 'Andersonii'. For example, *H.* 'Hendersonii' is listed in the *David Hay, Montpellier Nursery* catalogues of 1861 and 1863, and as noted above *H.* 'Andersonii' is first referred to in 1865. However, the 1865 catalogue of *D. Hay and Son's Montpellier Nursery* listed *H.* 'Andersonii' but not *H.* 'Hendersonii'. No other references to *H.* 'Hendersonii' in New Zealand have been located, and it appears that the name did not become established in general use. Although D. Hay of Montpellier Nursery does not state from where he obtained his original stock of *H.* 'Hendersonii' it was possibly imported from Luther Burbank in California. Burbank and Hay are known to have corresponded (Nairn, 1932; Dreyer, 1985), and as leading nurserymen in their respective countries it is likely that they exchanged plants. Plants of *H.* 'Hendersonii' would have been available to Burbank, as it was cultivated in America by 1858 (Anon., 1858).

However, accepting that *Hebe* 'Hendersonii' is distinct and that it was introduced to New Zealand before *H.* 'Andersonii', the question arises as to why the name 'Hendersonii' did not become established in the horticultural trade. One possibility is that, owing to the extensive publicity *H.* 'Andersonii' had received in British and European gardening and horticultural literature, it was generally assumed that "Hendersonii" was an orthographic error for "Andersonii" (Metcalf, 1991). Perhaps for this reason the name "Andersonii" soon replaced "Hendersonii", even though the two cultivars were different plants. I too thought that "Hendersonii" was an orthographic error for "Andersonii" before I began this investigation.

The suggestion of an orthographic error has some support, as is evidenced by the putative parentage of *Hebe* 'Purple Queen'. This cultivar was raised by Veitch and Son's nursery, who give the parents as "*V. traversii* and *V.* 'Hendersonii'" (Veitch, 1906). However, the parentage of *H.* 'Purple Queen' has been given as "*V. traversii* and *V.* 'Andersonii'" by Anon. (1884) and the nursery catalogue of *Lemoine & Fils Horticulteurs Rue du Montet 130* (1895).

Evidence of the similarity between these cultivars is provided by Anon. (1858): "*Veronica hendersonii*, the same apparently as *V. andersonii*, and no improvement." However, the *Catalogue de graines Haage & Schmidt* (1883) lists *H.* 'Andersonii' and *H.* 'Hendersonii' to-

gether, which indicates that they were regarded as distinct by some horticulturists. The taxonomic position of *H.* 'Hendersonii' has varied, with Siebert and Voss (1895) listing it as a synonym of *H.* 'Andersonii' and Hill (1938) as a synonym of *H. speciosa*.

"*Veronica Hendersoni alba* (Lejeune)" is a cultivar name, without a description, that has an obvious connection to *H.* 'Hendersonii'. Only two references to this name have been located, in catalogues of the Belgian nurseryman Louis van Houtte. The two catalogues are number 167, p. 71 (1876–77) and number 187, p. 128 (1880–81). Because no description was provided by van Houtte, and no other references to this plant have been found, the name is primarily of historical significance. The use of "alba" could be a reference either to white flowers or to variegation of the leaves.

Research Methods

The methods used in this study include detailed morphological examination and two-dimensional paper chromatographic analysis (2D PC).

The 2D PC procedure used for the extraction of phenolic compounds follows Mabry et al. (1970), whereby the plant material is extracted with 70% ethanol, spotted on to Whatman 3MM paper, and run in TBA (3:1:1 tertiary butyl alcohol: glacial acetic acid: distilled water) for 20 hours and then in HOAc (15% acetic acid: 85% distilled water) for 4 hours. The resulting chromatogram is examined under UV light and UV light with ammonia vapour. In this study the phenolic compounds have not been identified, but each spot is characterised by its colour, intensity, and position on the chromatogram (Rf value). The usefulness of this method is that the spot pattern of F1 hybrids can often be the additive combination of the putative parents. In some hybrid plants certain compounds from either parent may be missing, or new 'hybrid' compounds may be formed (Alston et al., 1965).

Research Results - *Hebe* x*andersonii* 'Andersonii'

Morphological examination of *Hebe* x*andersonii* 'Andersonii' gives cause for doubt that *H. salicifolia* was a parent. The vegetative and floral morphology supports *H. stricta* var. *stricta* (rather than *H. salicifolia)* and *H. speciosa* as the putative parents. The most important diagnostic features are the presence of hairs on the adaxial and abaxial surfaces of the calyces and bracts, and on the stems of *H. stricta* var. *stricta* and *H.* 'Andersonii'. *Hebe salicifolia* and *H. speciosa* have glabrous stem, calyx, and bract surfaces, although occasionally young branchlets of *H. salicifolia* may have sparse bifarious pubescence. For *H.* 'Andersonii' the number and density of hairs is less than was present on the available specimens of *H. stricta* var. *stricta*.

Fig. 1. An 1848 specimen of *Veronica lindleyana* from the Kew herbarium, identified as *Hebe stricta* var. *stricta*.

Further confirmation that *Hebe stricta* var. *stricta* is one putative parent is provided by an 1848 specimen of *Veronica lindleyana* from the Royal Botanic Gardens, Kew (Fig. 1). This, the only extant specimen of *V. lindleyana* located in British herbaria, has been determined as *H. stricta* var. *stricta*.

The phenolic data (Fig. 2; Tables 1, 2) also support *Hebe stricta* var. *stricta* and *H. speciosa* as the putative parents. In *H.* 'Andersonii' all five *H. speciosa* spots (5, 7, 8, 9, and 10) are present, and six of the ten *H. stricta* var. *stricta* spots (1, 3, 11, 13, 14, and 15) are recorded. The presence of all the *H. speciosa* spots and of the *H. stricta* var. *stricta* marker spots 11, 13, 14, and 15 are particularly persuasive. Two new compounds (6 and 12) recorded in *H.* 'Andersonii' are not present in either of the putative parents.

Hebe salicifolia has six spots, of which three (1, 3, 8) occur in *H.* 'Andersonii'. Spots 1 and 3 are shared with *H. stricta* var. *stricta*, and the other is shared with *H. speciosa*. In total, *H. salicifolia* shares five of its six spots with *H. stricta* var. *stricta* and only one with *H. speciosa*. The *H. stricta* var. *stricta* marker spots are not present in *H. salicifolia*. This evidence is congruent with the morphological data that support *H. stricta* var. *stricta* and exclude *H. salicifolia* as one putative parent.

Research Results - *Hebe* x*andersonii* 'Hendersonii'

It is accepted here that *Hebe* 'Andersonii' and *H.* 'Hendersonii' are both cultivated in New Zealand. *Hebe* 'Andersonii' is the cultivar commonly available in Britain, and it is not known to what extent *H.* 'Hendersonii' is grown there. It is appropriate to first establish that *H.* 'Hendersonii' is different from *H.* 'Andersonii', and second, that the putative parents of both are *H. stricta* var. *stricta* and *H. speciosa*.

Hebe 'Hendersonii' and *H.* 'Andersonii' are similar cultivars that are difficult to tell apart except when they can be directly compared. Important diagnostic characters include *H.* 'Hendersonii' having pubescent branchlets, longer calyx lobes, an occasionally ciliolate style, light violet flower colour (RHS colour chart 86d, 87a,b), and the abaxial midrib pubescent, in contrast to *H.* 'Andersonii' with bifariously pubescent branchlets, shorter calyx lobes, a glabrous style, darker violet flower colour (88a,b,c), and the abaxial midrib glabrous.

Morphological analysis of *Hebe* 'Hendersonii' strongly supports *H. stricta* var. *stricta* but only weakly supports *H. speciosa* as the putative parents. The presence of hairs on the abaxial and adaxial surface of the calyx and bracts and on the style is strongly supportive of *H. stricta* var. *stricta*.

The phenolic analysis (Fig. 2; Tables 1,2) supports a close relationship between *Hebe* 'Hendersonii' and *H.* 'Andersonii', which share seven spots (1, 5, 6, 7, 9, 10, 12). Especially indicative are the hybrid spots 6 and 12, neither of which occurs in the putative parents. Of particular significance in *H.* 'Hendersonii' is that four (5, 7, 10, 12) of the five *H. speciosa* spots were recorded, but only one (1) of the ten *H. stricta* var. *stricta* spots. In contrast, *H.* 'Hendersonii' has strong morphological similarities to *H. stricta* var. *stricta* and less obvious similarities to *H. speciosa*.

Segregation of F2 hybrids to the morphological characteristics of one or the other parent has been documented for *Hebe* x*lewisii* 'Lewisii' (Metcalf 1987) and may have occurred with *H.* 'Hendersonii'. The presence of four *H. speciosa* phenolic spots and only one *H. stricta* var. *stricta* spot could be taken as evidence of segregation of the biochemical pathways towards *H. speciosa*, and likewise, the morphological characters are more similar to *H. stricta* var. *stricta*. *Hebe* 'Hendersonii' may therefore be an F2 hybrid between *H. stricta* var. *stricta* and *H. speciosa* which was raised from selfing *H.* x*andersonii*; specifically, it may be an F2 hybrid raised from the plant given to the "friend" by Anderson-Henry.

Table 1. Occurrence (+) of the phenolic compounds mapped in Fig. 2.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
salicifolia (CHR 465710)	+	+	+	+	–	–	–	+	–	–	–	–	–	–	–	–	–
speciosa (CHR 471150)	–	–	–	–	+	–	+	+	+	+	–	–	–	–	–	–	–
stricta var. *stricta* (CHR 470133)	+	+	+	+	–	–	–	–	–	–	+	–	+	+	+	+	+
'Andersonii' (CHR 471148)	+	–	+	–	+	+	+	+	+	+	+	+	+	+	+	–	–
'Hendersonii' (CHR 471141)	+	–	–	–	+	+	+	–	+	+	–	+	+	+	+	+	+

Table 2. Characteristics of phenolic compounds mapped in Fig. 2. Key: **d**ark; **l**ight; **f**luorescent; **P**urple; **Y**ellow; **G**reen; **B**lue

No.	UV	UV/NH_3	Rf TBA	RfHOAc
1	dP	dG	0.11	0.08
2	P	dG	0.28	0.09
4	P	fY	0.34	0.16
5	lP	lG	0.09	0.18
6	P	Y	0.13	0.31
7	lP	lG	0.28	0.41
8	P	P	0.13	0.77
9	P	P	0.44	0.45
10	lB	lB	0.34	0.61
11	lG	lG	0.44	0.24
12	lY	lY	0.43	0.11
13	G	G	0.53	0.13
14	P	P	0.61	0.16
15	lG	lG	0.61	0.24
16	dG	dG	0.74	0.04
17	dG	dG	0.81	0.02

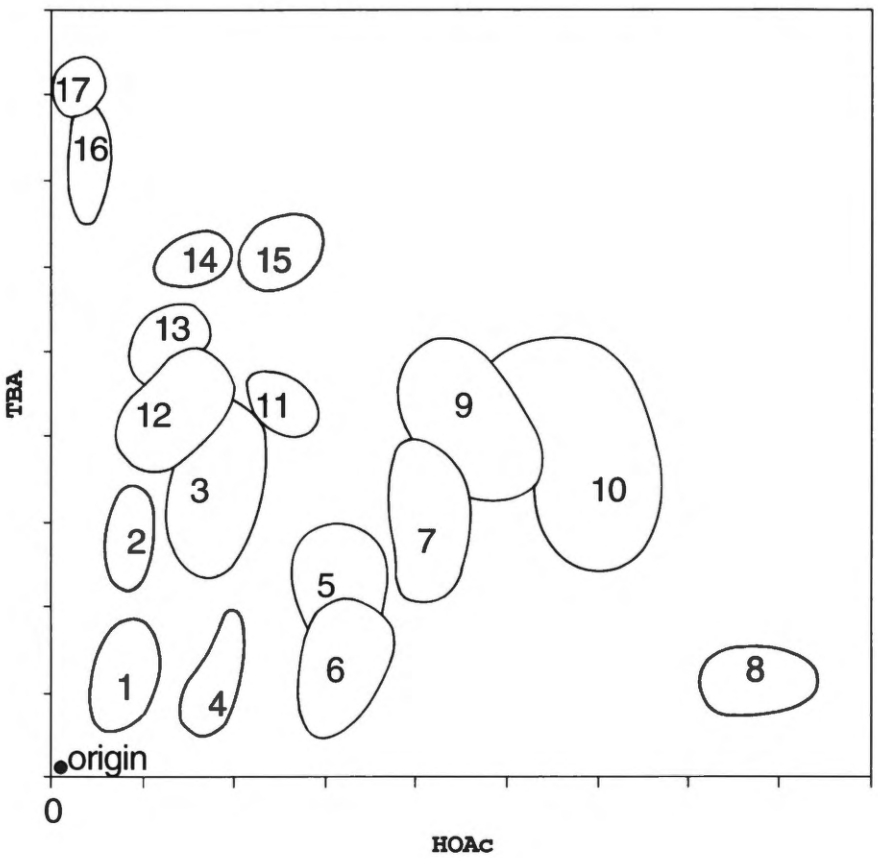

Fig. 2. Two-dimensional paper chromatogram of phenolic compounds observed in *Hebe* x*andersonii* 'Andersonii' and 'Hendersonii', and the putative parents *H. stricta* var. *stricta*, *H. speciosa*, and *H. salicifolia*.

Discussion

Given that *Hebe stricta* var. *stricta* and *H. speciosa* are now accepted as the putative parents of *Hebe* x*andersonii*, why was *H. salicifolia* regarded as one parent for over 140 years? Firstly, the taxonomy and nomenclatural history of *H. stricta* var. *stricta* and *H. salicifolia* are closely interwoven; this is why *H. lindleyana* was treated as a synonym of the latter species. *Veronica stricta* was described in 1846, but it was not accepted as a species by subsequent authors until it was transferred to *Hebe* by Moore (in Allan 1961). During the intervening years it was treated as first *Veronica* and then *Hebe salicifolia* var. *stricta* (Hooker 1853; Cockayne and Allan 1926). Therefore, for many years these two species were treated under the earlier name *H. salicifolia*. In Moore's treatment (in Allan 1961) *H. salicifolia* is accepted as being restricted to the South Island of New Zealand. The distribution of *H. stricta* var. *stricta* is in the North Island and the northernmost part of the South Island.

References in the literature to *Veronica* 'Hendersonii' allude to a selection of the herbaceous *V. subsessilis*, a true *Veronica*. The flower colour of this cultivar is described as "an intense purplish-blue" (Anon. 1878), "a rich deep purple" (Anon. 1881), or a "rich indigo-blue" (Anon. 1891). All references to "Hendersonii" before 1878 are associated with shrubby rather than herbaceous plants, and the first references to the herbaceous *V.* 'Hendersonii' appear 27 years after the earliest mention of plants referable to *Hebe* 'Hendersonii'.

In the Kew Herbarium there is an 1855 specimen labelled "*Veronica andersonii* Major". This is the only known specimen of this cultivar, and no published reference to this name has been located. The early collection date and the use of the name "*andersonii*" indicate that this plant may be another selection of *Hebe* x*andersonii*. It could be the specimen that Anderson-Henry sent to his "friend", or a synonym of *H.* 'Andersonii'. Detailed examination has resulted in *H.* 'Andersonii Major' being treated as *incertae sedis*. It can be separated from *H.* 'Hendersonii' by having a glabrous style and from *H.* 'Andersonii' by the presence of pubescence on the abaxial midrib of mature leaves. However, the small sample of leaves and flowers available for examination from the specimen of *H.* 'Andersonii Major may not provide reliable characters.

There is a reference to *Veronica* 'Variegata', which is described as having

coloured flower spikes and a parentage of *V. salicifolia* and *V. speciosa* (Anon. 1853). The description refers to a cultivar with a bicoloured inflorescence rather than variegated leaves. Indeed, it may refer to *H.* x*andersonii* 'Andersonii', as in the original description for that cultivar Lindley and Paxton (1851) make particular reference to the bicoloured inflorescence. Alternatively, but less likely, it could also be another cultivar that was raised from the original Anderson-Henry cross. Souster (1962) has suggested that it may have been *H.* 'Andersonii Variegata'. For lack of conclusive information this cultivar too is treated as *incertae sedis*.

Hebe x*andersonii* 'Andersonii' has given rise to two variegated sports, *H.* 'Andersonii Variegata' and *H.* 'Andersonii Aurea' (Souster 1962; Chalk 1988). These cultivars are sports from *H.* 'Andersonii' as they have identical flower colour, similar leaf size and shape, and hairs on the adaxial and abaxial surfaces of the calyx and bracts. The first authentic reference to a *Hebe* with variegated leaves is by Anon. (1857) for *Veronica* 'Andersonii Variegata'.

Nomenclature and Botanical Descriptions

Hebe stricta var. *stricta* and *H. speciosa* are accepted as the putative parents of *H.* x*andersonii*, and this hybrid combination is formally presented below, along with descriptions for the cultivars *H.* x*andersonii* 'Andersonii' and 'Hendersonii'. It is acceptable under Article 14 of the International Code of Nomenclature for Cultivated Plants (ICNCP) (Brickell *et al.*, 1980) to place *H.* 'Hendersonii' as a cultivar of *H.* x*andersonii*. *Hebe* 'Andersonii Variegata' is accepted as the name for the variegated selection of *H.* 'Andersonii'.

***Hebe* x*andersonii* (Lindl. et Paxton) Cockayne**, *Trans. & proc. Roy. Soc. New Zealand* 60: 468 (1929).

Basionym: *Veronica andersonii* Lindl. et Paxton, *Paxton's Fl. Gard.* 2: t. 38, 1851.

Lectotype: Illustration in *Paxton's Fl. Gard.* 2: t. 38, 1851.

Parentage: *Hebe stricta* (Benth.) L.B.Moore var. *stricta* x *Hebe speciosa* (A.Cunn.) Cockayne et Allan.

***Hebe* x*andersonii* 'Andersonii'**
(Lindley, J., and J. Paxton, *Paxton's Fl. Gard.* 2: t. 38, 1851).

Description: Branchlets bifariously pubescent, terete. Leaves 70–115 x 25–36 mm, oblanceolate to occasionally elliptic, subcoriaceous; apex acute; base attenuate; margins ciliolate; abaxial midrib pubescent; adaxial midrib glabrous when mature; leaf bud with sinus. Inflorescence a lateral raceme, 90–130 mm long, with 80–160 flowers; flowers dense and the rachis hidden. Bracts 1.75–2 mm long, ovate; adaxial and abaxial surfaces sparsely pubescent; margin ciliolate. Peduncle 18–32 mm long; rachis 72–98 mm long; pedicel 3.5–5.5 mm long; peduncle, pedicel, and rachis covered with eglandular hairs. Calyx c. 2 mm long, lanceolate; lobes free; abaxial and adaxial surfaces sparsely pubescent; apex acute; margins ciliolate. Corolla lobes bishop's violet (88a,b), spreading; tube white, c. 3.5 mm long, 2 mm diam., ± 2x calyx length; posterior lobe elliptic, c. 4 mm long; anterior lobes ovate to elliptic, 2.5–3 mm long; apices obtuse to subacute. Style glabrous, c. 10.5 mm long.

Representative specimen: CHR 471148, *P.B. Heenan*, October 1993, cultivated in a private garden, Christchurch, New Zealand.

***Hebe* x*andersonii* 'Andersonii Variegata'**
(Anonymous, 1857, *The illustrated bouquet*, fig. 4, no page number, as *V. Andersonii variegata*).

Description: As for *H.* 'Andersonii' except the leaves are margined with cream-white. The original description is "foliage finely variegated, nearly two thirds of the leaf being white".

Representative specimens: CHR 471142, *P.B. Heenan*, April 1993, cultivated Missouri Botanical Garden, St Louis, U.S.A., ex D. Chalk; CHR 471149, *P.B. Heenan*, October 1993, cultivated Christchurch Botanical Garden, Christchurch, New Zealand.

***Hebe* x*andersonii* 'Hendersonii'**
(Naudin, 1851, *Rev. Hort.* ser. 3, 5: 414–415, as *Veronica hendersonii*).

Horticultural synonym: *Hebe* 'Andersonii', in part.

Description: Branchlets pubescent, terete. Leaves 82–120 mm x 20–35 mm, elliptic to occasionally oblanceolate, subcoriaceous; apex acute; margins ciliolate; abaxial and adaxial midribs pubescent; leaf bud with sinus. Inflorescence a lateral raceme, 90–200 mm long, with 80-160 flowers; flowers sparse and the rachis visible. Bracts 2–3 mm long, lanceolate; margin ciliolate; adaxial and abaxial surfaces sparsely pubescent. Peduncle 30–40 mm long; pedicel 4 mm long; rachis 120–150 mm long; all with pubescence. Calyx c. 3 mm long, elliptic to ovate; lobes free; apex acute; adaxial and abaxial surfaces with sparse pubescence; margins ciliolate. Corolla amethyst violet (86d, 87a,b); posterior lobe 5 mm long; anterior lobes 3.5 mm long; all lobes elliptic to lanceolate; apices acute to subacute; tube calyx, narrow, c. 1.5 mm wide, c. 2.5 mm long. Style c. 10.5 mm long, occ. ciliate.

Representative specimens: CHR 471141, *P.B. Heenan*, May 1992, cultivated Christchurch Botanical Gardens, Christchurch, New Zealand. AK 8470, *T.F. Cheeseman*, undated, cultivated Auckland; AK 8469, *T.F. Cheeseman*, undated, cultivated.

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Plant Raisers' Award, 1993

New Zealand is recognised as one of the leading countries in the orchid breeding world, and is particularly noted for the breeding of cymbidiums. New Zealand's high standing is in very large part due to the success of Mr Andrew Easton of Geyserland Orchids, Rotorua, who is acknowledged as this country's foremost cymbidium breeder. Although part of Mr Easton's career was spent in the United States, he has been a commercial orchid grower in New Zealand for more than ten years. During that time he has become a prominent and respected grower, and he has served on many industry and horticultural committees, including a term as President of the Orchid Council of New Zealand. More important, he has earned an outstanding reputation for his success in orchid breeding.

Mr Easton is a cymbidium breeder of international standing, and he has had a major influence on the orchid cultivars grown today around the world. His breeding and improvement programme has been described as the "only true breeding of cymbidiums in the world". His programme is especially important for extending the flowering season to almost the whole year. Most Geyserland orchids are colchicine-treated, and this greatly increases the potential for improvement. In developing new cymbidium cultivars probably equal credit is due to the person who makes a particular cross and to the person who actually selects an individual cultivar from the millions of progeny produced. Mr Easton has excelled as one of the best cross-makers in the world; he makes about 300 crosses each year, and his influence has been spread by the cultivars selected by others from his crosses. However, he has also made a number of brilliant selections, of which we cite some outstanding successes:

- *Cymbidium* Dame Katherine 'Spring Day', NZOS HCC, 1987
- *Cymbidium* Jack Hadlow 'Waikanae', NZOS AM, 1989
- *Cymbidium* One Tree Hill 'Geyserland', NZOS HCC, 1989
- *Cymbidium* Runaway 'Pink Cloud', Bronze Medal, Cymbidium Society of America, 1989
- *Cymbidium* Wild Colonial Boy 'Wolfgang', Bronze Medal, Cymbidium Society of America, 1989
- *Cymbidium* 'Gladys Whitesell', winner of the only Gold Medal at the 1990 World Orchid Conference
- *Cymbidium* 'Rod Stewart' x 'Hazel Tyers'. 'Egmont Snow', Best Seedling and winner of a Silver Medal, 13th World Orchid Conference
- *Odontocidium* Tiger Mac 'Geyserland', Orchid Council AOM, 1988
- *Paphipedilum micranthum* 'Geyserland', NZOS AM, 1987.

Amongst his other awards, Mr Easton also has a Silver Banksian Medal from the Royal Horticultural Society.

The real success of any plant breeder, however, is to have his plants grown. Mr Easton's plants are grown around the world: it has been estimated, for example, that 50–70% of the commercial cymbidiums grown in The Netherlands have their origin in Geyserland Orchids, Rotorua. Mr Easton has done much to raise the standing of New Zealand horticulture throughout the world. He is a most worthy recipient of the Institute's Plant Raisers' Award, which this year is awarded for two particularly important and successful plants:

- *Cymbidium* 'Tracey Reddaway' – the finest yellow cymbidium yet produced
- *Odontoglossum* 'Geyser Gold' – a sensational new, pure yellow *Odontoglossum*.

Royal New Zealand Institute of Horticulture Citations for the Award of Associate of Honour AHRIH (N.Z.) 1993

DAVID R. GIVEN

BSc (HONS), PHD, CTHEOL, FLS, AFIAP

Dr David Given was born in Nelson and spent his youth there and in Hamilton, Australia. He was educated at Nelson College and Canterbury University, where he gained the degrees of BSc (Hons) and PhD. He is a Fellow of the Linnean Society, and he also holds a certificate in theology.

Dr Given joined the Botany Division of DSIR in 1965, and has subsequently become New Zealand's leading authority on our rare and endangered native plant species. He has personally studied species and habitat conservation at many locations. As a research scientist he has specialised in conservation botany and management, field ecology, biogeography, geothermal ecology and conservation, arctic-alpine biota and their conservation, and conservation ethics. His field work has been carried out in New Zealand itself, and in the Chatham Islands, the Subantarctic Islands, and Antarctica.

His research work has been published in an impressive list of scientific publications. He has also published widely on the preservation of threatened species and on habitat management. Some notable works on the conservation of plants include:

- *Rare and endangered plants of New Zealand*, 1981
- *Red data book on threatened species in New Zealand*, 1981 (co-author)
- *Conservation of Chatham Island Vegetation and Flora*, 1985
- *Guide to threatened plants of New Zealand*, 1989 (co-author)
- *Principles and practice of plant conservation*. This is a comprehensive work published for IUCN/WWF International covering all aspects including law, economics, ethics, reserves, and gene banks.

Dr Given's research and his reputation have resulted in his travelling widely overseas, and he has been invited to speak at many international conferences:

- Biological aspects of rare plant conservation (Cambridge, U.K.), 1980;
- Workshop on the conservation of plant genetic resources (New Delhi, India), 1982;
- Botanic gardens and the World Conservation Strategy (Canary Islands), 1985;
- Botanical management and human impacts on Galapagos Islands (Galapagos Islands), 1987;
- Conserving diversity into the 21st Century – Keynote speaker (St Louis, U.S.A.), 1988;
- Conservation of Pacific floras, Pacific Science Intercongress (Vina del Mar, Chile), 1989;
- Protective custody: the role of the botanic gardens in conservation (Canberra, Australia), 1991.

Dr Given has participated fully in the activities of many national and internal organisations devoted to conservation. In 1981 and 1988 he was a member of the New Zealand delegation to the IUCN General Assembly. In 1986 and 1988 he was an observer at Plant Advisory Group meetings of IUCN/WWF. He was on the North Canterbury National Parks and Reserves Board from 1882 and is now a member of the North Canterbury Conservation Board. He is also on the Steering Committee of the IUCN Species Survival Commission and is a regional representative, Chairman of the IUCN/SSC Specialist group on Pteridophyta Conservation, a member of an IUCN task force on Ethics, Culture and Biodiversity Conservation, and a regional member of the Pacific Sciences Association Standing Committee for Botany. He has served on a number of working groups concerned with plant conservation, including a Royal Society of New Zealand Committee for plant genetic resources, Antarctic policy workshops, and a Royal New Zealand Institute of Horticulture group to establish a national garden collection system. In 1988 he participated in a hui on Maori traditional plant uses and ethnobotany.

Dr Given has been an advocate for conservation through lectures and talks to both botanical and non-botanical groups throughout New Zealand and overseas. His work has included radio and television participation, and assistance with television production and the National Parks centennial film The Gift. He was recently awarded the qualification AFIAP (Artiste de la Fédération Internationale de l'Arte Photographique) for his nature (chiefly plant) photographs, which have appeared in many publications.

One in every ten New Zealand native plants can be described as being at risk. Dr David Given has devoted his scientific career to helping portect those plants at risk, our rare and endangered plants. He has rendered distinguished service to horticulture and plant conservation both in New Zealand and internationally. He is a most worthy Associate of Honour of the Institute.

ALAN DEAN JELLYMAN

NDH(NZ), FNZIPRA, FRIH(NZ)

Alan Jellyman commenced his employment in horticulture as an apprentice with Duncan and Davies Ltd Nursery in New Plymouth in 1957. During his time with Duncan and Davies he completed his National Diploma of Horticulture (RNZIH). He was a good student and was awarded several prizes – the J. A. Campbell Award, the David Tannock Prize, and the Cockayne Gold Medal.

In 1962, after concluding his apprenticeship, he transferred to the New Plymouth City Council as Assistant Superintendent of Parks and Reserves, and has spent the rest of his professional life in New Plymouth. In 1966 he was appointed Deputy Director of Parks and Recreation, in 1977 Director of Parks and Recreation, and in 1989, after the reorganisation of local government, he was appointed Community Services Manager for the new New Plymouth District Council. During this period of more than thirty years Mr Jellyman has contributed greatly to the development of New Plymouth's parks and reserves and to horticulture throughout Taranaki. He has overseen the development of a series of parks, the finest of which is Pukekura Park, noted as one of the country's finest horticultural gardens.

In his work with the Council, Mr Jellyman's responsibilities have included parks planning and development, recreation planning and development, afforestation management, botanical records and conservation, and foreshore protection. This work was assisted by his being awarded a British Council Bursary to study British parks in 1966, and as his responsibilities have increased he has undertaken formal management training.

Mr Jellyman has also taken on many other horticultural responsibilities: he is a Life Member and a member of the Board and Executive of the Pukeiti Rhododendron Trust since 1964; he is Horticultural Advisor to the QEII National Trust for Hollard's Gardens and Tupare; he is a member of the Technical Advisory Committee, Eastwoodhill Arboretum Trust; he is Chairman of the Advisory Committee, Hackfalls Arboretum; and he is a member of the International Dendrology Society. Mr Jellyman has also taken on local duties; for example, he was a member of the Board of Governors of New Plymouth Boys' High School from 1983 to 1989.

Mr Jellyman has made a particularly important contribution to the New Zealand Institute of Park and Recreation Administration. He has been the Taranaki / Wanganui Branch representative on the National Executive since 1974, and has been Chairman of the Executive since 1987. He was also editor of the Parks and Recreation Journal for five years. He has been active in promoting the professional profile of the Institute of Parks and Recreation Administration, and is a strong advocate of the importance of training and education, especially at the Branch level. His contributions to the Institute and to horticulture in general was recognised by his being elected a Fellow of the New Zealand Institute of Park and Recreation Administration in 1975, and of the Royal New Zealand Institute of Horticulture in 1988.

Taranaki is renowned throughout New Zealand for the excellence of its parks and gardens. This excellence is due in no small part to the sustained efforts of Alan Dean Jellyman; he is a most worthy Associate of Honour of the Institute.

KENNETH WALTER KIDDLE
CMG, MSc, FNZSHS

Ken Kiddle spent his youth in the Hutt Valley, and was educated at Victoria University College, Wellington, gaining an MSc in chemistry in 1945. This early scientific training has been of great benefit to him in his role in advising on the ways in which scientific research can assist the fruitgrowing industries. His interest in science was undoubtedly further encouraged by his marriage to Marion Marwick, a lecturer in zoology at Canterbury University College, Christchurch.

Mr Kiddle worked for more than ten years as an industrial chemist, but he eventually decided that he wanted to do something for himself, and to work in an environment where *he* made the decisions. In this he was encouraged by his wife, and in 1956 they toured the country seeking a suitable block of land with fruit trees on it.

After looking at all the growing districts they settled on Hawkes Bay and bought a small orchard on the Waimarama Road out of Havelock North. This initial block was only about five hectares, and only four hectares could be used for orcharding. Life was tough, and to make up the drastic fall in income he took on a whole variety of jobs, working in a bakehouse, building a garage for a racehorse owner, and even sorting over heaps of rotten potatoes for Watties. Now he and his wife, in partnership with some of their children, control some 30 hectares of orchard.

The orchard may originally have been only small, but Mr Kiddle soon proved that he was certainly an innovative and progressive orchardist. He was amongst the first growers to plant 'Gala', one of the most profitable of our apple cultivars. He was also quick to take up the pioneering work of the late Don McKenzie, and in 1960 he planted the first centre-leader semi-intensive apple orchard in the country.

Subsequently he was one of the first growers to experiment with other new cultivars such as 'Royal Gala', 'Spartan', 'Splendour', and 'Red Fuji'. He is a good grower who believes that "a grower still needs to know and almost talk to his or her trees." The "her" in that last quote indirectly demonstrates his recognition of the most important role his wife has played in the management of their orchard.

Almost from the beginning, Mr Kiddle wanted to be involved in determining the direction that the apple industry took. About 1959 he was elected a member of the Executive of the Hawkes Bay Fruitgrowers' Association. In 1966 he was elected a grower member of the New Zealand Apple and Pear Marketing Board, and he was to retain his position on the Board for the next twenty years, retiring after eight years as Deputy Chairman and more than ten years as Chairman.

Mr Kiddle was a good Chairman, and was lucky in his Board and their staff, who managed to achieve remarkable success in a world market oversupplied with apples. Of course, this success did not come easily. Mr Kiddle is a strong advocate of free enterprise without governmental intervention, and the activities of the Apple and Pear Marketing Board have proved the value of disciplined marketing of high-quality produce under the consensus control of the fruitgrowers themselves. Mr Kiddle has always been interested in economic research, and has continually stressed the practical value of studying market trends.

The Apple and Pear Marketing Board has a well deserved reputation for responding rapidly to market signals and relaying this information on to growers. This reputation is in large part due to the efforts of Mr Kiddle, who encouraged both the introduction of new and improved apple cultivars and the removal of cultivars which no longer fetched good prices on the market. This has certainly been worthwhile: about fifteen years ago there were serious doubts as to the future of the apple industry in New Zealand. The Apple and Pear Marketing Board was determined, however, that the industry was going to be successful, and in Mr Kiddle's own words: "An important part of the philosophy adopted was that to compete successfully internationally meant going into new varieties that had good shelf life and flavour characteristics. And that's now really paying off with varieties such as 'Braeburn', 'Gala', and 'Royal Gala'."

The Apple and Pear Marketing Board has made many other advances during the time that Mr Kiddle was a member. There was the establishment of the processing branch with its products such as Just Juice; there was the breaking away of the Board from the Conference Lines for shipping; there was the funding of the capital expansion of the industry, and there was the truly remarkable expansion in production. These achievements were not, of course, due solely to the efforts of Mr Kiddle, but there is no doubt that under his leadership the Apple and Pear Marketing Board has become the envy of fruitgrowers around the world. Mr Kiddle was involved with many other organisations, including the New Zealand Export Shipping Council, the Trade Promotion Board, the Joint Producer Boards Committee, and the New Zealand Agricultural and Horticultural Consultants Registration Board. He has also spent some twenty years in hockey administration.

Mr Kiddle has been a strong supporter of scientific research, and has played a most important role on the Fruit Research Committee for fourteen years. He has fostered close co-operation between the Apple and Pear Marketing Board and research organisations and this co-operation continues today. Horticultural scientists in New Zealand are indeed fortunate in receiving such financial support from the industries they serve.

Mr Kiddle's many responsibilities and service have been recognised by his being elected a Life Member of the Hawkes Bay Fruitgrowers' Association and a Fellow of the New Zealand Society for Horticultural Science, and appointed CMG in the 1982 Queen's Birthday Honours.

The pipfruit industry is one of our two important horticultural export industries. Its success today is in large part due to the efforts of Kenneth Walter Kiddle, a progressive orchardist, a clear-thinking scientific adviser, and a distinguished leader of the apple industry, a man of great resourcefulness and integrity, a man who has served his fellow growers and New Zealand. He is a most worthy Associate of Honour of the Institute.

Native Plants and National Identity in New Zealand Gardening: an Historical Review

Helen M. Leach

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In their contribution on the subject of New Zealand gardens, published in the *Oxford Companion to Gardens* (1986), Barbara Matthews and Michael Lancaster concluded that

> "... the increased interest in gardens and gardening, coupled with a growing awareness of the unique qualities of native as well as imported plants, is leading slowly towards the realization of a truly New Zealand garden." (Jellicoe *et al.*, 1986: 399)

It is noteworthy that the authors responsible for this, and for the national garden review articles on Canada and Australia in the same volume (Jellicoe *et al.*: 28, 91), believed that these countries had not yet achieved national identity in their gardens. At the same time none explained what they meant by a 'truly national', 'appropriate' or 'indigenous' garden style.

An initial examination of this complex issue suggests that it should be broken down into a series of related questions:

- What makes a type of garden distinctive of a particular nation?
- Is there a distinctively New Zealand type of garden?
- Is it obvious only to outsiders coming to this country from abroad, or to New Zealanders who go overseas and realise that foreign gardens look somehow different?
- Is it marked by the extensive use of indigenous and endemic species?
- Can it emerge as the culmination of conscious acts of planned garden making (as in the case of an indigenous school of landscape design), or is it only apparent in the mass of unplanned gardens which are subject to a continuous process of piecemeal alteration as horticultural fashions change? In other words, if there is a distinctively New Zealand garden style, will we find it in the average suburb as a subconscious manifestation (underlying the coloured flax, golden conifer, and red photinia), or will it be the sort of garden that is featured in the media?

Recent comments made on a popular television programme referred to one New Zealand garden as the 'Sissinghurst of the South', and to another as 'a little bit of Europe on the edge of the Kaikouras'. A famous North Island garden was described as 'the quintessential New Zealand garden', although its creator was in the same programme called 'the Gertrude Jekyll of New Zealand'. Such comparisons suggest that the script writers and presenters saw foreign inspiration as the driving force behind even the best New Zealand gardens. If the same questions are applied to other design fields that are influenced by fashion, such as clothing, interior decoration, and architecture, most would agree with the script writers : New Zealanders are strongly influenced by overseas, cosmopolitan trends, to the extent that no-one would argue seriously that we wear distinctively New Zealand clothes, have distinctively New Zealand furniture or décor, or build distinctively New Zealand houses. If this powerful external inspiration dominates New Zealand horticulture to the same extent, a close examination of what would constitute national identity in our gardening may well conclude that it has not yet appeared.

However, there are several areas of New Zealand culture that do exhibit a form of national identity: eating patterns diverged from those of Britain by the 1930s (Leach, in press), and spoken English is now quite distinctive (Gordon and Deverson, 1985). In neither case was the trend seen as desirable by the élite members of New Zealand society who strove to preserve the old meal rituals and the received English pronunciation. In fact, the speech patterns which distinguish New Zealand speech today evolved in middle and working class New Zealand. Perhaps that is where a distinctive form of New Zealand garden might be identified? Such identity would derive from repeated combinations of particular plants sold at budget prices and in large numbers from national garden centre chains. Like the speech patterns, it would be obvious only to an outsider. But lacking any conscious design component, or qualities of 'plantsmanship', such a national style of gardening would hardly become a source of national pride, or be likely to be copied by overseas gardeners as 'the New Zealand style'.

As cited above, Matthews and Lancaster hinted that recognition of the special qualities of native plants, in association with exotics, would play an important role in bringing to fruition 'a truly New Zealand garden'. This theme, the role of native plants in national identity, has a long history. In his book *A Destiny Apart: New Zealand's Search for National Identity*, the late Keith Sinclair described deliberate but premature attempts at expressing national consciousness in the 1890s, with the formation of largely Pakeha groups called New Zealand Natives Associations (Sinclair, 1986: 31–45). Their adoption of symbols such as the silver fern, and their interest in native flora and fauna (which extended into Maori antiquities and early attempts at scenery conservation) suggest that one hundred years ago indigenous elements were already seen as some sort of key to national identity.

From this period on, it might be expected that the expression of a national identity in New Zealand gardening would be linked to the use of endemic and indigenous flora, though not associated in a simple quantitative way. It is not a case of measuring distinctiveness by the proportion of native plants in a garden, since some gardens in the Scilly Isles, for example, have more New Zealand species in them than many New Zealand gardens. Gardens are more than the plants they contain. To plant content, an examination of structure and technique should ideally be added, if the issue of national identity in gardens is to be examined in any depth. This paper will concentrate, however, on native plant content, in particular on the changing reasons for its inclusion in New Zealand gardens.

Maori Gardening

Starting with the first horticultural tradition, that reached this country nearly a thousand years ago, it is known that five tropical cultigens used for food were introduced and survived to be recorded in the late 18th and early 19th centuries: the kumara, yam, taro, gourd, and the tropical cabbage tree. One plant was introduced as a source of clothing material, the paper mulberry, but could not produce anything like the quantity of bark needed. The tiny bark cloth rolls became precious ornaments, worn in the ears.

These exotic plants dominated Maori

gardens, almost exclusively. The gardens themselves followed tropical Polynesian patterns, despite centuries of isolation (Leach, 1984). Yams and kumara were grown on small mounds called *puke*, as they were in East Polynesia. The water-loving taro was planted in basin-like hollows with sand mulches. Dry grass mulching of taro was more common in Hawaii, while the Easter Island gardeners conserved water with stone mulches. But the principle of mulching remained the same. As elsewhere in East Polynesia, Maori garden plots were laid out as long rectangular strips, with their edges marked with stone rows, or alignments of single boulders, or sometimes with boundary trenches. The *tapu* nature of gardens during the growing season required the marking of paths wherever they ran in the vicinity. Stone edgings for such paths were in use throughout Polynesia. The crops were set out with great precision, using cords and pegs to achieve exact spacing of the mounds; a commonly encountered pattern was that of the quincunx, like the five side of a dice.

The degree of precision of layout was probably more than might be judged necessary for purely economic reasons. An aesthetic element was also present in Maori gardening, judging from some early comments by explorers and missionaries. On Cook's first voyage, the surgeon Monkhouse spoke of some houses at Anaura Bay "ornamented with gourd plants in flower" (Beaglehole, 1968: 583–4). While the 18th century Tongans surrounded their houses with "trees and Shrubs of Ornament whose fragrancy perfume the very air in which they breathe" (Beaglehole, 1969: 265), some 19th century North Island Maori described by William Colenso (1868a: 375) "often planted the red parrot's bill acacia [kaka beak]... and the ornamental variety of striped-leaved flax about their houses, on account of their beauty." One other indigenous species was taken into cultivation by the Maori, the karaka tree (Colenso, 1868b: 242fn.), whose natural range seems to have been extended into the interior of the North Island. As the evidence stands, the Maori introduced more exotic plant species than the native plant species they brought into cultivation. At the level of plant varieties, however, they may have cultivated a larger number of flax cultivars, originally retrieved from the wild.

Overall, the content of Maori gardens over many centuries of occupation was primarily introduced, and the structure of their gardens was still recognisably Polynesian. They had, however, found it necessary to make some changes in planting and storage techniques commensurate with a shift from all-year-round to seasonal cultivation. Despite this adherence to the tropical Polynesian horticultural tradition, a Rarotongan or Tahitian visitor would probably have regarded the prehistoric Maori gardens as rather impoverished, noting the lack of irrigated pondfields and the major change in cultigen dominance caused by the loss of virtually all the tree crops.

European Gardening Tradition

If indigenous New Zealanders concentrated for some 800 years on the cultivation of exotics, it should not be a surprise that the second wave of migrants have followed the same trend. Plants that have been an integral part of a gardening tradition for hundreds or thousands of years are not readily replaced, especially if they have acquired symbolic values deeply embedded in the parent culture.

What was the attitude of the European immigrants to the New Zealand native flora? The first recorded settlers' gardens were those of the missionaries, started in 1815. Putting the re-establishment of their English culture as equal in priority with the cultivation of the natives' souls, there was apparently no time for experiments with native flora. But these were already underway in Britain and Ireland, following the return of seed collected on the Cook voyages by Banks and Solander (Nelson, 1989: 6). Two missionaries with an interest in botany and horticulture, Richard Davis and William Colenso, were later involved in the export of native plants, but the bulk of the plants which reached Britain before 1850 seem to have been collected by professionals or officials with economic potential as a foremost motive. The New Zealand settlers shared the same objective, but instead of exporting native species they imported exotic plants to test their productivity under local conditions.

The well known Hutt Valley landowner Alfred Ludlam saw native species as useful to the establishment of exotic trees. He wrote in 1868 that

> "In forming my garden, I planted the places I intended for groups of trees and shrubberies thickly with native shrubs, which in two years afforded ample shelter for the protection of young plants. As I obtained different varieties of plants I cut away the insides of these plantations, and planted them in the place of the native shrubs ..." (Ludlam, 1868: 285–6).

In his extensive listing of 'plants of a more ornamental ... and durable character" (p. 285) than the settlers' favourites (blue gums, poplars, and willows), he included only two natives: the kauri, which he described as "more curious than beautiful" (p. 288), and the nikau.

Ludlam's contemporary Thomas Mason felled giant totara forest at Taita so that his "cattle could graze and crops [be] sown" (Shepherd, 1991: 34). Once established as a successful farmer, he developed his homestead block with an extraordinary collection of introduced trees: conifers and other imported trees, both fruit and ornamental, obtained from Australia and Britain. None of the survivors have yet reached the size of the original totara (though they are on the Register of Notable Trees). In the list of species growing in his garden in 1896, native species would probably make up less then 5% (Mason, 1896).

By the 1870s there was a widespread belief that native trees were unsuitable for plantations for timber purposes. Crawford explained this as follows :

> "Accustomed to grow naturally in close proximity, thus sheltering each other, they seem unable to stand the greater exposure to air and light when planted by man ..." (Crawford, 1876: 205)

Josiah Firth (1874: 187) had noted the same problem, though he commented that if shade and moisture were artificially provided when the seedlings were transplanted into the open, native trees would be more successful. But he concluded prophetically

> "After long and careful consideration I am convinced that our efforts in the direction of forest creation must be mainly directed to raise forests from the two great orders of the *Eucalypti* and *Coniferae*." (Firth, 1874: 189)

Dr Purchas of Auckland took a more 'evolutionary' attitude to the subject of native trees. He is reported to have said in 1874 that:

> "Some of the New Zealand trees might be preserved, but many of them could not resist the advances of civilization, and, like the native birds, would in time almost entirely vanish. It was a natural result, and they must not bemoan it, but rather make preparations for filling their place with trees that would live and bear cultivation." (*Proceedings of the New Zealand Institute* 7: 519)

Similar sentiments were expressed about the future of the native New Zealanders!

With this attitude prevalent among the educated élite, it is not surprising that other elements of the native flora were largely neglected by New Zealand gardeners. Of course there were exceptions, but most of these people were professionally involved in horticulture. For example John Armstrong and his son Joseph built up an outstanding collection of native species at the Christchurch Botanic Gardens, and exhibited natives at the Canterbury Horticultural Society shows in the late 1860s (Challenger, 1989: 56; Metcalf, 1993: 245). H. Hart and Henry Darton assembled collections of native shrubs at Weatherstones, near Lawrence (Metcalf, 1993: 246). Henry Matthews (before his appointment as the first State Forester

in 1896) had expanded the native holdings of his father's Hawthorn Hills Nursery in Dunedin, through collecting trips to the West Otago mountains with Johnnie McIntyre, the nursery foreman. One of their late 19th century catalogues held in the Otago Early Settlers' Museum archives included

> "21 named species of celmisia, 15 species of olearia, 14 of senecio, 50 of veronica, 100 named ferns, and 100 other New Zealand trees, shrubs and herbs." (Gow, 1986–87: 86)

But it was clear from the accompanying instructions that this catalogue was addressed at potential overseas customers as much as for the local market.

Photographs of late 19th century gardens show that cabbage trees and flax were common components, but a case may be made that they were valued not as natives, but because they looked exotic. Palms were highly fashionable for both indoor and outdoor decoration in late Victorian and Edwardian Britain, Australia, and New Zealand. J. Lockhart's *An Easy Guide to New Zealand Gardening*, published about 1900 in Wanganui, described four types of exotic palm suitable for indoors and four for outdoors. With countries of origin of these introduced palms as far afield as North Africa, China, Japan, California, and Australia, it is possible that the local cabbage tree was viewed as a much cheaper alternative. In one of her Wanganui gardens Emily Marshall-White, the 'Suffolk Lady', used cabbage trees formally, with wisteria trained on ropes between them. She also added other native species to her garden, particularly ferns, provided they matched her criteria of beauty (Carman, 1990: 91). In 1907, when the fourth edition of Michael Murphy's best-selling *Gardening in New Zealand* appeared, cabbage trees, flaxes, and toetoe were singled out for giving a "sub-tropical effect", not for the significance of their origins (Murphy, 1907: 226).

At the same time there was a widening interest in New Zealand plants as 'collectibles', in much the same way as Maori artefacts were collected. Murphy commented

> "During the past decade the cultivation of New Zealand native plants has much increased in popularity." (Murphy, 1907: 222)

After printing a list of native species suitable for gardening, prepared by Leonard Cockayne, Murphy went on to say

> "Besides the above, there are many other New Zealand plants excellent for garden culture, and the amateur once attacked with the fever for growing our native plants, will not be contented until he has a full collection." (Murphy, 1907: 226)

That Murphy saw native plant species as largely specialist collector's items is evident from his lists of ornamental trees and shrubs and hardy herbaceous plants, which included only two natives: the kaka beak and the Chatham Island forget-me-not. Dwarf veronicas [hebes] were mentioned as possible edging plants, and certain pittosporums as rather unsatisfactory hedging shrubs (Murphy, 1907: 237, 241, 242).

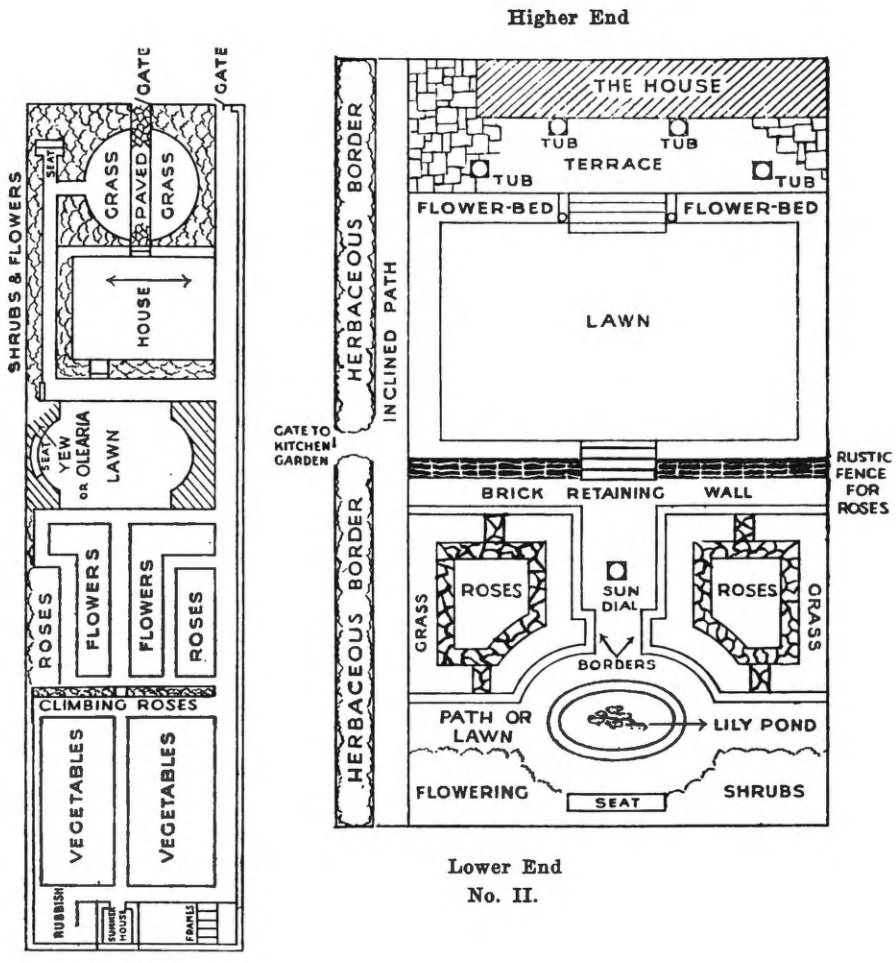
A.E. Lowe's *The Sun Gardening Book*, published in Christchurch in 1915 had no separate section on native plants and indeed mentioned only one, in terms that suggest that both he and his intended audience did not consider that indigenous plants really belonged in the New Zealand garden :

> "V. [*Veronica*] Lavaudina is a native habitant of the Port Hills, and is a very acceptable *guest* in the garden." (Lowe, 1915: 65) [emphasis mine]

David Tannock's *Manual of Gardening in New Zealand* (1914) was designed to replace Michael Murphy's *Manual*... and it achieved equal popularity. Tannock noted growing professional interest in the indigenous flora :

> "The popularity of native plants has increased greatly since the red manuka ... received the gold medal for the most meritorious new plant ... at Chelsea a

Fig. 1. This Duncan and Davies advertisement appeared at the beginning of Leonard Cockayne's 'The Cultivation of New Zealand Plants' (1923). It leaves little doubt that it was unusual or 'novelty' native cultivars that were becoming fashionable.



No. I.—This plan would be suitable for a long town section, and provides for both flowers and vegetables with suitable lawns. The path through the front lawn could be omitted. Climbing roses on a rustic fence could separate the vegetables from the flowers. A sweet pea fence or espalier fruit trees could be substituted for the roses. A hedge of Escallonia or Olearia Fosteri could form the boundary on one side.

No. II.—This plan would be suitable for a sloping site, the house occupying the higher position. A low rustic fence would separate the lawn with its surrounding flower borders from the rose garden, and on it climbing or rambler roses could be grown. The rose beds are surrounded by paved paths and there is really no need to have grass at all, if more roses are desired. The long path would be a suitable place for a pergola, which would provide a vista the whole length of the garden. This plan provides a good view of the garden from the house as well as a good view of the house from the garden.

Fig. 2. David Tannock provided two garden plans in his 1934 'Practical Gardening in New Zealand' (p. 2). Apart from the option of an *Olearia* hedge, as an alternative to yew in the left-hand plan, there is nothing to suggest that New Zealand gardens were diverging from those of Britain in terms of design or content.

few years ago. Horticulturalists are now devoting more attention to them, and native sections are becoming a prominent feature in all public gardens." (Tannock, 1914: 132)

Tannock had been in charge of the Dunedin Botanic Gardens since 1902 and was fortunate in obtaining Henry Matthews' native alpine collection after Matthews' death in 1909 (Gow, 1973: 108). Far from emphasising rareness or unusual qualities so important to a collector, Tannock seems to have appreciated native plants for their ornamental qualities. He singled out for special mention red beech, young rimu, ribbonwood, rata, kowhai, manuka, kaka beak, toetoe, and flaxes (Tannock, 1914: 132–7).

The second edition of Tannock's *Manual* came out in a series of New Zealand Practical Gardening Handbooks issued by Whitcombe and Tombs in the 1920s. One of the early books in the series was Leonard Cockayne's *The Cultivation of New Zealand Plants* (1923). As subsequent advertising explained,

"New Zealand has the unique distinction of being the first country whose flora has been made the sole theme of a practical gardening handbook. The author of this notable book is a most enthusiastic gardener, as well as a botanist of world-wide reputation." (Tannock, *ca*1924: back cover)

Unlike the books in the same series which dealt with flower and with vegetable gardening, Cockayne's classic appears not to have been reprinted. It was still available in 1934 from an original printing of 5000.

That some native cultivars were acquiring fashion status by the 1920s can be detected not from Cockayne's text but from an accompanying Duncan and Davies advertisement (Fig. 1):

"Among the novelties offered are – Double Flowered Pink Manuka, Variegated Karaka, Bronze Cabbage Tree, Bronze Rangiora, etc., etc." (Cockayne, 1923: vi)

Cockayne began his book by refuting the still-held belief in the difficulty of cultivating native plants. He then moved on to the real reason for the public's lack of interest :

"... our flower-gardening is, in large measure, an imitation of that of the Motherland, although here the capabilities for open-air horticulture are far wider, and plant after plant, not hardy in Great Britain, can be readily grown." (Cockayne, 1923: 8)

He then tried to turn the latter point into an argument for the cultivation of native plants :

"Thus our gardens should surely possess a peculiar stamp of their own, and a national horticulture come into being with not only a rich exotic garden flora, but one where New Zealand plants themselves would play no inconsiderable part." (Cockayne, 1923: 8)

Finally he based his plea on patriotism, declaring that native plants

"are part of ourselves...they are our very own! That innate patriotism which compels us to feel that our country stands high above all other lands, must also make us love its natural characteristics, so that in our gardens, of all the trees, or shrubs, or herbs, which we cherish, none can ever rank quite as high as those which slowly took their shape on New Zealand soil in the far-distant past." (Cockayne, 1923: 8)

The same theme of the right of native flora to a foremost place in our gardens was repeated in the final paragraphs of the book (Cockayne, 1923: 122–3).

Cockayne accepted that cabbage trees, flax, certain hebes, and a variety of native hedging species were widespread in New Zealand gardens, but believed that only public gardens and specialist growers did justice to the great variety of other natives. However, the slow growth of interest might actually be beneficial, he argued, "if their coming into horticulture is to be permanent and not a mere fashion" (Cockayne, 1923: 9). This was a pertinent comment in the light of the accompanying Duncan and Davies advertisement for novelties.

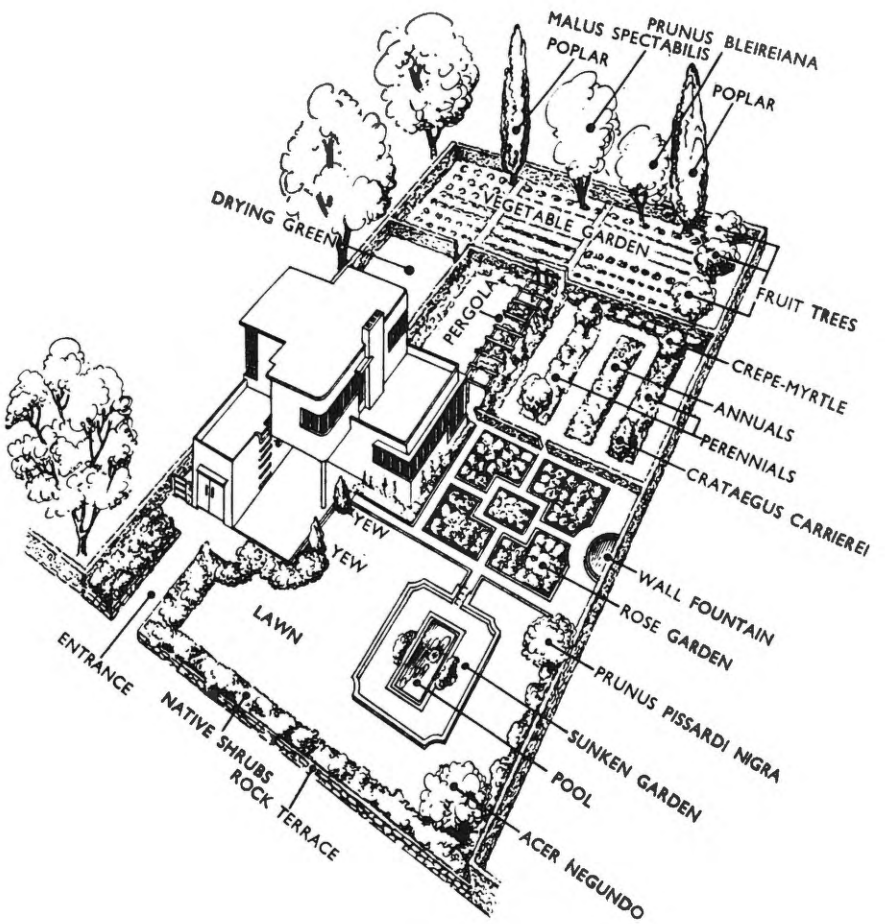
In the subsequent chapters of his book Cockayne tried to promote native shrubs as replacement for "the privets, escallonias, *Euonymus* and small conifers now planted *ad nauseam*" (p. 21). For steep banks he recommended shapely hebes and native ground-covers (p. 22). Native alpines were ideal additions to rockeries (p. 24), while natural ferneries could be established in the shade of larger trees instead of within the ugly artificial structures prevalent at that time (p. 104).

There is little evidence that Cockayne's recommendations were widely followed (e.g., Fig. 2), especially as New Zealand was soon to enter a period of depression followed by the Second World War. In economically difficult times, horticultural efforts often shift towards food production. However the connection between patriotism and the cultivation of native plants must have surfaced again during the War, judging from an article published in a 1946 issue of the newly founded *New Zealand Gardener* (see also Fig. 3). Entitled 'Some Colourful New Zealanders; Shrubs Noted for Gay Flowers or Foliage', it stated

> "Apart from the enthusiastic specialist, who collects every species and variety of the New Zealand flora, our native flowering plants receive but scant consideration from the average gardener. There are, of course, a number of good people who feel it a patriotic duty to have some representatives of the country's flora in their gardens, and usually manage to find space for a few kowhais or pohutukawas, or even flax bushes, and leave it at that.
>
> "There is no need to approach the growing of our native flora from a sense of duty; it should be judged on its merits and planted for its floral value. Our flora includes some of the most colourful and beautiful subjects in the whole plant kingdom, which arouse the greatest enthusiasm in overseas horticultural circles." ('M', 1946: 339)

The plants actually recommended in this article included coloured manukas, the hebes, kaka beak, purple rangiora, and bronze akeake, nearly all of them in the nursery novelty range; so we may surmise that 'M' had a strong nursery connection and that the article was designed to promote new lines.

The 1946 issues of the *New Zealand Gardener* contained a series of articles on specific native plants by W. B. Brockie, a specialist in this field who was in charge of the Otari Native Plant Museum. However, the overall post-War trend seems to have been to include a few popular natives within the general lists of ornamental shrubs or trees, as in the widely read book *Flower Gardening with the Journal of Agriculture* (Salinger *et al.* 1962 : 93, 96). When the American



Design for Garden

Fig. 3. J.A. McPherson provided this bird's-eye view of an ideal garden in his 1943 'Whitcombe's Complete New Zealand Gardener' (p. 2). Provision was made for a short (token?) section of native shrubs in the front border.

fashion for pebble gardens arrived, Salinger's book *The New Zealander's Guide to Pebble Gardens* (1971) explicitly stated that

> "New Zealand broadleaf natives ... have been included alphabetically with other shrubs, as apart from the fact that they are indigenous, there is no reason why they should be separated; many such as the hebes are most attractive foliage plants in their own right." (Salinger, 1971: 37–8)

In the light of New Zealand's preoccupation with South African racial issues throughout the 1970s, it is not unreasonable to read into these remarks an argument for assimilation of indigenous with introduced, and *against* a form of plant apartheid. Even the final comment that "many ... are most attractive ... in their own right" carries echoes of the frequently heard comment of the period "some of my best friends are Maori".

If pebble gardens were to be the location of assimilation, then the 1970 successor to Cockayne's book, Muriel Fisher's *Gardening with New Zealand Plants, Shrubs and Trees*, was to advocate what we would now describe as affirmative action, with a conservationist goal. Muriel Fisher (1970) criticised the nursery industry for not encouraging home gardeners to use native plants (p. 153), the apathy of most New Zealanders in the face of the destruction of native bush (p. 15), the land developers for bulldozing existing trees and topsoil to fill in gullies (p. 21), and surburban gardeners for their stereotyped attitudes to garden design (p. 148). Like Cockayne, she tried a direct appeal to New Zealanders' national consciousness:

> "I appeal to you – the gardener. For too long there has been nothing to encourage your interest in cultivating any of the native plants. Most dampening of all has been a lingering influence from the time of the early settlers, that anything native had no horticultural merit whatsoever - indeed it was just something that should be destroyed. There have been many prejudices in respect of planting anything native in one's garden. Another theory has been that they wouldn't grow in cultivation anyway. With few exceptions they will grow very well and, may I add, give

distinction to your garden." (Fisher *et al.*, 1970: 18–19)

Lawrie Metcalf's *The Cultivation of New Zealand Trees and Shrubs* first appeared in 1972, shortly after Muriel Fisher's book. Providing more detail on the plants themselves, it reinforced the message that the decline of native species in the wild should be matched by increased cultivation in gardens. Like Cockayne, Metcalf argued that:

"We should have our own brand of horticulture based, not as at present on ephemeral displays of annuals, but on trees and shrubs, and in which New Zealand plants should play a prominent part." (Metcalf, 1991: 6)

The companion volume *The Cultivation of New Zealand Plants* was finally published in 1993. Lawrie Metcalf (1993: 4) commented that "while more New Zealand plants are being grown, it is the trees and shrubs that are given the greatest prominence by nurseries", not the smaller species which are still largely neglected.

In this 70th year since publication of Cockayne's classic, Metcalf's views echo those of Cockayne and of all the other advocates of the cultivation of native plants who wrote in the intervening years: that there has been some growth in interest, but it has been slow. When measured over a century, it has been exceedingly slow! In fact this may be a function of changes in the prevailing reasons for an interest in growing native plants. Starting in the 19th century with natives for shelter, New Zealanders moved on to appreciate certain natives for their exotic appearance in the late Victorian and Edwardian eras. They then became interested in them as collectibles, which stimulated the search for rare varieties which in turn became nursery-grown novelties. Native plants as symbols of patriotism brought about a resurgence of interest at the time of the two world wars. Post-war interest was largely in their ornamental qualities, and this encouraged work on hybridisation. Some of the most striking selections, like *Pseudopanax lessonii* Gold Splash and *Phormium cookianum* Cream Delight (Metcalf, 1991: 251, 287), have received the same sort of media promotion as the latest exotics. But it is likely that the majority of purchasers are no more aware of (or interested in) the indigenous parentage of these plants than the English gardeners who buy European-raised hebe hybrids. The most recent motivation for interest has been stimulated by the conservation movement.

At this point, then, it seems that only a small number of New Zealand gardeners cultivate native plants as an expression of their national identity, though a growing number are doing so to express their solidarity with the conservation message. Though conservationism is now seen as a global movement, its expression in gardens may eventually produce a local distinctiveness in plant content, simply because New Zealand conservationists will give priority to New Zealand's endangered species.

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Does the Nursery Industry Provide the Products and Services that Customers Want?

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Do nursery people think like their customers? In a market-driven economy this is an important question. Nursery people are selling into the luxury end of the marketplace, and as a result need to understand their customers very well. In order to be competitive the products must meet consumers' requirements.

How well do nursery people understand their customers? How well might they answer the following questions?

- What size plant would customers prefer to purchase?
- How fast would customers like the plants they purchase to grow?
- How much plant maintenance and what type of maintenance is acceptable to customers?
- What foliage colour do customers consider the most preferable?
- How important are flowers as a plant feature?
- How important is pest and disease resistance when selecting a plant?
- How much are customers prepared to pay for a plant?

If nursery people could answer every one of these questions, for every one of their customers, then one could anticipate that in New Zealand's garden centres it would be easy to find whatever plant was desired. Unfortunately life is seldom that simple.

Buying a plant is a complex decision. Each plant is made up of a spectrum of attributes: size, growth rate, mature height, leaf colour, flowering qualities, resistance to pest and diseases, and price, to name but a few. If asked, most people would likely respond that a plant that is relatively large at time of purchase to provide instant impact, grows quickly to a mature size to fill in the gap, never needs much spraying or pruning, is covered in beautiful flowers for most of the year, and is given to them for nothing, constitutes the ideal plant. The problem is that this product is unlikely to exist, and even if it did exist the nursery person could not afford to give it away.

In reality, when we buy any product, plants included, we are likely to trade off certain features. An example of a trade-off might be to forego some size in order to pay a lower price. This is a simple example of a trade-off of two variables, but plants are multi-attribute products. The question now becomes, what is the relative importance of each of the attributes? Once this has been identified, how can such information be used by both producers and retailers to supply the types of products customers desire?

Using some relatively sophisticated marketing techniques it is possible to gather information that will aid nursery people to understand the product and service requirements of their customers.

An example of the marketing concept in action can be provided in the following conjoint analysis of preference for evergreen shrubs. At the 1992 NZNA July meeting held in Palmerston North a survey of the industry representatives present was conducted. The aim was to find out if the representatives thought like their customers. A comparison is made here with some data collected before, and presented at, that meeting.

The comparative data were collected from interviews with fifty residents of a middle-class suburban area of Palmerston North. Results from this group were similar to two previous studies of a Manawatu rural population and a small Taranaki rural district, but it should be remembered that populations from different socio-economic, ethnic, or geographical areas may have produced entirely different results. It is best to focus market research upon the market in question, and not rely on results gathered elsewhere.

Respondents were asked to rate on a scale of 0 to 10 eighteen hypothetical plant profiles. The reason for using the hypothetical profiles was to avoid any personal preferences had actual plants been used. The focus of the research was on seven plant features, each at three specified levels (Table 1).

If all these features at the various levels were combined, the result would give 2187 possible combinations. Using a computer modelling technique eighteen profiles were selected. Two sample profiles might read as follows.

- Plant 1: purchase size 0.4 m, average growth rate, low stature at maturity, yellow foliage, no flowers, high pest and disease resistance, $20.00.
- Plant 2: purchase size 0.8 m, fast growth, low stature at maturity, green foliage, flowers a major feature, high pest and disease resistance, $8.00.

The respondents then rated the profiles on a basis of 0 being that they intensely disliked the plant, to 10 a plant considered ideal in every way. The results were then statistically analysed. The same profiles and form of analysis were implemented for all four groups surveyed.

The results are expressed as:

- the relative importance of each plant feature;
- the utility (relative degree of positive or negative disposition) at each level;
- the distribution of first preferences for each of the levels.

The utility data for each level within a profile could be summed to give a 'total desirable' score. The value could then be compared with other profiles, the highest-scoring plants being the ones the group considered most desirable.

Two outstanding features (Table 2) in the Palmerston North results are the emphasis upon flowers as a feature of the plant and the importance of pest and disease resistance. These two factors made up sixty-six percent of the purchasing decision for this group. By comparison the nursery person group based only fifty-one percent of the purchase decision on these combined factors.

From the producer and retailer's perspective it is the next highest rating areas that provide greatest interest. The most important factors for this group

Table 1. Seven plant features at three levels.

Size at purchase:	0.2 m	0.4 m	0.8 m
Growth rate:	slow, seldom needs pruning	average, may need occasional pruning	fast, may need frequent pruning
Mature height:	low (groundcover)	medium (1+2 m)	tall (2 m plus)
Foliage colour:	yellow	green	purple/bronze
Flowers:	none	a minor feature	a major feature
Pest/disease resistance:	low	medium	high
Price:	$8.00	$14.00	$20.00

are leaf colour and price; to the consumer these rated considerably lower. From the targeted consumer groups it is evident that the emphasis of the retailers may be incorrect. While price will be a part of the decision-making process, it would appear that consumers tend to value other features more highly.

To understand fully what is going on it is necessary to analyse the data in a second manner. By using what is referred to as utility data, the relative importance of each attribute at each level can be examined. In this study an additive approach was adopted, where the sum of the utility data for each feature at a stated level would give an overall preference value. In this example the maximum value obtainable is 10 and the minimum value –10. For the consumer, the largest contributing factor to a plant's popularity are the flowers and pest and disease resistance. This is evident when one sees that flowers as a major feature contributes a 3.87 value and high pest and disease resistance 2.68 for the consumer group (Table 3).

For the plant profiles mentioned earlier, Plant 1 rated –1.44 for consumers and –4.61 for producers and retailers; Plant 2 rated 8.29 and 8.81 respectively. For both groups the second plant was most preferred; however, for the producer/retailer group this was boosted in popularity by the lower price. This may lead producers and retailers to believe that consumers were attracted by the lower price. In fact this had only a small bearing upon the consumer's decision.

It is possible to assign values to all 2187 plant profiles; however, this would be a tedious task. The data are presented to help producers and retailers focus upon the more important issues when selecting plant production and retailing strategies, and for the consumer to compare what their individual preferences might be in comparison with the targeted survey groups.

Before leaving Table 3 it is worth noting the distribution of preferred levels for price. In this analysis the percentage of respondents who rate each level highest is given. The producers and retailers exhibited a strong bias towards low price, far more than did the consumers, of whom 29 percent were prepared to pay the top price.

Table 2. The relative importance (%) of the seven plant features for the Palmerston North and nursery person samples.

	Palmerston North	Nursery persons
Size at purchase:	5.5	9.5
Growth rate:	6.6	2.6
Mature height:	11.2	5.0
Colour/shade of leaf:	2.9	16.3
Flowers as a feature:	36.1	23.6
Resistance to pests and disease:	30.2	27.5
Price:	7.5	15.5

Table 3. Utility data and distribution of preferred levels for seven plant features.

		Utility level		Distribution of preferred levels (%)	
		Palmerston North	Nursery persons	Palmerston North	Nursery persons
Size at purchase	– 0.2 m	0.13	–0.93	40	14
	– 0.4 m	–0.62	–0.03	14	20
	– 0.8 m	0.49	0.96	46	66
Growth rate	– slow	–0.74	0.33	30	46
	– average	0.13	–0.20	35	27
	– fast	0.60	–0.12	35	27
Mature height	– low	0.02	–0.38	23	19
	– medium	1.13	0.61	64	51
	– high	–1.15	–0.23	13	30
Leaf colour	– yellow	0.25	–1.80	23	10
	– green	–0.34	1.45	26	61
	– purple	0.09	0.36	51	29
Flowers	– none	–3.46	–2.02	6	3
	– minor	–0.41	–0.66	7	10
	– major	3.87	2.69	87	87
Pest/disease resistance	– low	–3.46	–3.07	5	0
	– medium	0.78	0.65	21	21
	– high	2.68	2.41	74	79
Price	– $8.00	0.97	1.56	55	72
	– $14.00	–0.53	0.01	16	26
	– $20.00	–0.44	–1.54	29	2

While there do exist some similarities between the two groups investigated here, there are also some differences in perceived attitudes towards various plant features. The producers and retailers still have to think more like their consumers if they are going to maximise their sales potential by meeting consumer's needs.

As has been stressed at points along the way, this is just one piece of research that illustrates that variation exists between two particular groups. Greater or less variation might occur if the research were undertaken elsewhere. With this in mind, are there any lessons to be learned? From a consumer's perspective, the study presented and the other two consumer studies have shown sufficient similarities to support the following suggestions.

(1) To consumers, the flowering qualities of a plant are extremely important. In the selection and development of new evergreen plant products more success in meeting consumer needs is likely to be achieved by focusing on plants with flowers as a major feature.

(2) In-store promotions would probably benefit from greater emphasis being placed upon flowering qualities, if present, than on price. This does not mean a brief description on a hard-to-read plant label, but rather a picture, exhibit, or larger display sign with description.

(3) Pest and disease resistance should be an area of focus for those developing new plant products.

(4) If pest and disease resistance are already a part of the products' attributes, then these should be promoted actively. Clear signs and labels will help in communicating this message to consumers.

(5) Consumers should not all be treated as one group. Different market segments will have different plant and information requirements. Nursery people, by focusing upon price, often forget that a reasonable proportion of consumers are prepared to pay a higher price for a product that meets their quality specifications.

On the basis of the points raised, how does your local garden centre measure up? From your observations, do garden centre operators have expectations that differ from their consumers? When you go to your local garden centre, are you provided with the information you need? Is the information provided suitable for those with a limited horticultural knowledge? These are important questions for which the nursery industry must have answers.

Market research can remove much of the personal bias that exists in decision-making. This can then lead to the development of products that meet the demands of the marketplace being delivered in the most appropriate manner.

Book Review

Small-leaved shrubs of New Zealand by Hugh Wilson and Tim Galloway. Manuka Press, Christchurch, N.Z., 1993. ISBN 0-473-01851-9.

At first I wondered if there is a place for one more book about New Zealand shrubs. The subject seems to be well covered, while we are starved of information about many non-woody plants. Did the authors persuade me otherwise in 300 pages with quite a full text, 30 colour illustrations, and 180 line drawings bound between a pair of very solid covers?

We have a remarkable number of small-leaved shrubs (and trees) in unrelated families. It is as if a sap-sucking insect injected a gene that made some plants throw anomalies. The introduction to the book does not accept or reject two theories put forward to explain the origin of small-leaved divaricating shrubs, but says they "make good stories". Both may be elements of a complex explanation. Pokaka has a transitory juvenile stage, while in *Pseudopanax anomalus* the form persists throughout life. In each of these genera only one species is microphyllous. Some native conifers have smaller leaves as adults.

To qualify for inclusion in this book the plants had to be between 30 cm and 6 m tall and with leaves less than 2 cm long. This did not exclude trees like rimu which at one stage lie within the limits, or climbers or the occasional alien woody weed.

Such a book would be expected to fall into natural sections, and it does: introduction (pp. 1–14), key to species (pp. 15–58), and description of plants (pp. 59–290). This is followed by glossary, references, index, and notes about the authors. Good maps occupy the inside of both covers.

The key works: my test samples were named in about 5 minutes each. A user less familiar with keys might do about as well, because there are few technical terms requiring the adequate glossary. In places a hand lens is needed to see some of the plant features clearly.

The descriptive part is a mini-flora. It is much more readable than a flora because it does not have to conform to the same conventions. Authority names are not used, and meanings are given for the binomials. None of the common names are continued for the sake of having a vernacular.

Most of the descriptions occupy 6 to 8 lines (up to 18) and use words like leaf stalk, petal, stubby, springy, furry, downy which are appropriate terms. Similar plants are compared as a further check on correct naming. About 230 species are covered, 165 in considerable detail.

Some genera have numerous small-leaved plants given full treatment - *Coprosma* 33 species, *Hebe* 22, *Olearia* 14, and *Pittosporum* 7. To call them species is not entirely correct; they are distinct entities, but not all have names. The flora covering woody plants published in 1961 is well out of date. One long-retired botanist gives his own tag names "a", "b", "c" and so on to entities he recognised in *Coprosma* without adequate names, and has used up all the alphabet. There are scores and scores of unnamed plants in our relatively small native flora. Until recently a small team of world-class taxonomists worked to correct this deficiency. Now the team and their internationally known organisation exist no more: such is the state of this fundamental plant science.

The standard of naming in the plant trade is appalling, and is not helped by botanists not being able to supply published names for plants that evolved in this country. Hugh Wilson does not resolve these taxonomic deficiencies, but makes us aware of them. In his many publications he has been forced to use descriptions and illustrations to indicate each plant deserving a name. Many 'new species' have been discovered in his intensive vegetation survey of Mt Cook National Park, Stewart Island, and Banks Peninsula.

The line drawings are by Tim Galloway, who has already distinguished himself as an artist in other publications. Surely, this project must have been the most demanding. Writing about *Coprosma* species (p. 83), the authors say "They are difficult to identify, because not only do they resemble one another, but the variation within species is considerable, involving both genetic and environmental factors. In particular, the difference between plants of a single species growing in shade and in full sun can be very marked. Nevertheless each species has its distinctive features, and identification, although challenging, is far from impossible!"

This was a challenge to the artist. The drawings are not only accurate but they look right. There is a level of economy in making a line drawing at which every line and every dot is significant. The artist found that level. Readers of this book will appreciate finding the drawing close to its main entry.

'Small-leaved shrubs of New Zealand' is more for botanists than for gardeners, but it will take its place in the substantial horticultural literature of the world because many of the plants in the book are used in gardens, and there are prospects for growing many more of them.

Alan Esler

Correction

In Vol. 4 No. 2 (Winter 1993) the caption to fig. 2 on p. 28 should read ... *Dracophyllum traversii* ...