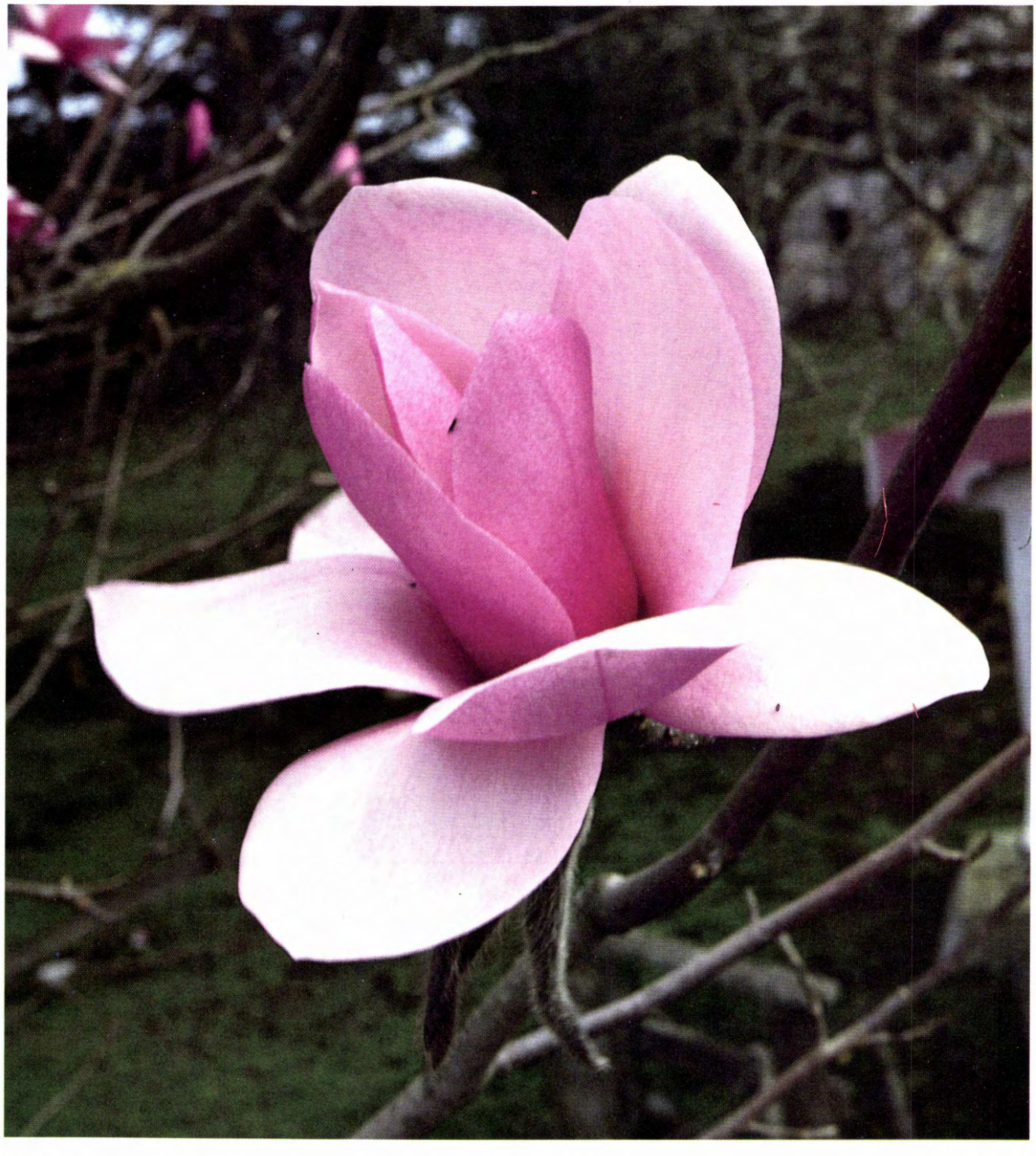
HORTICULTURE IN NEW ZEALAND

Journal of The Royal New Zealand Institute of Horticulture (Inc.)



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ARTICLES

Front Cover Picture:
Magnolia 'Sweetheart', a seedling of *M.* 'Caerhays Belle' (*M. sargentiana* var. *robusta* x *M. sprengeri* 'Diva'). Selected and named by P.B. Cave, Hamilton, this seedling was chosen for its upright growth and deep pink, erect flowers. This striking new selection is beginning to be planted widely in the United Kingdom.
Photograph P.B. Cave

Plant Life of some Inner Hauraki Gulf Islands

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7 Stilwell Road, Mt Albert, Auckland

The Hauraki Gulf is dotted with islands. Some of the Maritime Park islands such as Rangitoto and Little Barrier have predominantly native vegetation. Many others bear the scars of fires, cultivation, grazing, wild animals, removal of firewood and timber, suppression by alien plants, housing, defence activities, mining, quarrying, roading, and vandalism. Yet native plants are still a feature, particularly on the highly visible coastal slopes where topography has favoured their survival. This article is about some of the inner islands of Hauraki in the late 1970s, when information was gathered to guide their management.

Although the inner islands (Fig. 1) have geological differences – a few are of volcanic debris (Fig. 2) some are of soft sandstone (Fig. 3), and some of hard greywacke (Fig. 4) – their steep coasts have some similar plant features because of over-riding effects of salt-laden winds and dearth of soil. Where it can gain a foothold pohutukawa ranges from the shore to the clifftops and beyond, while the more specialised salt-hardy plants are quite restricted.

Pohutukawa (*Metrosideros excelsa*), the symbol of northern coastal forests, is a prominent tree on coastal slopes. Where the rock is soft, pohutukawa forms a fringe along the top of the cliff (Fig. 3). As the cliff erodes some trees are able to maintain a roothold while the crown yields to gravity and sprawls down the slope. Branches continue to grow outwards and upwards, and new roots supplement those anchoring the tree from above. Often undercutting of cliffs beneath pohutukawa stands dislodges chunks of vegetation, which may reestablish at a lower level. On gentler, stabler slopes pohutukawa trees may be dense enough to form coastal forest.

The plants that grow with pohutukawa are all of smaller stature. A sparse understorey is formed by karo (*Pittosporum crassifolium*), houpara (*Pseudopanax lessonii*), coastal karamu (*Coprosma macrocarpa*), and kawakawa (*Macropiper excelsum*). In a denser layer growing to about shoulder height the main plants are *Astelia banksii*, New Zealand flax (*Phormium tenax*), and *Gahnia lacera*, a sedge resembling a miniature bamboo. The grass *Poa anceps* may be found here, and the ferns *Asplenium oblongifolium* and *Polystichum richardii* (coastal shield fern). This is the ideal situation, now seldom seen except in small pockets. As pohutukawa forest deteriorates, *Gahnia lacera*, coastal shield fern, and the shrubs disappear first. The ultimate is the isolated pohutukawa tree.

Near the island shores the broad zones seen on sheltered mainland coasts are compressed and intermingled in narrow bands. Here grows the fleshy-fingered salicornia (*Sarcocornia quinqueflora*), deprived of its normal salt-marsh habitat, and the needle-tipped shore tussock (*Stipa stipoides*). A space for anchorage encourages New Zealand celery (*Apium prostratum*), a dwarf sedge (*Scirpus cernuus*), the creeping *Samolus repens*, the grass-like *Triglochin striata*, and the versatile *Lobelia anceps*. The cliffs with ledges may support New Zealand ice plant (*Disphyma australe*), the shore groundsel (*Senecio lautus*), and taupata (*Coprosma repens*), here hugging the rock face but in more favourable places growing into a small tree. Renga lily (*Arthropodium cirratum*) is much less frequent than New Zealand flax, which in many places has been encouraged by fires.

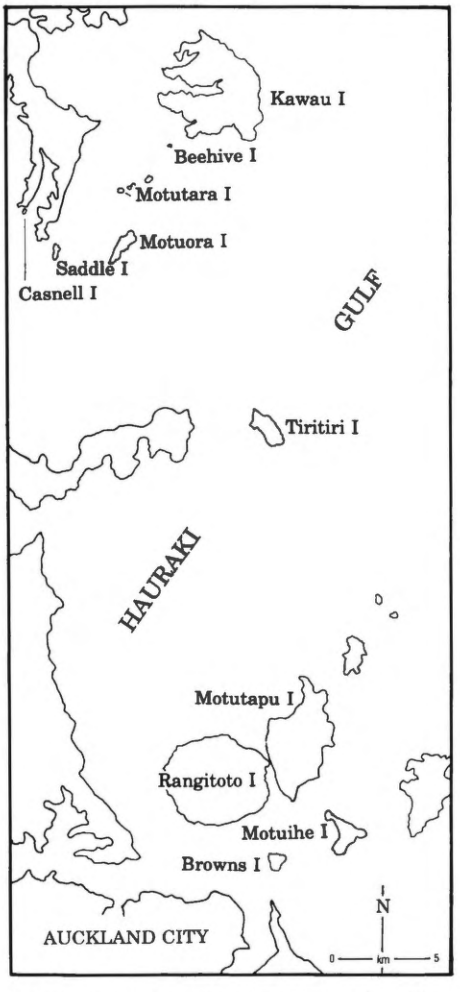

Fig. 1. Inner islands of the Hauraki Gulf.

The inner gulf islands had other forest trees besides pohutukawa. There is no certainty that forest was more extensive than the fragments known in the middle of last century, and only scraps of these remain. Here and there are small groves of taraire (*Beilschmiedia tarairi*) or kohekohe (*Dysoxylum spectabile*) and the occasional large puriri (*Vitex lucens*), karaka (*Corynocarpus laevigatus*), totara (*Podocarpus totara*), mangeao (*Litsea calicaris*) and tawapou (*Planchonella costata*), rimu (*Dacrydium cupressinum*), tawa (*Beilschmiedia tawa*), and rewarewa (*Knightia excelsa*). There is no record of kauri having grown on any of the inner islands of the park, except Kawau.

In some places where forest has been partially destroyed and has been allowed to recover a number of trees, shrubs, and other plants make up secondary forest where we may expect to find silver and black tree ferns (*Cyathea dealbata*, *C. medullaris*), mahoe (*Melicytus ramiflorus*), cabbage tree (*Cordyline autralis*), mapou (*Myrsine australis*), kohekohe, lacebark (*Hoheria populnea*), lancewood (*Pseudopanax crassifolius*), kawakawa, rangiora (*Brachyglottis repanda*), kowhai (*Sophora microphylla*), houpara, New Zealand flax, and several species of *Coprosma*. In the absence of possums, kohekohe could become the most prominent tree in the new forests.

On Kawau in particular secondary forest has not developed to this stage, and the main cover is of tea tree scrub composed of both manuka (*Leptospermum scoparium*) and kanuka (*Kunzea ericoides*).

Native plants have almost entirely given way on some islands to plantations, shelter belts, ornamental trees and pastures. Mansion House Bay on Kawau was extensively landscaped a century ago in the days of Sir George Grey, and on some other islands exotic trees mark former habitations. In more recent times trees and shrubs have been planted to beautify some of the bays.

There is beauty too in well kept pastures in this maritime setting, and they preserve and display Maori earthworks better than any other vegetation can. Grazing also keeps many aggressive exotic plants in check.

Motutapu Island (1508 ha)
Away from the steep coast the dominating feature is the tidy farmland with abundant Maori earthworks giving soothing relief from the noisy urban activity just a few

kilometres away across the water. Scattered native trees add character to the landscape, and with the unique ribbon swamps in the gullies are reminders that the scene is not entirely man-made.

The sandstone cliffs are too unstable to give a permanent foothold for trees, but on the hard greywacke forming most of the coast pohutukawa are dotted up the slopes from the shore (Fig. 3). They are accompanied in a few places by karaka, kohekohe, kowhai, tawapou, mapou, and mahoe. A small cluster of trees just south of Home Bay indicates that there have been at least small areas of forest containing in addition totara, rimu, tawa, taraire, rewarewa, and mangeao. When Thomas Kirk reported on the vegetation (Kirk, 1879) the island had been farmed for more than 20 years. At that time half of Motutapu was in grass and the remainder grew manuka and fern, with also pohutukawa on the cliffs and in some bays. No mention was made of forest, which must have been a minor feature at that time. Pohutukawa is threatened by its inability to replace itself in face of the destruction of seedlings by possums, wallabies, and farm stock. Many of the other 140 or so native species cannot persist much longer.

Further vegetation details are given in *N.Z. journal of botany* 18: 15–36 (1980).

Fig. 2. On the eroding northern and eastern slopes of Browns Island pohutukawa and a few other native plants cling to soft volcanic debris. Most of the remainder is grassy. (11 April 1974.)

Tiritiri Island (206 ha)

Tiritiri has a long history of farming going back for over a century, during which time the forest became restricted to a few gullies. Nature's urge to reclothe the land with forest began with the spread of tea tree and bracken into the pasture. Burning did nothing to curb the bracken, and almost certainly encouraged the tea tree. When farming ceased in 1972 tea tree found no more bared ground to invade, but bracken marched on to cover one-third of the island, leaving little more than half in grass. The tea tree areas are developing into secondary forests of mapou, mahoe, kohekohe, and other species. Bracken was too vigorous to allow these or other plants to establish naturally. The forest of kohekohe and taraire is typical of the vegetation that could develop over most of the island. Pohutukawa will continue to be a feature of the coasts.

With the expiry of the grazing lease came an awakening to the need to present the distinctive plants and animals of the park to the public in an accessible place while leaving the special reserves as undisturbed as possible. So Tiritiri became the focus for enhancement planting to hasten the return of forest. That is another story.

Further vegetation details are given in *N.Z. journal of botany* 18: 15–36 (1980).

Motuihe Island (178 ha)

Pasture covers most of this island. West of the trig a young forest is developing around scattered trees that have been there since Maori times. Two deep gullies draining onto South-east Beach are heavily forested with taraire, kohekohe, puriri, and karaka. The interrupted fringe of pohutukawa around the coast is a dominating feature of the island. The waves lapping Ocean Beach have undercut the sandstone cliffs beneath the pohutukawa. Many of these giants toppled, and yet continued to grow propped up on their elbows on the beach.

The first reference to the Motuihe vegetation seems to be the comment by T. Kirk, who in 1879 said that the island "contains about 460 acres, more than half of which is pasturage. The open cleared portion is chiefly covered with fern or manuka, the large patches of arboreal vegetation are to be found on the slopes, the most important being pohutukawa, which attains great dimensions."

The older plantings of trees add much to the atmosphere of the island. The prominent species are Norfolk pine, maritime pine, Aleppo pine, macrocarpa, and poplars. Many additional species grow on the north-western headland. The rows of olives here are said to have been planted by John Logan Campbell. In recent years the planting of ornamental trees has been extended, mainly on fenced-out portions of the coast. Both native and exotic species have been planted here.

Further vegetation details are given in *N.Z. journal of botany* 18: 15–36 (1980).

Browns Island (59 ha)

Browns Island (Motukorea) was described by E.J. Searle in *City of Volcanoes* as "a whole volcanic system in miniature" (Fig. 2). Yet this heavenly spot was planned to receive the effluent of Auckland until better sense prevailed.

There is no evidence of the island ever being forest-clad. It was cultivated for kumara and taro in the 1820s when visited by Samuel Marsden and R.A. Cruise. John Logan Campbell took up temporary residence in 1840 and made some reference to "brushwood", and D'Urville obtained firewood, although the island was mainly carpeted in grass.

Today Browns Island is grassy, and Maori earthworks and stone walls stand out prominently. Pohutukawa and a few shrubs cling to the volcanic ash on the steep eastern face. Some exotic trees dot the western margin.

Further vegetation details are given in *N.Z. journal of botany* 18: 15–36 (1980).

Kawau Island (220 ha in park)
The dominant impression of Kawau is the vast blanket of tea tree and the paucity of other native plants. Pine trees have spread from plantations, and are prominent in parts.

When the land ceased to be managed for economic pursuits there was not a steady progression of the vegetation back to native forest. Wallabies continually nibbled the grasses so closely that the vegetation could only feebly resist the invasion by tea tree. At the same time wallabies removed the seedlings of almost every forest tree as soon as the shoots appeared. According to the botanist J. Buchanan (1877), the island grew 348 kinds of native plants in 1877. It would be difficult to find 100 today.

The full impact of animals cannot be appreciated without crossing the few metres of channel which form a barrier between Kawau and Challenger Island, its southern appendage. The island may have been sparsely populated with plants when it was occupied by the Maoris, but now young and vigorous pohutukawa covers the ridges and spurs. Luxuriant coastal shrubland of houpara, *Hymenanthera* (now called *Melicytus novaezelandiae*), karo, coprosma, and New Zealand flax spills over the western face to near the high tide mark. This vegetation contrasts sharply with the stark brown Kawau cliffs nearby with their dead and dying pohutukawa ravaged by possums.

Fig. 3. Motutapu Island: steep, undercut sandstone cliffs with few pohutukawa trees, some of which have slid down from the clifftop. Greywacke in the foreground is stable, gently sloping, and well clothed with pohutukawa trees and grass. (29 November 1977.)

Fig. 4. Eastern face of Tiritiri Island: pohutukawa, grassland, and bracken fern. The rock is greywacke. (6 September 1972.)

Most of the glory of Sir George Grey's 7-hectare garden has gone, but you can still see his Kaffir-boom, Norfolk pine, Moreton Bay fig, bunya-bunya, hoop pine, and massive Chilean wine palms. So successful were some of his other plants that they multiplied and are now a prominent part of the landscape – the pines, the wattles, the curious Mauritius hemp plants with sword-shaped leaves, and many others.

Motuora Island (79 ha)
This island is picturesque but not notable for its native plants. Pasture with shelterbelts sweeps down to the bays between the pohutukawa-dotted low cliffs. Gorse and kikuyu grass are very prevalent.

Saddle Island (4 ha)
In less than 50 years the vegetation has changed from grass and low bushes infested with rabbits to a forest of pohutukawa trees on the western side. The denseness and erect form of the trees tell us that this is a young community. Rabbits account for the predominance of pohutukawa, because they have little liking for pohutukawa and eliminate most of its competitors. Competition is with

plants of its own kind, and they grow close, tall, and straight as a result. Two islands in the Firth of Thames, Motuwi and Moturua, have a predominance of pohutukawa for the same reason.

Casnell Island (6 ha)
The steep seaward face of Casnell belies its true nature as it is mostly gently sloping and is grazed by sheep periodically. It is grassy with only pohutukawa, puriri, kowhai, tawapou, tea tree and a few other natives conspicuously representing a flora of about 50 species.

Beehive Island (1 ha)
Not only is the shape of this island striking but also its plant life. It looks like a piece carved out of Mansion House Bay and set adrift. There would be little left if we removed the dozen pines, the dense shrubby layer of *Polygala myrtifolia*, and the two species of sword-leaved plants, Mauritius hemp and the more succulent *Agave americana*. This island is privately owned.

Motutara Island (4 ha)
Not more than a few dozen native plant species share this island with the dominant pines. Pohutukawa is the most conspicuous of these. The only other native woody plants noted were ngaio (*Myoporum laetum*), karo, coastal karamu, taupata, a planted *Meryta sinclairii*, and the bird-introduced alien, boneseed.

Conservation and the Islands
These ten islands are different in form, function, and future. Conservation, to many people, involves promotion of plant and animal communities, where they exist, and preservation of durable historic features. A conflict arises if enhancement planting jeopardises the visibility and persistence of Maori earthworks, which are best preserved under managed grazing. Plantings can also obscure the semi-natural processes of vegetation change, and foster weed problems when farming ceases. The public afloat in boats do not seek this degree of biological conservation for all islands. They argue for leaving some degraded islands as is, as objects of scenic interest, unless they are serious weed havens or adverse to wildlife. Some such places may be enriched by planting native or appropriate exotic plants to conserve aesthetic values. Conservation has come to mean many things on these fascinating islands.

References

Buchanan, J., 1877: On the botany of Kawau Island. *Transactions of the New Zealand Institute* 9: 503–527.

Kirk, T., 1879: Notes on the botany of Waiheke, Rangitoto, and the other islands in the Hauraki Gulf. *Transactions of the New Zealand Institute* 11: 444–454.

Book Review

Restored Period Gardens - Middle Ages to Georgian Times by John Harvey. Shire Publications Ltd, Princes Risborough, U.K., 1993. Shire Garden History Series no. 1, 2nd edition. ISBN 0-747-20200-9.

Interest in Britain in garden history increased with the founding of the Garden History Society in 1965, and extensive literature searches on period gardens have been undertaken. Archaeological excavations have also contributed to the restoration or recreation of gardens more than a century old, many sponsored by the National Trust.

John Harvey's concepts for the restoration and recreation of historical gardens have wide applications in maintenance programmes for all gardens and parks. Harvey stresses that long-term upkeep of restored gardens must be considered. A garden changes naturally at a fast rate, and heavy costs of a major restoration can be wasted unless both an annnual and longer-term phased management plan of work is drawn up and strictly followed.

Sound restorations or recreations cannot be hurried, for all aspects of researches of original archives and archaeological excavations have to be considered. Plantings need to match the main period of the buildings in the area. The author quotes the anomaly of using modern floribunda roses, with no counterpoint in the 17th century, in a period rose garden at 17th century Edgell Castle, Tayside.

Harvey comments on the contribution trees made to the English landscape in the 18th and 19th centuries, and asks how this influence can be perpetuated. Clear-felling and replanting has been shown not to be the answer, and he urges better efforts to preserve original trees and hedges.

Restoration of period gardens in Britain is described under five historical periods, and examples are given for these periods, as well as some back-ground on the historical influences of the time.

In the first period, the Middle Ages (1066–1485), there are no written texts to serve as guides, but fragments of information have been collected from many sources. The Queen Eleanor Gardens, Winchester Castle, is a restored garden of this period.

In the Tudor period (1485–1540) and a later period (1540–1605) a more ornate type of formal garden developed, with elaborate topiary and 'knot' gardens. With the invention of printing the first English books on horticulture appeared: Thomas Hill (1558) on horticultural practice, William Turner (1558) on garden plants, and Gerard's Herbal or Generall Historie

(continued on p. 9)

Observations on the History and Opportunities for Ornamental Use of *Leptospermum* and a New Cultivar – *Leptospermum variabile* 'Karo Crimson Pearl'

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Leptospermum species

The revision of the genus *Leptospermum* by Joy Thompson (1989), a taxonomist of the National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, describes 79 species. In this revision she points out that *L. scoparium*, commonly known as manuka, is the only one indigenous to New Zealand. It is also indigenous to Tasmania, Victoria, and New South Wales. It is curious that there has been so much selection of ornamental cultivars for *L. scoparium*, but very little for the large number of other species. Also, as far as can be determined, this selection has been based entirely on plants originating from New Zealand. Metcalf (1987) reported that there had been at least 85 named ornamental cultivars of manuka released, and this number now exceeds 100 (Harris and Heenan, 1992).

L. scoparium is a widespread and important species in New Zealand and performs a key successional role from sea level to above the timberline on the three main islands. Over this wide distribution range manuka shows gradients of variation that are genetically based but are modified by local environmental conditions. Understanding of these gradients has played only a small role in the ornamental diversification of manuka. Instead, ornamental selection has been largely based on sports or extreme variants shown by plants collected in the wild or noticed in nurseries.

Manuka cultivars

Probably the three most significant manuka cultivars discovered in the wild have been *L. scoparium* 'Nichollsii', *L.* 'Leonard Wilson', and *L.* 'Keatleyi'. *L.*'Nichollsii', the main source of the crimson flower colour characterising many *L. scoparium* cultivars, was discovered near Kaiapoi in 1898 and distributed as an ornamental cultivar by the Christchurch nurseryman Robert Nairn.

Leptospermum 'Leonard Wilson', discovered at Port Levy, Banks Peninsula, is possibly the source of the double-flowered character bred into many cultivars. However, Cockayne (1918), when describing *L.* 'Leonard Wilson', noted two other discoveries of white double-flowered manuka, and others were discovered later.

Even the combination of pink and double flowers may have originally been found in a wild plant. Recently Mr John Palmer of Arnold Books, Christchurch, gave to me an undated cutting about double pink-flowered manuka found in the wild in North Auckland written by J. Drummond for the 'Lyttelton Times'. A reference to a memorial being built at Chunuk Bair, Gallipoli, on the reverse side of this cutting dates the article between 1918 and 1929, when the 'Lyttelton Times' was last published.

Leptospermum 'Keatleyi' was discovered in 1917 near Parengarenga Harbour (Stevens, 1944) among populations of *L. scoparium* var. *incanum* that grow in that area. *Leptospermum* 'Keatleyi' is a tetraploid, and three other cultivars derived from crosses with it, most notably *L.* 'Martinii', are triploids (Dawson, 1990).

Other plants discovered in the wild have provided variations in the vegetative characteristics of manuka cultivars, most notably prostrate spreading and dwarf habits, and variation of leaf colour from green to bronze.

Oddly, the next step of taking these variants from the wild and recombining their characteristics through crossing and selection to produce new cultivars has mostly taken place overseas. A leader in the breeding of *L. scoparium* hybrids was W.E. Lammerts, who began breeding new manuka cultivars in 1939 in California. His work, one of the best documented examples of breeding and selection of New Zealand native plants (Lammerts, 1945), produced a series of cultivars from progeny of the F2 cross between *L.* 'Nichollsii' and *L.* 'Rose Double'. The origin of *L.* 'Rose Double' is uncertain, and Metcalf et al. (1963) stated that the name is probably illegitimate since it does not seem to have been correctly published. Drummond's article in the 'Lyttelton Times' raises the possibility that *L.* 'Rose Double', like *L.* 'Nichollsii', was a cultivar of wild origin.

Many other manuka cultivars have come from the nursery of E.F. Jenkin & Sons near Melbourne. These cultivars, including *L.* 'Burgundy Queen', *L.* 'Crimson Glory', and *L.* 'Pink Pearl', are among the most widely available and popular ones in New Zealand today. Other important sources of New Zealand-bred cultivars have been the dwarf and semi-dwarf cultivars named after New Zealand birds released by Duncan and Davies in the 1950s, and recent 'Wiri' selections made by Jack Hobbs, Curator of the Auckland Regional Botanic Gardens.

Australian Leptospermums

Several Australian *Leptospermum* species have been introduced, but only a few are grown in any number in New Zealand. For example, Cockayne (1911) recommended the coast tea tree, *Leptospermum laevigatum*, as a shrub useful for dune reclamation, and I have seen it grown as a hedge at Tahuna Beach, Nelson. Another species, probably the one most regularly seen now in nursery outlets, is sold as *L.* 'Coppershine', and what appear to be very similar plants are also sold with the cultivar names *L.* 'Copperglow' and *L.* 'Pacific Flame'. These seem to be selections of a bronzed-leaved form of *L. polygalifolium*, a widespread and variable species (syn. *L. flavescens*).

Leptospermum rotundifolium, formerly regarded as a variety of *L. scoparium*, is also grown in New Zealand, especially the cultivar *L.* 'Jervis Bay', which has striking purplish-pink flowers, part of the range from white to purple flower colour shown by this species. Two other Australian species cultivated as shrubs in New Zealand are the woolly tea tree, *L. lanigerum*, and the prostrate subalpine shrub *L. rupestre*, from Tasmania.

Joy Thompson (1989) described 27 new species in her revision. A selection from one of these was given the name *Leptospermum* 'Christmas Star' (Harris and Percy, 1988) before publication of the species name *L. spectabile*. *Leptospermum* 'Christmas Star' has proven susceptible to frosts at Lincoln, Canterbury, but is certain to display its spectacular red flowers to advantage when grown in the Auckland region. This cultivar has been supplied to several propagators for distribution.

Leptospermum variabile

Another of these newly described species, *Leptospermum variabile* J. Thompson, has proved an attractive shrub, well adapted to the rigorous conditions at Lincoln, Canterbury, where it has been evaluated since 1983. It has shown remarkable resistance to frost, drought, and manuka blight. The seed was collected in October 1983 by Warren Sheather of the Botany Department, University of New England, New South Wales. He said it was seed of a then undescribed *Leptospermum* species from Point Lookout, 80 km east of Armidale. This is within the southern part of the natural distribution of *L. variabile*, which extends from the mountains of southeastern Queensland to scattered occurrences on the tableland escarpment and coastal ranges of New South Wales as far south as the Taree district. Thompson (1989) listed its natural habitats as rocky summits or ridge tops, in heath, skeletal soil, or rock crevices, on sandstone, granite, or volcanic rock. The 1566 m altitude of Point Lookout at latitude 30°29'S suggests that the species has a good degree of hardiness.

Leptospermum variabile shows variability in many characters, especially those of leaf width and fruit size (Thompson, 1989). *Leptospermum variabile* and *L. scoparium* are in the group of *Leptospermum* species with woody fruit capsule valves. But the two species are placed in different subgroups as the valves in *L. variabile* are delicately woody, whereas in *L. scoparium* they are strongly woody. Personal observations suggest that this is a subtle and relative distinction, and that the two species are not markedly dissimilar in this characteristic. *Leptospermum variabile* is further distinguished from related species by glabrous and deciduous sepals. It is finally separated in Thompson's key by having the style base inset in the capsule top surface and the base of the open capsule rounded.

Thompson (1989) described the flowers of *L. variabile* as white, about 15 mm in diameter, and usually borne singly on the ends of short several-leaved branches. This flower size is larger than the range of 8–12 mm given for *L. scoparium*, but larger flower diameters have been recorded for cultivars of this species (Dawson, 1990). The variable capsule size of 5–12 mm given for *L. variabile* also exceeds the range of 6–10 mm given for *L. scoparium*. The flowers of the Point Lookout population grown at Lincoln showed pink flushing of the petals, a characteristic which may be not be evident on dried herbarium specimens.

Leptospermum variabile may be a compact or spreading shrub 1 to 2 m tall or a small tree to 5 m or more tall. Leaves range from 10 to 20 mm long and 2 to 8 mm wide, and vary in shape from obovate-oblanceolate to narrowly or broadly elliptical. These characteristics are similar to those of *L. scoparium*, but *L. variabile* mostly has nearly erect leaves, whereas *L. scoparium* has widely diverging, spreading or deflexed leaves. Also, leaves of *L. variabile* are usually glabrous and rarely pungent (sharp-tipped), but leaves of *L. scoparium* are often pubescent and are usually pungent.

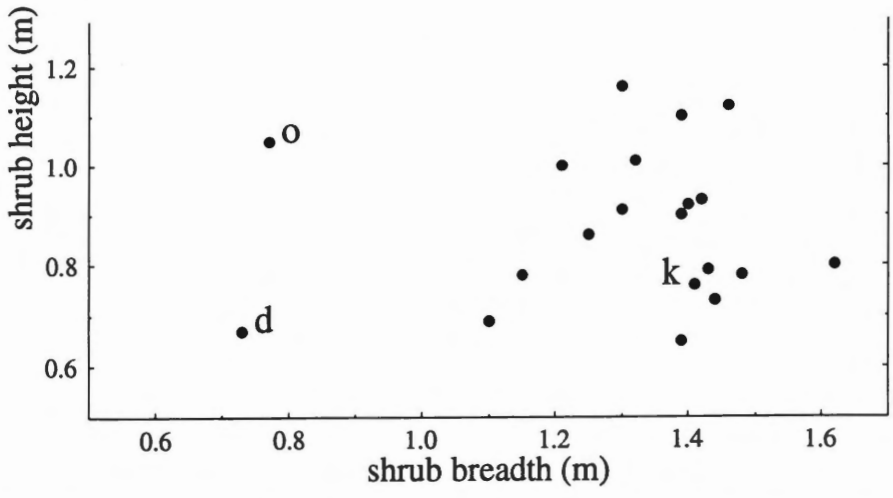

Fig. 1. Comparison of the height and breadth of 21 two-and-a-half-year-old shrubs of *Leptospermum variabile*. The shrubs, labelled d, k, and o, were selected as representing the range of habit variation in the population.

Selections of *Leptospermum variabile*

Twenty-one *L. variabile* plants were successfully established at Lincoln in 1983 and their development into shrubs was observed in the years that followed. One feature that quickly emerged was the wide variation in shrub height and width (Fig. 1). One shrub (d) had a short, compact habit, and another (o) had a tall narrowform. Shrub (d) was identified as a useful candidate for naming as a cultivar, and was retained for more detailed observation. Shrub (o), and shrub (k) as a representative of a more characteristic shrub form of the population, were also retained. All three shrubs have been clonally propagated, and provide attractive floriferous plants of markedly different habit. In December 1992 their height and breadth dimensions were: shrub (d) 1.18 m x 1.63 m; shrub (o) 2.50 x 1.25 m; shrub (k) 1.40 m x 3.14 m.

All the shrubs in the original population first flowered in spring 1985 when just two years old, which was quick compared to some other *Leptospermum* species evaluated at Lincoln. Records of commencement and duration of flowering in 1986 and 1987 for the *L. variabile* population are compared with a Manawatu *L. scoparium* population in Fig. 2. The smaller number of shrubs of the Manawatu population was due to deaths from manuka blight, which did not affect the *L. variabile* population. In both years *L. variabile* flowered about a month before all the *L. scoparium* populations in the planting. All the *L. variabile* shrubs were very floriferous, and their flowering was concentrated in a well synchronised period of four weeks beginning mid to late October. Peak flowering was about a week later in the 1987 flowering year, and this was probably caused by a lower heat sum that year. When in flower the *L. variabile* shrubs were visited by large numbers of honey bees, and a local bee keeper commented that their flowering at Lincoln was at a time when there is a shortage of pollen and nectar.

As well as a high degree of resistance to manuka blight *L. variabile* is usually less affected than *L. scoparium* by leafroller caterpillars. The shrubs have maintained their foliage in good condition without spraying for these pests. Leafrollers have caused some damage to shoot tips in summer in most years, but the effects of this have largely gone in the spring during bud and flower display. As well, the shrubs of *L. variabile* have withstood frosts up to –8°C and prolonged summer drought without significant damage.

Leptospermum variabile 'Karo Crimson Pearl'

The most compact shrub (d) referred to above is described as a new ornamental cultivar. As well as having a compact habit, this shrub is distinctive for the mass of crimson pearl-like buds that are displayed for an extended period before the flowers open. These bud characteristics inspired the cultivar name *L.* 'Karo Crimson Pearl' (Fig. 3 a, b). The name 'Karo', an acronym of "Known and recorded

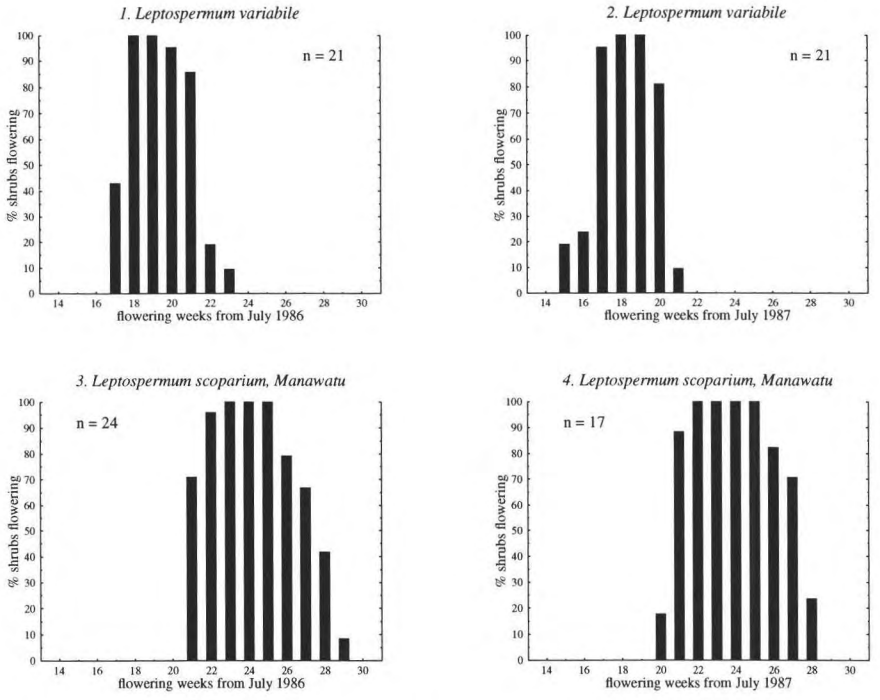

Fig. 2. Comparison of the flowering pattern of the *L. variabile* population with an *L. scoparium* population from the Manawatu Gorge grown in the experimental garden at Lincoln. Flowering was recorded in weeks numbered from 1 July. n = number of plants in population that flowered.

Fig. 3. Flowering branch (a) and detail of flowers and bud (b) of *Leptospermum variabile* 'Karo Crimson Pearl'.

origin", is used to identify ornamental plants released by Manaaki Whenua - Landcare Research as a continuation of the programme initiated by the Botany Institute, DSIR (Heenan, 1992). The sepals dominate the bud colour, and these, together with a pink flush at the base of the petals, give a general impression of oriental pink when the flower is open. Observations made in 1992 provide the basis of the description below. The shrub has retained a similar form for several years. Colour descriptions are based on the 1966 Royal Horticultural Society Colour Chart (R.H.S.).

Description: Shrub, 1.2 m tall and 1.6 m wide. Trunk diameter 7 cm, branching 2 cm from base, branches twisted and curved upward so that terminal branchlets in the upper central part of the generally rounded crown are erect. Branches generally leafless to a height of about 50 cm, bearing dead branchlets and split capsules from flowering of several years earlier. Bark on older branches easily removed in strips, the separate layers papery, light orange-grey-brown, incorporating shades in R.H.S. nos. 177 and 199. Branchlets mostly 1–2 cm but up to 7 cm long, most often at an angle of 25–30° from the supporting branch. Young stems silky pubescent but soon becoming glabrous, with a flange characteristic of the species curving around the stem and up beside the leaf base. Section of stem below youngest leaves crimson (R.H.S. 52A), grading to bark colour on older stem. Leaves not as aromatic as those of *L. scoparium*, green (R.H.S. 137) with narrow crimson margin and tip and lighter green at base, mostly lanceolate and oblanceolate, subsessile, 4–10–(14) mm long x 2–3–(5) mm wide, erect on upper shoots but spreading to patent on shaded shoots in shrub canopy, slightly pubescent when young, glabrous when mature, leaf apex pointed and slightly folded but not pungent. Flowers terminal, on short 1–3 cm lateral branches borne on longer secondary branches that continue vegetative growth, solitary but spaced on branches to give almost full coverage of bloom on the shrub when in full flower, opening in sequence from the base to the tip of the secondary branches. Flower diameter when fully open 16–17–(18) mm. Hypanthium in bud surrounded by golden-brown bracts (R.H.S. 164A). Buds carmine (R.H.S. 52A) owing to sepal colour, 6–7–(8) mm diameter just before opening. Sepals 5, in bud carmine grading to white at margins and lightening to carmine-rose (R.H.S. 52C) when showing in a star-shaped pattern between petals in the fully open flower. Petals 5, not overlapping, white but often with a light pink flush, most apparent on the base and underside. Stamen filaments white, of similar length and evenly distributed around the hypanthium rim. Anthers golden brown to beech brown (R.H.S. 164A, 165A). Hypanthium disk yellow green (R.H.S 145B) when flower first open, darkening to dark green-brown (R.H.S. 152B) by the time petals are shed. Fruit a woody capsule with 5 valves, rounded base, sessile, valves raised above the rim and curved into the centre to enclose the base of the stigma. Capsules persistent, retained unopen for three or more years and opening when branchlet on which they are borne dies, sepals remaining attached in first year of capsule but shed from older capsules, 10–12 mm wide x 7–8 mm deep when mature. Young capsules beech brown (R.H.S. 165A,B) becoming greyer with maturity, margins of valves of young capsules distinctly highlighted by darker brown. Flowering period at Lincoln mid October to mid November, later in colder seasons.

Representative specimens: CHR 468798 A, B, W. Harris, 26 Oct. 1990, N.Z., Canterbury, Lincoln, DSIR, Botany Institute, Garden Coll. Prov: Australia, N.S.W., Point Lookout.

This parent plant of *L.* 'Karo Crimson Pearl' has been grown with a minimum of horticultural care for nine years. This, with its compact shrub form, suggests it

will persist as a long-lived specimen in home gardens, and that it will be useful for larger-scale low maintenance landscaping. With pruning it should be possible to retain it as a rounded shrub with foliage to ground level, or it could be allowed to grow to show the interesting architecture of the lower branches and the bark characteristics.

Evaluations in the Landcare Research experimental gardens and cooperative evaluations with Elliot's Wholesale Nursery, Amberley, show that it can be readily propagated from cuttings and successfully raised as a container-grown plant. The cultivar has been successfully used as a parent for crosses with other *Leptospermum* species. The progeny from these crosses, combining the attributes of *L.* 'Karo Crimson Pearl' with the ornamental attributes of other species, provide exciting prospects for the selection of new *Leptospermum* cultivars.

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(continued from p. 5)

of Plants (1597). With the Reformation, new eastern European plants and trees were introduced to the West, e.g., tulips, ranunculus, horse chestnut. There is a Tudor garden at the Tudor House Museum, Southampton.

The author divides the Stuart period into two phases, 1603–1660 and 1660–1714. Extravagance marked the first period, with wealthy courtiers establishing the ornate layouts seen in France and Italy, building terraces and grand staircases, lakes and waterways. Plant lists and catalogues produced in this period provide a good background to the plantings of the times. The year 1650, however, marked a downturn in our horticultural history, with the Parliamentary confiscation of large estates following the Civil War. The later Stuart period thus ushered in the era of the more modest 'home garden', incorporating orchard and kitchen garden.

In the first Georgian period (1714–1760) the author notes the development of the nursery trade, the most notable being Furber of Kensington Gore, London. A number of North American trees were introduced. The Georgian period 1760–1800 saw foreign trade and exploration introducing plants from all over the world, and the rapid development of Kew Gardens followed. The designer Lancelot 'Capability' Brown began to make an impact on garden landscapes. The flower border developed as a garden feature.

The book concludes with a short bibliography, list of abbreviations, and appendices. Appendix I provides a summary of sources and connections under the different chapter headings. Historical plant lists are given, taken from texts mentioned in the bibliography. These lists are arranged in chronological order, and to me are one of the most interesting features of the book. The list from Robert Furber's catalogues, Kensington 1724–1730, is truly remarkable. Appendix II lists roses in cultivation in Britain before 1830, an interesting addition.

The book provides a valuable and useful guide for visitors to Britain who are interested in garden history. It is interesting to consider these phases of early garden development in the context of New Zealand gardening. Cook's voyages to New Zealand occurred in the periods 1768–1772 and 1772–1776. Before this Maori immigrants had developed gardens based on food crops brought from the warm Pacific Islands. Helen Leach's book '1000 Years of Gardening in New Zealand' (1984) has described the course of pre-European Maori gardening identified by archaeological studies and followed the introduction of European food crops into New Zealand.

Reading Harvey's historical account of period British gardens shows how early European settlers in New Zealand would have been influenced by and profited from years of gardening experience in Britain. I found this book very interesting and valuable.

Joan Dingley

x*Kunzspermum hirakimata* 'Karo Hobson Choice' - a New Intergeneric Hybrid Tea Tree Cultivar

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Introduction

An intergeneric hybrid *Kunzea sinclairii* x *Leptospermum scoparium* was raised from seed collected from *Kunzea sinclairii* on Great Barrier Island and grown at Lincoln (Harris et al., 1992). *Kunzea sinclairii* is endemic to Great Barrier Island, and the other New Zealand tea trees, *Leptospermum scoparium* (manuka) and *Kunzea ericoides* (kanuka), also occur on the island.

Hybridisation between *L. scoparium* and *K. ericoides* was suggested by Cockayne and Allan (1934) and Cockayne and Phillips Turner (1947), but although these species frequently grow together, there have been no reports of hybrids between them. Dr Brian Molloy (pers. comm.) has proposed that *K. sinclairii* is an old hybrid between *K. ericoides* and *L. scoparium* that may have survived and stabilised because of the peculiar ecological conditions found in its habitat on Great Barrier Island. This is an interesting hypothesis that deserves further investigation. This new intergeneric hybrid *Kunzea sinclairii* x *Leptospermum scoparium* adds the family Myrtaceae to the other families for which New Zealand intergeneric hybrids are recorded: Asteraceae (Allan, 1939; Clarkson, 1988; Kit Tan and McBeath, 1988), Apiaceae (Webb and Druce, 1984), and Ericaceae (Franklin, 1962). Two of these intergeneric hybrids have been given intergeneric names: x*Leucoraoulia* Allan for *Leucogenes* x *Raoulia* (Allan, 1939), and x*Celmearia* Heenan for *Celmisia* x *Olearia* (Heenan 1993).

Intergeneric, collective epithet, and cultivar names are given for the new hybrid in this paper. Characteristics of the hybrid have been observed since seedlings emerged from seed sown on 12 September 1983. Twenty-four seedlings from this seed lot were transplanted in June 1984 to what were then the Botany Division DSIR Experimental Gardens. Once the hybrid was recognised, more intensive observations were made and cuttings were taken for propagation. Although the original plant has been removed to make way for other experimental plantings, two shrubs of the hybrid raised from cuttings are presently growing in the Manaaki Whenua - Landcare Research Experimental Gardens at Lincoln. There is widespread interest in the native tea trees, both as characteristic shrub species of the New Zealand landscape and as garden subjects. The hybrid combines characteristics of *Leptospermum* and *Kunzea* that are of ornamental interest. Consequently I consider it appropriate to give the hybrid a cultivar name and to promote its use as an addition to the native plants grown in gardens.

Names and Descriptions

x*Kunzspermum* W. Harris

x*Kunzspermum* is the condensed formula for the intergeneric hybrid *Kunzea* Rchb. x *Leptospermum* J.R.Forst. et G.Forst. This name combines the first syllable of *Kunzea* and the latter part of *Leptospermum*.

x*Kunzspermum hirakimata* W. Harris

x*Kunzspermum hirakimata* is the collective epithet for *Kunzea sinclairii* (Kirk) W. Harris x *Leptospermum scoparium* J.R.Forst. et G.Forst. The epithet 'hirakimata' refers to the Maori name of Mt Hobson, Great Barrier Island, New Zealand, where the seed providing the hybrid was collected (Harris et al., 1992).

Diagnosis: Frutex ex hybridatione *Kunzea sinclairii* (Kirk) W. Harris et *Leptospermum scoparii* J.R. et G. Forst. ortus; ob hypanthium pedicellatum, non persistens, *K. sinclairii* similis; ob folia lanceolata et pungentia *L. scopario* similis.

Shrub, a hybrid of *Kunzea sinclairii* (Kirk) W. Harris and *Leptospermum scoparium* J.R. et G.Forst. Hypanthium pedicellate similar to that of *K. sinclairii*, not persistent; leaves lanceolate, tips pungent, similar to those of *L. scoparium*.

Holotype: CHR 468797, W. Harris, 30 November 1990, Botany Institute Gardens, Lincoln, Canterbury.

This specimen was taken from the plant raised from a cutting on which the cultivar description given below is based.

Other specimens: CHR 474018 A, B, R. N. Patel & M. I. Dawson, 10 February 1989, Botany Institute, DSIR, Lincoln. CHR 465843, R. P. Buxton & W. Harris, 19 February 1990, DSIR Lincoln, Canterbury. CHR 468812, W. Harris, 14 December 1990, DSIR Botany Institute gardens, DSIR, Lincoln, Canterbury.

These specimens were all taken from the original plant from where it was planted in the experimental layout in June 1984.

Parentage: The female parent was a plant of *K. sinclairii* at 400 m on the eastern side of Mt Hobson (Hirakimata), Great Barrier Island, North Auckland, from which seed was collected by E.K. Cameron on 29 January 1983. The putative male parent is *L. scoparium*, which grows in the same locality as the female parent. Analysis of the characteristics of the hybrid reported by Harris et al. (1992) supports this parentage. The hybrid has 2n = 22, the same as wild specimens of *K. sinclairii* and *L. scoparium*.

Distribution: Cultivated shrubs, Manaaki Whenua - Landcare Research Experimental Gardens, Lincoln, Canterbury, from seed collected from Mt Hobson, Great Barrier Island; not recorded from the wild.

x*Kunzspermum hirakimata* 'Karo Hobson Choice'

By including 'Karo', an acronym of "Known and recorded origin", the cultivar epithet identifies this plant as being released for cultivation by Manaaki Whenua - Landcare Research. This is a continuation of the procedure initiated by the Botany Institute, DSIR (Heenan 1992). 'Hobson Choice' reflects the origin of the cultivar from seed collected from *Kunzea sinclairii* on Mt Hobson, Great Barrier Island, and alludes to the saying "Hobson's choice", meaning no choice, which is particularly relevant as this is the only hybrid of this kind being offered as an ornamental shrub cultivar.

The description is based on details given by Harris et al. (1992) supplemented by observations on the shrub when it was flowering in December 1992. Most of the characters described can be seen in the photographs of the shrub (Fig. 1) and flowering shoots (Fig. 2). Colours described are according to the Royal Horticultural Society (1966) colour chart, and are referred to as R.H.S. followed by the chart number.

Description: Shrub about 1.2 m tall x 1.2 m wide, branching from short 2–3 cm trunk at angle ±40°; branchlets also arising at a similar angle, generally remaining straight to shoot tips. Trunk bark grey, flaking; branch bark finely fissured with a pattern of grey ridges over a light-brown lower layer. Stem near shoot tips silky-hairy, greyed-orange (R.H.S. 174). Leaves spreading, patent or reflexed, subsessile,

finely silky-hairy when young, predominantly lanceolate, averaging 12 x 2.4 mm, tips slightly pungent, green (R.H.S. 137) with greyed-orange margins and tips. Flowers in sprays along main branches opening in sequence from base of these branches towards the shoot tip, which bears new vegetative growth. Individual flowers forming these sprays borne terminally on short lateral branchlets usually less than 1 cm long with 0–3 leaves, sometimes as single flowers but more often 2–6, diameter 12–15 mm. Hypanthium turbinate, pedicellate, 2–3 mm deep x 4–5 mm at rim, moderately pubescent, green with distinctly crimson (R.H.S. 52A) rim, circular brown gland cells conspicuous near rim. Pedicel pubescent, 2–3 mm long. Petals 5, not overlapping, horizontal or reflexed downwards from hypanthium rim, crumpled like crepe, 5–6 x 4–5 mm, suborbicular narrowed to short claw, white often with light pink flush near attachment to hypanthium. Sepals suborbicular, adnate to hypanthium, not or only partly obscured by petals, white, membranous at margins, green at base, crimson at triangular apex, circular gland cells prominent on underside. Hypanthium disk green when flower first open, later changing to brown. Style 3 mm long, brown at base, translucent white at top. Stigma green and not markedly broadened from style. Stamen filaments 2–4 mm long, white to pink near hypanthium rim. Fruit a non-persistent capsule shed 1–2 months after flowering. Main flowering at Lincoln November and December, with a tendency to flower at other times of the year depending on seasonal conditions.

Fig. 1. x*Kunzspermum* 'Karo Hobson Choice' flowering in the Experimental Gardens, Lincoln, in November 1991.

Ornamental Features

This shrub should be of curiosity value to growers of native plants because it combines the features of the New Zealand species of *Kunzea* and *Leptospermum*. Both genera have much greater representation in Australia. *Leptospermum scoparium* is New Zealand's only representative of the 79 species of the genus described by Thompson (1989), and like *K. ericoides* is also indigenous to south-east Australia (Thompson, 1983). *Kunzea* is currently being revised by Professor Helmut Toelken, Adelaide, as part of the 'Flora of Australia' series. The two New Zealand species of *Kunzea*, *K. ericoides* and *K. sinclairii*, are more similar to each other than to the more than 30 other species included in the genus in Australia. Some species are strikingly different, as shown by the yellow-flowered *K. vestita* and purple-mauve-flowered *K. micromera*, *K. pauciflora*, and *K. parvifolia* which have been introduced and grown at Lincoln.

Kunzea sinclairii is characteristically a prostrate straggling shrub usually less than 1 m tall. The *L. scoparium* that grows on the same sites as *K. sinclairii* on Great Barrier Island is also a shrub of low stature (Harris et al., 1992). As this form of *L. scoparium* is the putative male parent for *K.* 'Karo Hobson Choice' it is unlikely that the cultivar will grow much taller than the 1.2 m height used for the description. This short stature will make it a suitable subject for smaller gardens. Also, compared to many *L. scoparium* cultivars it is much less densely branched, a character it gets from *K. sinclairii*. However, the straightness of the branches, a character of *L. scoparium*, results in a striking, spaced, spike-like presentation of flowering branches when the shrub is in bloom (Fig. 1).

Hobbs (1991), in referring to *Leptospermum* 'Karekare', a cultivar selected by Albany nurseryman Graeme Platt, expressed his surprise that more use had not been made of white-flowered *L. scoparium* cultivars, as white-flowered plants are fashionable. *Kunzspermum*

Fig. 2. Flowering shoots, from left to right: 1. *L. scoparium*; 2. x*Kunzspermum* 'Karo Hobson Choice'; 3. *K. sinclairii*; 4. *K. ericoides*.

'Karo Hobson Choice' brings together the multiple-flowered cymes of *K. sinclairii* and the larger flowers of *L. scoparium* to provide a mass of bloom that covers the flowering shoots. These flowers can have a faint pink blush. This arises from the blend of the white petals and the carmine displayed in the hypanthium rim and the sepals. The stamen filaments are more prominent than for *L. scoparium* cultivars. These filaments, and the dark brown hypanthium disk, provide interesting contrast with the petals, which are characteristically crumpled like crepe. The spike-like character of the flowering branches suggests that they may be useful for floral arrangements, but unfortunately, as with *L. scoparium* cultivars, the flowers are likely to have a short vase life.

Kunzea sinclairii and *L. scoparium* both produce flowers earlier and are usually more floriferous at a younger age than is usually the case for *K. ericoides* (Harris et al., 1992). Consequently, *K.* 'Karo Hobson Choice' is also floriferous. Although it blooms freely in November and December at Lincoln, it has also produced some flowers in autumn and winter months in some years. Flowering is likely to be earlier in warmer parts of New Zealand, where the cultivar may also show more out-of-season flowering.

Old capsules can be unsightly for both *L. scoparium* and *K. ericoides*, although for some gardeners the architecture of the woody capsules of *L. scoparium* may provide an added interest. In studying wild *L. scoparium* I have observed that for some populations capsules develop, split, and shed their seed within a year. For other populations seed is held in capsules that do not open until their subtending branch dies through natural ageing or damage. Both *K. ericoides* and *K. sinclairii* have smaller non-woody capsules that shed their seed within a few months of flowering, but the open capsules remain attached to the plants for a year or more. x*Kunzspermum* 'Karo Hobson Choice' sheds its capsules within a few months of flowering, so the shrub is self-grooming. The shrub appears to be sterile.

The leaf form of *K.* 'Karo Hobson Choice' is like that of *L. scoparium*. It was because of this character that I first noticed the shrub as different from the others in the *K. sinclairii* population growing at Lincoln. The presence of silky hairs on the leaves is a feature of *K. sinclairii*, but this is also characteristic for the young leaves and stems of *L. scoparium*. Although the leaves of the hybrid are pungent, they are not as prickly as *L. scoparium* leaves. An added feature of *K.* 'Karo Hobson Choice' is its pleasant and distinctive aroma, which arises from essential oils released when the leaves are crushed. This aroma combines the more subtle pleasant juniper-like smell typical of *L. scoparium* and the eucalyptus-like smell characteristic of *K. ericoides* and *K. sinclairii*.

From its parentage, and its performance in frosty, windy, and droughty conditions at Lincoln, *K.* 'Karo Hobson Choice' can be regarded as a hardy shrub for New Zealand conditions. Distinctively infertile soil conditions have probably been important in the evolution and survival of *K. sinclairii* as an endemic species in the region of Mt Hobson (Harris et al., 1992). This adaptation may give the cultivar added tolerance to difficult soil conditions.

x*Kunzspermum* 'Karo Hobson Choice' shows some susceptibility to manuka blight and to damage to shoot tips by leafroller caterpillars. These are important disease and pest problems for *L. scoparium* cultivars (Metcalf, 1987). However the cultivar has acquired some of the resistance of *K. sinclairii* to manuka blight, and can tolerate the blight. Although blight has killed a large proportion of the *L. scoparium* from wild sources grown at Lincoln, its effect on the cultivar mainly shows as a blackening of the bark on older branches. x*Kunzspermum* 'Karo Hobson Choice' seems to be more susceptible to shoot tip damage by leafroller than *K. sinclairii*, possibly because the greater hairiness of the buds and young leaves of *K. sinclairii* acts as a deterrent to leafroller.

Collaborative evaluations with Elliot's Wholesale Nursery, Amberley, have shown that *K.* 'Karo Hobson Choice' can be successfully propagated from cuttings and raised as a container-grown plant. Consequently, it will soon be possible to make this unique plant available to those with particular interest in native plants, and to find out whether it has wider appeal to gardeners.

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Candied Chinese dates or 'honey jujubes' are commonly available in New Zealand supermarkets. They are the processed fruit of the Chinese date or jujube, *Ziziphus zizyphus* (L.) Karsten, which comes from China and has been cultivated there for more than 3,000 years. The Chinese date is one of the most important fruit crops in China, with an estimated 250,000 hectares of trees producing about 500,000 tonnes of fresh fruit annually. It is also cultivated in a number of other countries, particularly in areas with low rainfall. The fruit is eaten fresh or it is dried or processed.

The Genus *Ziziphus*

The Chinese date belongs to *Ziziphus*, a large genus in the family Rhamnaceae. The classification and nomenclature of the genus, like that of many other cultivated plants, is particularly confused.

Linnaeus had placed the Chinese date in the genus *Rhamnus*, giving it the name *R. zizyphus*. Miller, in 1754, shifted the species to a new genus which he called *Ziziphus*, following the spelling first used by the pre-Linnaean botanist Tournefort, and this genus is still accepted today. Lamarck later adopted the spelling *Zizyphus* from the specific name as used by Linnaeus. This incorrect spelling has, until recently, been the more common; it seems clear, however, that the generic name should be spelt *Ziziphus*, since this was the first to be validly published. The generic name is probably based on the Greek name 'zizyphon' (which then became 'zizyphus' in classical Latin), although some authors derive it from 'zizouf', the Arabic for *Z. lotus*.

There are possibly 100 species in the genus *Ziziphus*, which is widespread through America, Africa, the Middle East, Europe, Asia, and Australia. A few species yield useful timber, but the main value of most is for their fruit. Two species are commercially important:

- *Ziziphus mauritiana* Lam.

(*Z. jujuba* Lam., non Miller)

This is grown mainly in India, and is therefore often called the Indian jujube, although it is also grown in southern China and other south Asian countries. The most common Indian name is 'ber'.

- *Ziziphus zizyphus* (L.) Karsten

(*Rhamnus zizyphus* L.; *Z. jujuba* Mill.; *Z. sativa* Gaertn.; *Z. vulgaris* Lam.)

This is most widely grown in China and is often given the name Chinese date or Chinese jujube. Its Chinese name is 'zao' (pronounced 'tsao') and this is usually included as part of Chinese cultivar names. In older European texts it may be called the 'common jujube'.

In most horticultural literature the Chinese date is referred to as *Zizyphus jujuba* Mill., but correction of the spelling of the generic name to that used by Miller means that the combination *Ziziphus zizyphus* (adopting the specific epithet *zizyphus* first used for the species by Linnaeus) is legitimate since it is not tautonymous, i.e., the two names are technically different, as they are spelt differently. To add to the confusion, the epithet *jujuba* has also been used for the Indian jujube, and that plant often appears under the binomial *Zizyphus jujuba* Lam. (Lamarck being the first author to use this combination for that plant).

Deciding on the appropriate name to use is a question for expert nomenclaturists (see A. Rehder in *Journal of the Arnold Arboretum* 3, 1922, p. 220), but it seems that *Ziziphus zizyphus* is the name that should be used for the Chinese date. This name is becoming more accepted – e.g., see the *Supplement* (1988) to the 8th edition of W.J. Bean, *Trees and Shrubs Hardy in the British Isles* – but much of the older literature appears muddled as, unless botanical authorities are cited, it is often very hard to determine whether it is the Chinese date or the Indian jujube that is being described.

The Indian jujube or ber (*Z. mauritiana*) is a spreading tree with dark green pubescent leaves and yellow or green fruit which can have a red blush. The flowers are borne in autumn, and the fruits mature in winter or early spring. The tree is normally evergreen, but the leaves are sometimes lost during the summer dry period, not in winter. The Indian jujube is sensitive to frost, and it is therefore restricted to more tropical areas.

The Chinese date or Chinese jujube (*Z. zizyphus*) tends to be a more upright tree with bright green, glabrous leaves. The tree is deciduous, losing its leaves in winter; it flowers in the spring, and the fruits mature in autumn. It is resistant to winter cold, and can grow in cool temperate areas such as Korea and the north of China.

Fruits of several other *Ziziphus* species are collected for eating. Fruits of *Z. lotus* (L.) Lam., which occurs naturally in the Mediterranean area, are edible if not particularly palatable; these have been identified as the fruits eaten by Homer's Lotophagi (lotus-eaters) of *The Odyssey*, engendering a dreamy forgetfulness. *Z. spina-christi* (L.) Desf., a small prickly tree likewise found around the Mediterranean and through the Middle East, is also valued for its fruit. It has been identified as one of the plants most likely to have provided Christ's crown of thorns. *Z. spinosa* (Bunge) Hu, closely related to *Z. zizyphus*, is a bad weed in parts of China. Its fruits are harvested from the wild because they are very rich in vitamin C (usually more than 1000 mg per100 g fresh weight) and the seed kernels have medicinal properties.

Common Names

The origin of the common name, Chinese date, is obvious. The fruit comes from China, and when dried or candied is often very reminiscent in size, shape, colour, and flavour of the fruit of the date palm (*Phoenix dactylifera*).

The older common name, jujube, is ultimately derived through French and Latin from the Greek 'zizyphon', likewise the origin of the generic name *Ziziphus*. From the Middle Ages onwards the name jujube was used for fruit of *Ziziphus* species growing in the countries bordering the Mediterranean. The fruit was used medicinally to soothe sore throats and as a remedy for coughs and, at one time, large quantities were imported into Britain from Provence and the Isles d'Hyrès for this purpose. The name jujube came to be used for lozenges made of gum arabic or gelatin and flavoured with, or in imitation of, this fruit. Eventually, by the middle of the nineteenth century, the connexion with the fruit was lost and 'jujube' was used simply for any lozenge or soft sweet. This usage was still common twenty or thirty years ago.

Origin and Domestication

Ziziphus zizyphus is thought to have originated in the middle Yellow River Valley (in the area included in the provinces of Shaanxi, Shanxi, Henan, Hebei, and Shangdong). This region contains most of the present plantings of

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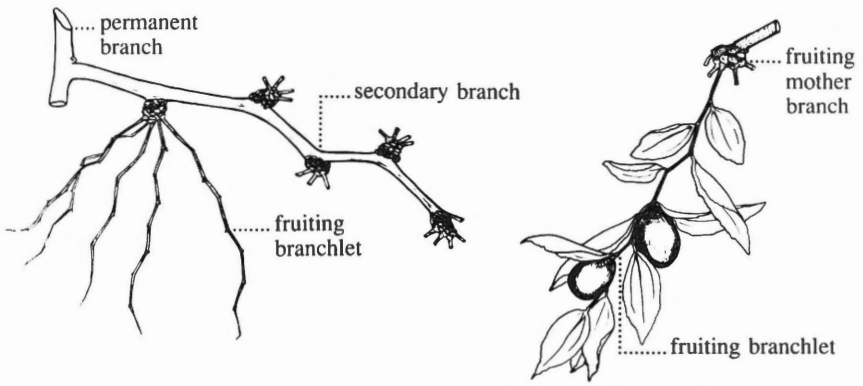

Fig. 1. Vegetative branching structure in Chinese date: *left*, permanent branch, secondary branch, fruiting mother branches, and fruiting branchlets (for clarity, the leaves and most fruiting branchlets are not shown; about one-quarter life-size); *right*, fruiting mother branch and fruiting branchlet with leaves and two fruits (most fruiting branchlets are not shown; about one-third life-size).

Table 1. Types of branches produced from vegetative buds of Chinese date.

Location of bud	*Type of bud*	*Vigour*	*Type of branch formed*
permanent branch growth	terminal	strong	permanent extension
		weak	fruiting mother branch
	axillary main	strong	new permanent branch
		weak	fruiting mother branch
	axillary lateral		secondary branch
secondary branch	axillary main		fruiting mother branch
	axillary lateral		fruiting branchlet
fruiting mother branch	terminal	very strong	new permanent branch (only occasionally)
		normal	extension growth of fruiting mother branch
	axillary lateral		fruiting branchlet

Chinese date, and is also the centre of distribution of *Z. spinosa*, the species most closely related to *Z. zizyphus* and thought to be the wild progenitor of the cultivated clones of *Z. zizyphus*. *Z. spinosa* is distinguished from *Z. zizyphus* by being a smaller, more shrubby plant with more spines, and by its fruit being smaller and rounder, less sweet, and having a different texture. These differences are not always clear-cut, however, and there is considerable morphological variation within the two species. It is debatable whether *Z. spinosa* should be maintained as a distinct species, especially as it is not now possible to identify any plants of *Z. zizyphus* that are unequivocally of wild origin.

The process of domestication must have been long and gradual. Good-fruited plants would have been collected or propagated from the wild, and their spread would have been assisted by the tendency of most plants to sucker vigorously. Propagation techniques such as grafting were well known to the early Chinese. Seed would have been planted, the good-fruited progeny kept and those with useless fruit discarded. Plants might have also escaped back into the wild. By the 6th Century A.D. Jia Sixie in the agricultural encyclopedia *Qi min yao shu* (Essential Arts for the People) recorded 45 selections of jujube, and there are similar reports in subsequent texts. The American plant explorer Frank Meyer estimated that in the early years of this century there were probably 300 or 400 named clones of Chinese date, and today there are some 400–500 local cultivars. These cultivars can vary greatly in growth requirements and behaviour, and our account below is therefore a generalised description of the Chinese date; individual cultivars may differ in some respects.

Vegetative Growth

The Chinese jujube grows into a shrub or a tall, handsome, upright tree 7–15 m in height. Young plants are often headed back to encourage the formation of a flatter, wider crown. Mature trees can resemble rather stiff silver birches; they can have an attractive weeping habit accentuated by the weight of the fruit pulling the branches towards the ground.

The trunk is dark grey with narrow furrows, but on younger branches the bark is smooth and reddish brown with a distinct bloom.

The patterns of branch growth in the Chinese date are extraordinarily complex, unlike those in any other fruiting plant, and as far as we know have not previously been described in English. Probably the most confusing feature is that in each leaf axil there are two types of bud: the main bud is a 'normal' bud, complete with bud scales, and can survive throughout winter; the lateral bud is smaller, lacks scales, and must continue growth the season that it is formed.

Different types of branches are produced by main buds and lateral buds, and the particular type of branch formed depends on the vigour of the bud, which in turn usually depends on its position on the plant. Fig. 1 and Table 1 summarise what is known.

(a) *Permanent branches.* These are strong shoots which come from strong main buds. Such shoots continue growing for many years, and develop into the permanent structure of the plant. Most axillary main buds along a strongly growing shoot remain dormant, but eventually the main shoot axis becomes less vigorous, the terminal bud becomes weaker, and extension growth is stopped by the formation of a terminal fruiting mother branch (see below). Axillary main buds further down the stem then break dormancy to produce strong shoots, which ultimately develop into new permanent branches. Occasionally, weak main buds along the shoot break dormancy and produce fruiting mother branches.

(b) *Secondary branches.* These are produced from strong lateral buds along the current extension growth of permanent branches. Secondary branches typically zigzag, because the direction of branch growth changes at each node. A secondary branch reaches its maximum length in its first year of life. The terminal growing point withers and dies by the end of this first year and, in successive years, distal parts of the branch tend to wither back to a node and die. Secondary branches growing from the lower part of the current growth of a permanent branch usually abscise completely at the end of the first season, but unless removed by pruning most other secondary branches survive for many years.

During the first year of life of a secondary branch the lateral buds at each axil grow into fruiting branchlets (see below), but the main buds in the leaf axils remain dormant until the following year, when they can produce fruiting mother branches (see below).

(c) *Fruiting mother branches.* These occasionally come from weak main buds on strong shoots (permanent branches), but most are produced by main buds of secondary branches. Fruiting mother branches look rather like conifer cones; they are very compressed shoots carrying not leaves but only a spiral of scales, in the axils of which are again main buds and lateral buds. Most of these main buds

remain dormant, but the lateral buds give rise in the same season to fruiting branchlets. The following year the terminal bud of the fruiting mother branch again makes very limited growth, allowing for a new whorl of up to ten fruiting branchlets. This process can continue until the fruiting mother branches are about ten years old, when they finally become non-productive. Fruiting mother branches sometimes branch or, if nutritional conditions are right (e.g., the tree is pruned back heavily), the terminal bud can shoot out to form a permanent branch.

(d) *Fruiting branchlets*. These are all derived from weak lateral buds, on either a secondary branch or a fruiting mother branch. It is these fruiting branchlets that actually carry the flowers and fruits. The branchlets are typically about 10 to 20 cm long and carry between 6 and 13 leaves and generally 1 to 3 fruits. The fruiting branchlets are deciduous, and may therefore be mistaken by casual observers for compound leaves; their true nature, however, is revealed by the axillary flowers and fruits. Although fruiting branchlets die in their first winter, they sometimes do not actually drop until the following spring.

Pruning methods are determined by patterns of fruiting. The best fruits are produced on fruiting branchlets coming from fruiting mother branches carried on secondary branches from permanent branches less than ten years old. One-tenth of the oldest permanent branches should be removed each year during winter pruning. When a permanent branch is pruned, the secondary branch below the cut is also pruned back to encourage the dormant axillary main bud on the permanent branch to break dormancy and form a new main shoot, which will become a replacement permanent branch. The tree can be trained to a certain shape, with or without a central leader, by training the permanent branches.

Young plants are generally spiny. The spines are modified stipules, and therefore occur at the base of the leaf stalks. They are usually in pairs of unequal length; the longer spine is straight and up to 3.5 cm long, the shorter is viciously recurved. A few cultivars have two recurved spines of the same size. As trees age they tend to produce fewer spines, and any spines that are produced are shorter and thinner and are apt to shrivel and fall. A few cultivars appear to be spineless, but this is because their spines are shorter, thinner, and softer, and drop early.

The leaves are alternate, usually 3 to 8 cm long, narrow, ovate to oblong lanceolate, with three prominent veins running from the base. The leaves tend to be leathery, smooth and glossy green above, somewhat paler below. Leaves turn bright yellow in autumn and fall early, usually before the fruiting branches themselves fall.

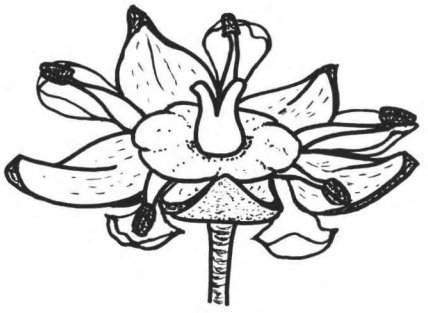

Fig. 2. Flower of Chinese date (about 5 mm across). The bifurcating style above the circular nectariferous disc is surrounded by five stamens, five small petals, and five large and prominent sepals. As the flower matures the petals and stamens flatten down.

Flowers

The abundant flowers are very small and insignificant, only about 0.5 cm in diameter (Fig. 2). They occur on the fruiting branchlets in small axillary clusters of up to about half a dozen. The flowers have five sepals, five petals, five stamens opposite the petals, a bilocular ovary, and a bifurcating style. They are a not particularly appealing yellowish-green colour, but are very attractive to pollinating insects as they produce copious quantities of concentrated nectar from the nectariferous disk; they also have a sweet, fragrant scent.

Flower buds differentiate in spring. Chinese dates are therefore unlike most other temperate fruit trees such as apples, pears, or peaches in which flower buds have differentiated by the previous autumn.

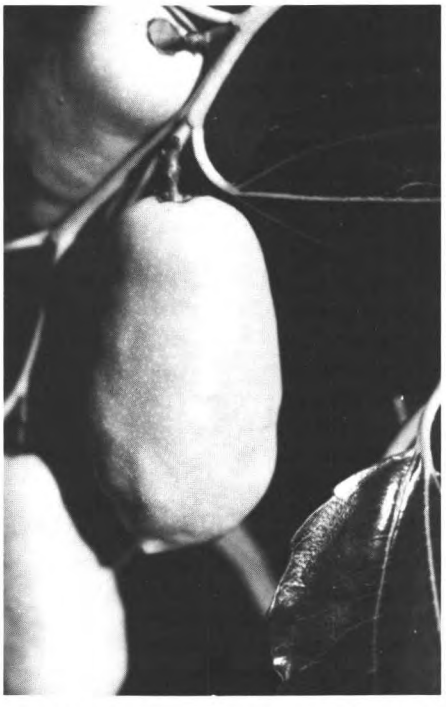

Fig. 3. Fruit of the cultivar 'Silverhill' (probable synonym 'Tiger's Tooth') approaching maturity as the skin becomes light green. Fruits are usually 3.5 to 4 cm long. (Photo Roger Meyer.)

Cultivars vary in the duration and intensity of flowering. Most plants have a very extended flowering season, but the period of fruit set is usually much more restricted. Several weeks may separate the first and last flowers within each axillary cluster. Furthermore, flowers in clusters near the base of a fruiting branchlet develop before those more distal on the branchlet. Early flowers often fail to set fruit because temperatures are too low; later flowers may not achieve the same size as those set earlier. Some clones will flower again if the fruits first set are lost through disease or damage. There are also clones which may flower several times during one growing season, and flowers, green (unripe) fruit, and red (ripe) fruit may be borne simultaneously on the same tree.

Although trees produce tremendous numbers of flowers, generally only 1 to 2 percent of the flowers actually set fruit. The reproductive biology of the Chinese date requires further study, but there seem to be several mechanisms to ensure cross-pollination.

- Most cultivars appear to be self-incompatible, although some can produce fruit from self-pollinated flowers or parthenocarpically. For home gardens it is obviously an advantage to have trees that are self-compatible or that set fruit parthenocarpically. Most of the cultivars widely grown in the United States appear to be self-compatible, in that many isolated trees set heavy crops.
- The flowers are protandrous, that is, the anthers dehisce and the pollen is released as soon as the flowers open, but it is only after some hours that the stigmata become exposed through the recurving of the upper parts of the styles, and that nectar is released. This helps ensure cross-pollination.
- Opening of the flowers on an individual plant appears to be synchronised, but clones can generally be divided into two classes, those with flowers opening early in the day and those that flower 6 to 12 hours later. The actual timing seems to depend on clone and on climatic conditions. Limited studies indicate that effective cross-pollination and fruit setting requires trees of opposite flowering types. Even this, however, is not always sufficient to guarantee good yields.

Introducing beehives into the orchard during flowering is a common practice to enhance fruit set. Girdling of the trees during or just prior to full bloom is a traditional way of increasing fruit set. In orchards in northern China, where it is often very dry during spring, farmers spray the flowers with fresh water to prevent premature desiccation and withering of the styles and stigmatic surfaces. An improved technique routinely

Fig. 4. Chinese dates bought in an Auckland Asian food shop. From left to right: red dates which have been allowed to dry after harvest; black dates which have been smoked; and large honey dates which have been cooked in a sugar solution (note the striations caused by cutting of the skin to allow the fruit flesh to absorb sugar solution). On the right, pitted honey dates, frequently available from supermarkets.

used today is to spray with 10 to 20 ppm gibberellin solutions.

Fruit Growth and Harvest

Botanically, the fruit of the Chinese date is like a drupe with a succulent flesh (pericarp) surrounding the stony endocarp. A small collar of tissue at the stalk end is derived from the nectariferous disc. The sweet whitish flesh encloses a hard two-seeded stone. The skin is thin and smooth (Fig. 3), becoming reddish brown and wrinkled on ripening.

In China the fruits mature during September and October (i.e., late summer to early autumn). The immature fruits have a green skin, and will not ripen if picked. Fruit picked later will continue to ripen after harvest. There are three main stages in fruit maturation and the use that is to be made of the fruit determines the stage at which it is harvested.

(a) *Skin whitish:* at this stage fruits achieve their maximum size and the skin changes from green to greenish-white (milky green), whereas the flesh remains a pale green. Fruits at this stage of maturity can be candied.

(b) *Crisp maturity:* patches of the skin turn brown, so that the fruits appear spotted, and eventually the skin becomes reddish-brown; the flesh changes from green to white, but is still hard and crisp. Fruits for consumption fresh are best harvested when about half the skin has turned brown. Fruits tend to ripen unevenly on the tree or after picking and, if they are to be eaten fresh, several harvests may be necessary. Experiments have shown that an alternative would be to harvest fruits when the skin becomes whitish and then ripen them by treatment with ethylene, if permitted.

(c) *Full maturity:* the skin changes to a dark red, the fruit becomes wrinkled, and the flesh is yellowish, soft, and spongy. The sugar content reaches a maximum. Fruit at this stage can be harvested for drying.

Fruit harvested at the earlier stages of maturity is usually picked by hand. Fruit that is to be dried can be left on the tree until it drops. Traditionally, Chinese dates were harvested by knocking the tree with a stick, followed by collection of fruit from the ground. Some growers in China have now adopted techniques in which trees are sprayed with ethylene-producing chemicals about two weeks before harvest. A large sheet is placed on the ground under the tree to catch fruits dislodged by vigorously shaking the trunk.

The skin of the Chinese date is relatively tough, and the fruit is easily handled or stored. Research in California has shown that it can be stored for several months at 10°C without significant loss of quality, but it is susceptible to chilling injury if held at temperatures below 2.2°C. It can also develop surface moulds if cool stored. Dried fruit can be stored for up to a year.

Fruit Composition and Processing

The fresh fruit has a high sugar content, higher than in most other fruit, but only low titratable acidity. As a result the fruit, although pleasantly sweet, may seem insipid to some tastes, and the high dry matter content (25 to 35 percent fresh weight), mainly sugars, means that the fruit tends to be rather mealy. The dried fruit can have a remarkably high sugar content, as much as 70 to 80 percent fresh weight.

Nutritionally the single most valuable attribute of the fruit is its high concentration of vitamin C, between 400 and 1000 mg per 100 g fresh weight. This is much higher than in most other fruit: 80 to 100 times the concentrations in apples, 10 to 20 times that in citrus fruits, and 5 to 10 times that in 'Hayward' kiwifruit. The fruit also contains high concentrations of phenolics (responsible for the brown colour) and rutin, sometimes ascribed 'vitamin P' activity.

In China, possibly half the fruit produced is dried, and roughly equal quantities of the remainder is eaten fresh or is processed. The red dates (Fig. 3) sometimes available in New Zealand shops are Chinese dates that have been allowed to dry after harvest, usually under cover. In China, red dates are eaten directly as such or they are incorporated into cakes or breads or other dishes. Honey dates are usually much larger fruits which have been cooked in a sugar solution and sometimes flavoured with honey. Traditionally the surface of the entire fruit was scored with thin knives to allow the sugar syrup to penetrate the fruit, plumping it up and rendering it more succulent. The honey dates most readily available in New Zealand supermarkets have been pitted, and are a deep brown colour. Black dates are less common; they have been smoked. Small quantities of fruit are canned in syrup or preserved in spirits.

Both the fruit and the seed have been used medicinally in China – the fruits are considered to be beneficial to body metabolism and the vascular system, and the seeds have sedative properties. A variety of pharmacologically active compounds have been isolated from *Ziziphus* species.

Cultivation

The Chinese date is one of the toughest and most tolerant of all fruit trees, being able to withstand very poor growing conditions. It can take a remarkable amount of neglect without apparent harm, and can survive drought, extended periods of waterlogging, and temperature extremes as low as –30°C or as high as 50°C. It flowers at least a month after most other fruit trees, and production is therefore not usually affected by spring frosts. The toughness of the Chinese date should not, however, be exaggerated; it grows best in hot climates where, after adequate rain early in the growing season, the summer is long, hot, and dry, there is plenty of sunshine, and nights are warm. Drought may result in fruit drop, and the plant responds to appropriate irrigation with an increase in both growth and crop yield. It prefers sandy loams or lighter soils, but will grow on heavier clays and can tolerate saline, alkaline, or slightly acid soils. Vegetative growth and cropping are usually poorer in areas with cool damp summers, and rain during the period of fruit maturation can cause the fruit of some cultivars to split.

The adaptability of the Chinese date is shown by the range of conditions under

which it grows in China. In the north, trees are found mainly in the mountains or hills, especially in stony areas or wasteland, but they are also planted on the coastal saline soils as shelter belts around narrow wheat or cotton fields. This type of dual cropping is effective because the Chinese date is slow to break dormancy in spring, and its late-developing canopy does not inhibit early growth of the crop. The trees also bear more fruit under these conditions than when growing in an orchard, probably because they get more sunshine and fresh air. Further south in China, trees can also be found growing on the banks between rice paddies. Comparatively few trees are planted out in regular orchards. Planting distances in such orchards depend on the cultivars grown, but would average within row spacings of about 4.5 to 6 m, with the rows 6 to 7.5 m apart.

The Chinese date starts producing good crops at an early age. Most grafted trees bear some fruit in the season they were grafted, and in orchards of the cultivar 'Li Zao' yields can reach 23 tonnes per hectare only three seasons after grafting. Yields tend to be consistent, with little evidence of alternate (biennial) bearing. Such yields are exceptional, and neglected trees, as often found in many parts of China, would carry far less fruit.

The Chinese date is one of the most important fruit crops in China. Apples, citrus, and pears are by far the most important, and then – in order of total production – come bananas, grapes, persimmons, pineapples, and the Chinese date. Most Chinese dates are produced in the north, in the provinces of Hebei, Shandong, Shanxi, Henan, and Shaanxi, with considerably smaller amounts from Gansu. Appreciable quantities are also produced further south in Hunan, Anhui, Hubei, and Guangxi.

Propagation

Until recently the Chinese date was propagated primarily by root suckers, since most trees sucker very readily, especially if the ground is tilled. Now, however, more and more farmers graft or bud onto seedling rootstocks. Seed of Chinese date can be used, but fruit of the closely related *Z. spinosa* more often contains viable seed, and these are frequently used instead. The stones are collected in the autumn, stratified over winter, and sown in a seedbed in spring. Although the stone contains two embryos, usually only one seedling develops. The seedlings can be budded in early autumn or grafted the following spring. More than 95 percent of grafts take successfully if scionwood is coated with a thin layer of wax. Chinese dates have been successfully propagated by tissue culture, but attempts to root hardwood cuttings have generally failed.

Cultivars

There are 400 to 500 cultivars of Chinese date in China, but all are of local distribution and none is grown throughout the whole country. Cultivars selected for the north may grow well in provinces to the south but not crop satisfactorily; the converse is also true. The cultivar grown depends on the use made of the fruit. Smaller fruits are often dried, and these need to have a high sugar content when ripe. Fruits which are to be candied need not be sweet, but they should be large, and the flesh should be spongy so that it can absorb the sugar solution used in processing. Other cultivars have fruits which are best eaten fresh.

There is enormous variation amongst the cultivars available. Fruits usually weigh 10 to 20 g (about the size of a cherry), but in some cultivars may weigh up to 50 g (the size of a smallish plum or apricot). Fruit shape is also variable, from mainly ovoid in many clones to ellipsoid, up to about 5 cm long. The fruits are sometimes flat or constricted, and one cultivar even has fruits shaped like a teapot. There are several stoneless cultivars with a kernel so soft that it is almost imperceptible when eaten. A particularly promising cultivar is 'Zanhuang Dao Zao', a triploid from Hebei – the only known triploid Chinese date – which has good-quality, large fruits weighing more than 25 g, and which is very tolerant of drought or barren soil. Several cultivars also have ornamental potential – one, 'Tai Li Hong' ('Embryonic Red'), has fruits which are purple-red throughout most of the growing season; others, e.g., 'Long Zhao Zao' ('Dragon's Claw') have peculiarly gnarled and twisted or falling branches. A national germplasm repository for Chinese date has recently been established in Shanxi Province.

The Chinese Date outside China

The Chinese date has been cultivated longest in China, its probable place of origin, but over the last several thousand years it has spread into neighbouring countries such as Korea, Vietnam, and Burma and areas formerly in Soviet Asia. By the beginning of the Christian era it had been taken to Syria, probably along the Silk Road, the main pathway of communication and trade between China and the countries of the Mediterranean. According to Pliny the Chinese date was then introduced from Syria to Italy and Sicily during the reign of the Emperor Augustus. Plantings subsequently spread throughout southern Europe and northern Africa. The olive-sized fruits from seedling trees are still sold in southern Europe today. In Provence three main cultivars are grown, one with large yellow fruits which has been there for centuries and two Chinese cultivars. Similarly in North Africa the main cultivars now grown are of Chinese origin, including 'Lang' ('Lang Zao') and 'Li' ('Li Zao').

The Chinese date was first introduced to the United States of America from Europe in 1837, and separate introductions were made from Europe to California and neighbouring states by 1876. These were mainly seedlings producing only small, poor-quality fruit. During the period 1908 to 1914 the plant explorer Frank Meyer sent more than 80 of the best cultivars of Chinese date from China to the United States. Notable amongst the cultivars introduced were 'Li' and 'Lang'. These introductions were the source of much of the material planted in different countries throughout the world. The Chinese date adapted well to conditions in the United States, particularly drier areas, and has naturalised along the Gulf Coast from Alabama to Louisiana. A few small orchards have been established, but the Chinese date is still largely limited to home backyards in the southeast and southwest, largely because of unfamiliarity with the fruit and insufficient information on how to grow the plant. Orchardists in California get good prices for their fresh fruit, up to U.S.$3.00 per kg retail; their best customers are Vietnamese immigrants.

In Australia the potential of the Chinese date as a fruit tree for semi-arid regions is being assessed. Cultivars have been imported from both the United States and Italy.

Plants are occasionally seen in gardens in New Zealand. Since the Chinese date prefers cold winters and hot, dry summers and dislikes high humidity, suitable growing areas are probably restricted to the east coast of the North and South Islands. The potential for commercial orchards is probably limited, the fruit being supplied mainly as confectionary or to health food shops. The increasing numbers of recent immigrants from Taiwan and Hong Kong could also provide a worthwhile market for the fresh fruit. For home gardens, however, ornamental cultivars or cultivars that are parthenocarpic could be attractive but undemanding trees for drier districts. S.N. Dawes, then of Fruit Research Division, DSIR, imported seed and also scionwood of the cultivar 'Li' about 30 years ago. The late Dr Don McKenzie also imported some material. A few trees were planted at the Hort-Research orchards at Havelock North and Clyde, and have made reasonable growth. However, the trees at Clyde flower very late in the season (January) and do not seem to have borne fruit. Trees have also been planted in Marlborough. It would be worth testing other cultivars of Chinese date in New Zealand, preferably using material from countries other than China; in its homeland, the Chinese date is attacked by a number of pests and diseases.

Acknowledgements

We thank Roger Meyer, 16531 Mt Shelly, Fountain Valley, California for his detailed comments on the manuscript and for allowing us to publish some of his photographs. Mr Meyer's nursery sells many different Chinese date cultivars, including some originally introduced into the United States by Frank Meyer. We also thank W.R. Sykes (Landcare Research) for helping confirm the botanical nomenclature.

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Book Reviews

The Dry Garden: Gardening with drought-tolerant plants by Jane Taylor, Godwit Press, Auckland, New Zealand, 1993, ISBN 0-908877-27-7, price $59.95.

This book appears to be a direct reprint of *Plants for dry gardens*, first published in the United Kingdom this year. Ms Taylor is a well known gardening writer, justifiably respected for her knowledge, her accuracy, and her style. Her previous books have proved most popular, and this new book has also been well received overseas. It appears to have been written for the international market, with great emphasis being placed on hardiness zones (although these are rather perfunctorily defined, without maps of the zones). The question, then, is whether this is a suitable book for New Zealand.

Many parts of New Zealand, especially those east of the main divide, have relatively low rainfall and can suffer extended dry periods. Even in much wetter areas, such as Auckland, gardens may require frequent watering during the summer, particularly those gardens that are on lighter soils. For gardeners in this country, the main use of this book is probably indicated by the subtitle, *Gardening with drought-tolerant plants*. A knowledge of which plants can tolerate drought, which look good under dry conditions, and which can withstand the owners' absence on extended summer holidays can only be very helpful.

A wide range of plants are described under the logical headings of trees and shrubs, conifers, palms and cycads, climbers, perennials and ephemerals, bulbs, grasses, succulents, and xeropytes. All this in just on 160 pages. The inevitable consequence is that many of the descriptions are very brief, often with cursory, indeed superficial, information as to the plant's form and the growing conditions required. Here, I would have preferred more details as to the amount of water needed than hardiness. Other important information is also not included, e.g., very sparse details are given as to the eventual size of the trees and shrubs.

The plants listed vary greatly in their suitability for New Zealand gardens – some would be only half-hardy in the north, others are only too well adapted to our growing conditions. Jack Hobbs in his rather cautious introduction issues a public health warning about 18 of the genera listed. Certainly gardeners here would be ill advised to follow the advice that the Chinese privet (*Ligustrum lucidum*) is "even more beautiful... an indispensable tree or large shrub for dry or desert gardens wherever the winters are mild enough for it to thrive." Even more misleading for novice gardeners in this country is the comment that "*Crocosmia* x *crocosmiflora*, the montbretia, increases fast to form weed-excluding carpets of narrow, arching, fresh green sword leaves." Weed-excluders are too often weeds under another name. Expected plants are missing – for example, proteas, leucodendrons, leucospermums, and many of the South African bulbs that do so well in much of New Zealand. These problems are perhaps inevitable when a book is written for many different markets with gardens having such different growing conditions.

The Dry Garden is very well produced: the binding is strong, the type good and clear, the layout most attractive. There is a pleasing absence of misprints, and Ms Taylor has obviously made a special effort to check nomenclature and adopt more recent changes. Many of the photographs are superb, and most are informative, giving a reliable indication of the plant. Some I found most irritating, being just out of focus; these appear to be mostly by the one photographer.

The back cover of *The Dry Garden* states that "this is the first guide to choosing plants that will flourish during water shortages." This is certainly not true, and I can think of a number of books on gardens for drier climates or on Mediterranean plants. A good example is Beth Chatto's *The Dry Garden* (J.M. Dent, 1978), which is almost dowdy in comparison, but much richer in detail and especially valuable for its discussion of general principles.

I enjoyed reading Jane Taylor's *The Dry Garden*. It is well written and attractive, it made me think, it gave me ideas as to what plants to try, it was certainly good browsing on a cold and wet night during the Auckland winter. I would recommend it, and would be happy to lend my copy. However, it doesn't compare with some other books on the same subject. Now Beth Chatto's book is one to *treasure*, one to be lent to only trusted gardening friends who are also rapid readers!

Ross Ferguson

The Cultivation of New Zealand Plants by Lawrie Metcalf. Godwit Press Ltd, Auckland, New Zealand, 1993. ISBN 0-908877-23-4.

Over the past thirty years Lawrie Metcalf has made an enormous contribution to our understanding and enjoyment of native plants. He is perhaps best known to New Zealanders for his landmark publication *The Cultivation of New Zealand Trees and Shrubs*, a book that bridged the gap between horticulture and botany. Less known has been his work for the RNZIH as convenor of the Nomen-clature Committee overseeing the publication of checklists of native plant cultivars. He is currently working on the *Hebe* checklist, a massive undertaking which includes over 900 cultivars. It is planned to publish this in 1994.

Lawrie Metcalf is one of New Zealand's great plantsmen, whose knowledge of plants has been gained from study in their natural habitat as well as in cultivation. This knowledge is reflected in his latest book, *The Cultivation of New Zealand Plants*, which deals with herbaceous plants, ferns, grasses, grass-like plants, and small shrubs. This book, as he explains in the introduction, has had a long gestation, and was originally scheduled to appear soon after the publication of *The Cultivation of New Zealand Trees and Shrubs*. Work pressures and later a deteriorating economy meant it was put on hold. With the publication of this book and the recent updating of the book on trees and shrubs, Metcalf has put the cap on a remarkable career.

The format of the book follows closely that of its sister publication. Part 1 contains a general introduction to growing the plants, including methods of cultivation and propagation. Detailed information is given about alpine and shade houses and the construction of scree and moraine gardens. Finally, a useful chapter on plants for different situations and problems that are likely to occur and how they can be remedied.

Part 2 contains an alphabetical listing of the genera, followed by general information about propagation, cultivation and pest and disease problems. Then follows a botanical description of the garden worthy species and/or cultivars in that genus, including detailed information on the cultivation of these plants. All in all it provides information on 114 genera and over 360 species.

The book concludes with a comprehensive glossary and a chapter on early botanists and horticulturists and their role in introducing N.Z. natives into cultivation.

Having used Metcalf's first book as a standard text for many years, I find it invaluable to have the same treatment applied to the rest of the higher plant flora. The strength of this book is the linking of botanical and ecological information with cultural details. With the plethora of gardening books on the market today it is refreshing to find one that deals with a subject in real depth and relies on first-hand quality information rather than the regurgitation and lack of research common in many popular publications.

The book covers well known as well as rarely cultivated plants and will certainly encourage people to grow a wider range of natives. One of the problems that will always remain, however, is how people can get hold of the plants. A short list of suppliers would have been helpful, especially details of the New Zealand Alpine Garden Society, an organisation that produces an excellent seed list.

Metcalf mentions at the start the difficulty of choosing which plants to put in the book. There are always going to be pressures on space and not everyone will agree with the choice. Certainly the selection is comprehensive and includes many of the plants successfully grown at Otari and recognised as being garden-worthy. It also includes plants that we aren't growing now but that would be worth trying. A couple of conspicuous omissions include *Aciphylla squarrosa*, a very useful species that is hardy and easy to grow, if not quite as showy as some of the other Spaniards such as *A. glaucescens*. Also omitted, possibly because of publishing deadlines, are the new Jury *Celmisia* hybrids that are easily grown and provide spectacular flowering during spring.

Congratulations too for the excellent colour photographs in the centre of the book, which complement the text so well and provide the proof that our flora is anything but boring. The variation in foliage, form and flowers is staggering.

Having used the book I find it hard to criticise it except in one fundamental area, that being its title. It is downright confusing, and many staff who looked at the book and who were unfamiliar with its sister publication got horribly confused looking for trees and shrubs. Not every book buyer reads the introduction and dust cover before buying it, and I'm sure some readers and buyers are going to be disappointed when they find out it isn't what it says it is. I can see the reasons for calling it 'plants', but I believe a mistake was made, and it should have been called what it is, 'The Cultivation of N.Z. Herbaceous Plants, Ferns, and Grasses'.

In concluding, I would recommend that anyone serious about natives and wanting to increase the number they grow should read this book and use it. Together with its companion volume (with which I hope it will soon be sold as a set) it offers the most comprehensive horticultural treatment of New Zealand plants ever published.

Mike Oates

Discovering Herbs by Kay N. Sanecki. No. 89 in the 'Discovering' Series. Shire Publications, U.K. Fifth edition, 1993. ISBN 0-7478-0198-3.

Discovering Herbs gives sensible advice on the growing of herbs, evidently taken from first-hand experience.

It is a soft-cover book of A5 size. It begins by describing what constitutes a herb, and traces the history of herbs to the present day. General growth requirements, propagation methods, and planting ideas follow. Thorough and detailed descriptions are given on how and when to harvest and store herbs.

The main body of the book consists of 78 pages devoted to 118 individual herbs and their related species and cultivars, with suggestions for their growth and use. The book finishes with short sections on cooking with herbs and making potpourri. A section entitled 'Herb Gardens Today' describes gardens to visit around Britain, and includes a surprising number of disparaging remarks.

Addresses of sixteen Collections of herbal relevance under the auspices of the National Council for the Conservation of Plants and Gardens are given, followed by a list of further reading.

The index is quite inadequate, as it does not list botanical names. This is astonishing, considering the horticultural background of the author.

Herbs are currently in vogue, and the market is flooded with books on the topic. So many of these are 'coffee table' books, full of glossy pictures but very little useful information, with botanical accuracy and cultural advice in particular often lacking. However, Kay Sanecki's emphasis is on growing herbs, and accounts of associated myths and legends are avoided.

Botanical names are used throughout the text, including family names (although many of these are now obsolete). Forty-one photographs illustrate the 120 pages of text. They are acknowledged to the Iris Hardwick Library of Photographs, and would benefit from being either larger or in colour.

Most of the listed plants are available and may be grown in New Zealand. Also, most of the cultural information is relevant, provided the seasons are reversed for the Southern Hemisphere.

Kay Sanecki gives up-to-date information on modern drug uses and research involving herbs, and states which practices are now obsolete. I was glad to see a caution on the need for correct identification and preparation methods for herbs, especially for medicinal purposes. She also rightly advises against depleting wildflower populations by collecting in the wild.

The most valuable features of this book are the cultural advice and the herb growing ideas. However, *Discovering Herbs* is probably of most use to beginners. Experienced New Zealand gardeners wanting a book on growing herbs would do better buying a book written for growing N.Z. herbs under N.Z. conditions.

Marian Jones

Stem and Branch: Patterns of Tree-planting in Central Canterbury since 1852 Part 2. The Plains

Derrick Rooney
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By the early 1850s much of the Canterbury plains had been settled. These windswept grasslands and shrublands had little natural shelter, and far-sighted settlers soon recognised that without treeplanting there was little hope of successful farming, or even of comfortable living.

Early planting records kept on some properties, and early nursery catalogues, show that a very wide range of tree species was tried. For a time, the French maritime pine (*Pinus pinaster*) was vigorously promoted. Only a handful of specimens planted before the turn of the century survive, and most have been disfigured or badly damaged by wind or snow. In Canterbury, *P. pinaster* proved unsuitable for shelter as well as intolerant of the climate. As it ages it sheds its lower branches, whereas a good shelter tree retains a low sweep of branches throughout its life.

A block of fine old specimens of *Pinus pinaster* in Hagley Park, near Deans Avenue, has undergone extensive tree-surgery in recent years and remains a well-known feature of Christchurch, but few attractive mature French maritime pines are to be seen elsewhere in the region. Most resemble the few storm-battered specimens, possibly a little younger than the Hagley Park trees, that grow alongside the main south railway line between Templeton and Weedons.

Surviving plantings on the old estates, and old shelter belts on farms that were once part of larger properties, clearly indicate that a distinctive Canterbury pattern of planting, with most of the tree rows oriented towards shelter from the north-west winds, evolved quite quickly. The choice of species was also settled quite early; *Pinus radiata* and *Cupressus macrocarpa* are still the most prominent tree species on the plains.

Sir John Hall, of Terrace Station, Hororata, was an influential figure in the development of shelter and farm forestry in Canterbury. Numerous old shelterbelts on properties as far inland as Windwhistle which were once part of Terrace Station are an indication of this. Descendants of Sir John Hall still farm Terrace Station, and although it is now reduced from its original 12,000 ha to about 450 ha, it still includes old woodlot and shelter plantings that reflect both Sir John Hall's willingness to experiment and his readiness to learn. Near the old woolshed, which has been declared an historic building, part of a small experimental planting has survived. There is a French maritime pine in this block but, like many in Canterbury, it has had its top blown out and is quite misshapen. Nearby is a fine big-cone pine, *Pinus coulteri*, 25.6 m tall by 96 cm dbh (diameter breast-high), but this is dwarfed by a manna gum (*Eucalyptus viminalis*), a massive, rounded tree some 26.8 m tall, with a dbh of 190 cm.

Another unusual planting is a shelter belt featuring the digger pine (*P. sabiniana*), in a mixture with eucalypts and more common conifers.

An extensive woodlot of deciduous English trees is another feature of Terrace Station. On its fringes are huge old radiata pines (the largest measured is 46.6 m tall and 174.5 cm dbh), plus *Cupressus macrocarpa* and more big-cone pines.

Near the homestead, the ornamental plantings feature a splendid evergreen oak (*Quercus canariensis*) 30.2 m tall by 116 cm dbh. A Douglas fir in the woodlot measures 40.2 m by 133.4 cm.

The Point Station, at Windwhistle, was taken up in 1852 by the Studholme brothers and sold in 1862 to Henry Phillips, whose descendants still farm the property and the nearby Rockwood Station, which Phillips took up in 1852.

Tucked underneath the Rockwood Range and overlooking the Rakaia Gorge, the Point homestead, built in the early 1860s (the only improvements on the property when Phillips bought it were stockyards and a shepherd's hut near the western boundary), is situated on a low ridge which affords excellent frost drainage. This creates a favourable microclimate for the growth of rhododendrons and other shrubs. As well as these introduced plants, the Point garden includes a good collection of native shrubs and alpine and subalpine plants, gathered by the late F.D. Richards.

The homestead and its garden are sheltered from the north-west by massive old trees planted by Phillips in the 1860s. One of the most impressive of these is the brown barrel (*Eucalyptus fraxinoides*). Some 46.3 m tall, it measures 258 cm dbh, but the measurement is inflated by massive fluting and buttressing in the trunk. A nearby wellingtonia, or big tree (*Sequoiadendron giganteum*) is bulkier, at a solid 244 cm dbh and 37.47 m. A *Pinus radiata* in an outer row exposed to the north-west has a dbh of164 cm and is 47.2 m tall. There are others almost as big. Larch planted in the lee of the pines have also grown very large; one is 42.6 m tall and 94 cm dbh. It is the biggest larch I have seen in Central Canterbury. Some of these trees were planted initially to shelter a skating pond, which is still in regular use in winter.

A field maple (*Acer campestre*) nearer the house is also a notable specimen, rivalling the field maple in the Christchurch Botanic Gardens which has been described (Burstall and Sale, 1984) as the biggest in the country. The field maple at the Point is 20.1 m by 84 cm. Although most of the ornamental trees near the homestead have survived, most of the woodlots planted by Henry Phillips and his son, T.A. Phillips, have matured and been felled. However, a spectacular stand of trees is preserved near the woolshed. This contains numerous wellingtonias averaging just over 40 m in height; one is 211 cm dbh. The ponderosa pines, mentioned earlier, stand on the north-west edge of this woodlot. Gunbarrel straight despite their exposure to the wind, they are of splendid form – lightly branched, with narrow crowns. Most of them are 140 cm to 145 cm dbh, and their height averages just over 49 m.

Quite clearly, the ponderosa is a tree that thrives at higher altitudes and away from the coastal influence in New Zealand. The irony of this is that when a mature woodlot including a number of ponderosa pines was felled at the Point in 1991, no sawmill was prepared to buy the splendid large logs. Although ponderosa pine is a major timber species in western North America, its timber when grown in New Zealand is of poor quality. It has low tensile strength, low density, and exudes resin which repels paint. The soft core causes uneven shrinkage as the timber dries. Its only end uses in this country are for pallets or boxwood. This is unfortunate, given the magnificent potential for growth of ponderosa pine in the South Island high country.

While the Phillips family, of the Point and Rockwood, and the Halls of Terrace Station were influencing the development and design of shelter and ornamental plantings on the high plains and foothills, the Deans of Homebush were exercising perhaps an even stronger influence over the patterns of tree-planting on the central plains.

Fig. 1. *Eucalyptus fastigata* at the Point, Windwhistle; 46.3 m tall, 258 cm dbh. The late F.D. Richards is standing in front of the tree, which was probably planted in the 1860s.

Homebush station, near Darfield, was settled by the Deans family in October 1851. The two brothers, William and John, had begun farming at Riccarton, Christchurch, some eight years earlier (the first European settlers on the Canterbury plains) and had rented from the Maori all the land within 10 km of their 162 ha freeholding at Riccarton. A patch of forest included in the Riccarton holding was preserved by the family and subsequently given to the nation. Now known as Riccarton Bush, it is unique in that it is the only remaining example of the Canterbury flood-plain forest community which once covered up to 100,000 ha on the plains (much of this original forest had been destroyed by natural disasters or Polynesian fires long before Europeans arrived).

The Deans family's leasehold covered all the land that had been selected by the Canterbury Association for the city of Christchurch, and after much negotiation (and eventually intervention by the Governor, Sir George Grey) the Canterbury Association allowed them to select a much larger run in the hinterland, in exchange for the lease.

The brothers chose run 41, not only the closest of the foothills runs to Christchurch but also one of the best, with its sheltered homestead site, and a natural stream which was subsequently dammed to provide a reliable water supply. The Deans named the run 'Homebush.' Originally, Homebush station included about 13,500 ha, but it was divided among the family in the early 1900s, and parts of it were subsequently sold. The homestead block, which contains numerous huge old trees planted by the first two generations of Deans at Homebush, is now occupied by Mr James Deans (III), who represents the fifth generation of his family to farm the property.

At one time the Homebush property, which carried 3000 cattle in the 1870s and 12,000 sheep in the 1880s, also included a coalmine and a brickworks, and directly or indirectly employed some 300 people. The Deans family has produced a number of outstanding sportsmen, including several All Blacks, but it is primarily as men of the trees that the earlier generations of Deans are remembered.

Without doubt, one of the finest woodlots in New Zealand is on the slope behind

Fig. 2. *Populus* x *deltoides* 'Virginiana' at Homebush. This tree was brought to New Zealand in a wardian case in 1852.

the Homebush woolshed – a distinctive building, adjacent to State Highway 72, built from bricks produced in the Glentunnel brickworks when it was owned by the Deans family. There are no trees around the woolshed; this area was deliberately left bare of shelter so that the yards where sheep are mustered for shearing remain as dry and airy as possible (R.G. Deans, pers. comm.).

The woodlot begins at the foot of the slope. Dominated by conifers, it includes a massive macrocarpa, some 171 cm dbh (in 1991) with a massive cylindrical stem rising more than 16 m to the first branch. This tree lacks the fluting and buttressing that often diminishes the value of old macrocarpas, and is widely regarded among foresters as a model for the silvicultural potential of the species (D.L. Franklin, pers. comm.). Planted – according to family records – about 1860, it is unfortunately now showing signs of incipient decline; it has flattened out at the top, and although its diameter is still increasing slowly, it appears to have lost its top in recent years. I measured it in August 1991, with the help of Mr H.H. Deans, at 39 m tall and 171 cm dbh. At least three measurements were taken from each of several different aspects to ensure accuracy; earlier heights recorded by Burstall were 41 m in 1969 and 41.4 m in 1982. The days of this magnificent tree may, alas, be numbered. However, in the oldest woodlot on the Homebush estate (on the south bank of the stream near the homestead) there is a macrocarpa of the same age which gives every appearance of still growing vigorously; its height, 52.4 m, makes it the tallest tree measured in Central Canterbury and almost certainly the tallest macrocarpa in the world.

There are many other big old trees on the Homebush property. One is the biggest *Pinus radiata* in Central Canterbury; planted in 1860, it is near the tallest macrocarpa and is not far short of it in height: 50.5 m. Its diameter at breast height was 187 cm in 1991, and its form is excellent.

In the woolshed woodlot there are stately ponderosa pines, now about 130 years old (the biggest is 49.3 m tall and 134 cm dbh), and a small group of Norway spruce, *Picea abies*, which includes probably the tallest Norway spruce in New Zealand, at 34.7 m. Its dbh is an impressive 95.6 cm. At the foot of the hill, adjoining a ride (originally planned as a habitat for feathered game), is a row of limes (*Tilia*

Fig. 3. Tallest macrocarpa in the world? A good stick, too; a splendid specimen 52.4 m tall in the oldest woodlot on Homebush station.

x *europaea*), which appear to have been coppiced at some time; all are multi-stemmed, an unusual habit of growth for the lime. The tallest of them is 25 m; all are within a metre or so of this height.

The homestead plantings include a number of fine rhododendron hybrids raised by James Deans (II), and a few rarities, including the 'Kentish Red' cherry, which I have not seen anywhere else (it is now growing in my own garden also). But they are dominated by big old trees, including a magnificent necklace poplar (*Populus* x *deltoides* 'Virginiana') which is the oldest tree at Homebush and one of the oldest of New Zealand's outstanding exotic trees. It was imported as a young plant from England in a wardian case (a type of glass box in which plants were packed for long-distance sea transport) in 1852. Despite storm damage to its crown in recent years (necklace poplar is notoriously brittle) it is still growing well; in 1991 it measured 198.3 cm dbh and 44.2 m tall. Cuttings of this tree were distributed throughout New Zealand and one of its progeny, in Frimley Park, Hastings, has exceeded its parent in both height and girth (Burstall and Sale, 1984). Other fine specimen trees at Homebush include a Himalayan cedar, *Cedrus deodara*, of 28.9 m by119 cm, an outstanding Turkey oak, slim and shapely (32.3 m tall), and a large whitebeam (*Sorbus aria*), an uncommon tree in New Zealand (18.6 m by 47 cm).

When the Deans family took up the property, indigenous black beech (*Nothofagus solandrii*) grew on the slope behind the house (a few beech still grow there). Exotic trees also thrived on the slope, and within 100 m of the homestead there are several outstanding Douglas fir, among which the tallest is about 51 m by 136.3 cm. Measured by Burstall at 48.7 m in 1967, this tree subsequently lost its top (H.H. Deans, pers. comm.). However, it appears to be growing strongly again. The trunk was clear-pruned to 15.2 m by forestry trainees in 1933, about the same time as the macrocarpa in the woolshed woodlot was pruned. Another Douglas fir in the group is 138.3 cm but is not as tall.

Among the species planted by the Deans which have since been adopted as reliable and useful trees for the dry Canterbury plains is the Atlas cedar, *Cedrus atlantica*. A tree of this species in a group behind the old orchard where the Kentish cherries are growing is probably the tallest Atlas cedar in New Zealand, at 40.2 m (98.5 cm dbh). Mr H.H. Deans, father of the present occupant of the property, recalls that his father planted this grove of cedars between 1905 and 1910. An older Atlas cedar, on the lawn in front of the homestead, is also a good specimen (29.2 m by 110 cm).

The Atlas cedar is now recognised as one of the primary shelter trees in Canterbury, and is often associated with radiata pine in a two-row shelter design developed by Mr P.W. Smail at Hororata from the 1950s and now widely used in Canterbury. Shelter belts of this design are side-trimmed mechanically (but never topped) by truck-mounted hydraulic flail cutters which can reach up 14 m. Regular trimming reduces the branch size and prevents the pines from overshading the slower-growing cedars.

When properly fenced from grazing stock, shelter belts of this type retain good, healthy foliage right to ground level. Although the pines are never topped, their crowns do not 'flatten out' like those of isolated pines. This is probably because of the regular trimming and consequent retention of a large amount of foliage lower in the trees. Because the belts have a moderate degree of permeability there is no wind turbulence in their lee, and they provide ideal shelter for livestock. Pasture growth may also be enhanced; studies by Dr Joan Radcliffe on Mr Smail's former property, 'Linton', showed increases of between 10 and 30 percent in dry-matter yields from pasture in sheltered paddocks.

Regular trimming restricts branch size, and on maturity logs from this type of shelter belt can fetch prices comparable to those of pruned logs. In the late 1980s, when log prices were lower than they are now, pines in this type of shelter belt were showing a mean annual increment equivalent to about $1000 a hectare (P.W. Smail, pers. comm.).

Pine shelter belts of the older design gradually lose their lower branches and become less effective after 40 to 50 years, on which they are generally clear-felled, with a consequent loss of shelter for several years while new trees are established. In the two-row, fast-slow concept, shelter is designed to remain efficient for up to a century; effectively, for the useful life of the slower-growing species. As many as four crops of pines may be planted and harvested in the life span of the cedars, and throughout this time shelter is continuously available.

While two-row, fast-slow shelter design is a modern concept, made possible by the machinery used to implement it, its development can be directly related to the discoveries made in pioneer plantings where species selection was a question of trial and error but lessons were learned quickly, and pragmatism was the mother of invention.

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John Luscombe - a Pioneer Hybridiser of *Hebe* and *Rhododendron*

Peter B. Heenan

Manaaki Whenua - Landcare Research, P.O. Box 69, Lincoln, New Zealand

Introduction

In Britain during the mid 1830s the introduction to gardens of the recently described *Hebe speciosa* (A. Cunn.) Ckn. et Allan (as *Veronica speciosa*) was waited upon with excited anticipation (Anonymous, 1836), indicating at that early date the high regard in which *Hebe* were already held as ornamental plants. The exact date of introduction for *Hebe speciosa* is not known, but it was before 1844, as in that year living plants were recorded as being introduced to Britain from Hokianga, New Zealand, by John Edgerley (Curtis and Hooker, 1844). *Hebe elliptica* (Forst. f.) Pennell was the first *Hebe* to be cultivated when it was introduced from the Falkland Islands in 1776 (Anonymous, 1793-95). Another important introduction for horticulturists was *H. stricta* (Benth.) L. B. Moore, as *Veronica lindleyana* Paxt. (Heenan, 1993), which was introduced as seed by Thomas Cleghorn in October 1843 from an unrecorded New Zealand locality.

With these three distinctive species in cultivation by the mid 1840s the logical development of the genus as a garden plant was to raise new forms by artificial hybridisation. The first suggestion of a hybridising programme was made in reference to increasing the variation of flower colour in *Hebe speciosa* and *H. salicifolia* (M., 1847). This recommendation was prompted by the observation of an *H. speciosa* "hybrid" whose flowers were distinct from typical *H. speciosa* in being "a rich deep rose-red." M. (1847) surmised that "the habit of *salicifolia* is, perhaps, all that can be desired, and if to this can be added a more distinct . . . colour . . . a plant would be produced, than which it seems difficult to conceive anything of the kind more beautiful." Anonymous (1850a) also observed that "it is well worth attention to impregnate the flowers (of *Veronica*) with each other in order to obtain other handsome varieties."

The first artificial *Hebe* hybrid was almost certainly bred by Isaac Anderson-Henry of Maryfield, Edinburgh, Scotland, who raised *Hebe* x *andersonii* 'Andersonii' by crossing *H. stricta* (female) with *H. speciosa* (male) (Anderson-Henry, 1868; Heenan, 1993) in 1848 (Anonymous, 1851; D., 1887). This plant was exhibited by Messrs Henderson, nurserymen, at a meeting of the Royal Horticultural Society (RHS) held in London on 6 November 1849 (Anonymous, 1850b).

Isaac Anderson-Henry's success in raising *Hebe* x *andersonii* 'Andersonii' appears to have prompted John Luscombe, of Combe Royal, Kingsbridge, Devon, England, to establish his own *Hebe* hybridisation programme. This paper reviews Luscombe's unique contribution to *Hebe** and also *Rhododendron* hybridisation and provides a biography of Luscombe.

John Luscombe the Hybridiser

John Luscombe, writing under the pseudonym 'A Devonian' (see below), suggested in 1850 that a "distinct race might be originated between *V. speciosa* and *V. decussata*." He further added, "I have . . . been seeking in vain for a stray flower or two with which to make the experiment, the blooming season being towards the end of May, so that *speciosa* must be brought on in heat to effect the union" (Devonian, 1850).

It is likely that Luscombe envisaged producing a hybrid that combined the distinctive flower colour of the shy-flowering *Hebe speciosa* with the free-flowering habit of *H. elliptica*. In particular, two pieces of information indicate that this may be the case. Firstly, Luscombe had observed that H. *elliptica* was a species that "blooms freely in this neighbourhood" (Devonian, 1850). Secondly, another of Luscombe's earlier selections, *H.* 'Kermesina', appears to have been selected because it was noted to flower at a much younger age than typical *H. speciosa*, the putative parent, which was often regarded as being shy-flowering (Loudon, 1855). Also, *Hebe speciosa* was regarded by some horticulturists as a being a poor garden plant that "speedily fell into unmerited disrepute" (Alpha, 1852) shortly after its introduction. Establishing a hybridisation programme would be a practical way to improve on those qualities that it did have.

It was another six years before the results of Luscombe's hybridisation experiments were made known when he sent a specimen of a putative hybrid to the editor of the *Gardeners' Chronicle*. Devonian (1856c) wrote "I send you a specimen of a new *Veronica*, a hybrid between *V. decussata* and a seedling from *V. speciosa*, by which you will perceive that the habit of the former is maintained, thus improving *speciosa*, while the colour is quite distinct from that of both parents." The editor adds that the flowers had a lilac colour.

Luscombe raised plants from several crosses, as in 1859 he sent further plant specimens to the editor of the *Gardeners' Chronicle* (Devonian, 1859). One specimen, labelled No. 1, was stated to be "of the first batch of seedlings, and is perfectly hardy with me, forming a very neat evergreen shrub, 4 feet high, and about 22 feet in circumference." The editor describes the flowers as having deep lilac, violet-tinged blossoms. Three similarities indicate that specimen No. 1 is probably from the same plant that Luscombe sent to the *Gardeners' Chronicle* in 1856. Firstly, the mature dimensions given for specimen No. 1 indicate that it was raised several years earlier; secondly, that it is from the first batch of seedlings; and thirdly, but somewhat tenuously, the lilac flower colour could be interpreted to be similar to deep lilac violet. Additional support for this suggestion is that two Luscombe references (Devonian, 1856c, 1859) refer to only one plant of *H. elliptica* and *H. speciosa* parentage.

Luscombe did not name this hybrid in any of his articles. An appropriate name does not seem to have been provided until 1865, when the name *Hebe* 'Devoniana Caerulea Multiflora' was published with the description "dark violet and white" (Anonymous, 1865). In this same article is the cultivar name *H.* 'Multiflora' with an identical description to that for *H.* 'Devoniana Caerulea Multiflora'. An extensive search of the early horticultural literature has not found any other reference to these cultivar names except for a reprint of the 1865 article (Anonymous, 1877). The connection between the hybrid raised by Luscombe and *H.* 'Devoniana Caerulea Multiflora' is established on the basis that the name "Devoniana" is a reference to Luscombe's

*The name *Hebe* replaces *Veronica* in all contexts except where *Veronica* is used in quotations from original sources. Likewises, current species names are adopted except where old names are given in original quotes. For plant dimensions, the original Imperial measure (feet, inches) is given where appropriate to the context.

pseudonym, and that "Caerulea" can be interpreted as a similar colour to deep lilac violet and lilac. Thus, from the available evidence it would seem that *H.* 'Devoniana Caerulea Multiflora' is a legitimate name for the *H. elliptica* x *H. speciosa* hybrid raised by Luscombe, and that *H.* 'Multiflora' is a synonym.

Because of the paucity of information on either the Luscombe hybrid or *Hebe* 'Devoniana Caerulea Multiflora' it is not known how widely this plant was cultivated. However, a hybrid between *H. speciosa* and *H. elliptica* with large, pinky purple flowers is still cultivated in Britain and has been referred to by Chalk (1988) as *H.* x 'Franciscana'. Of special interest is that Chalk (1988) attributed this plant to having been raised by 'Devonian'. In New Zealand two different cultivars are grown under the name *H.* 'Blue Gem', and neither of these corresponds with the original description for *H.* 'Blue Gem'. One of these cultivars is almost certainly *H.* 'Lobelioides', but the second is of unknown name and origin, and may prove to be *H.* 'Devoniana Caerulea Multiflora' (Heenan, 1993). Research is under way to clarify the relationship between *H.* 'Franciscana' of Chalk (1988), the unnamed New Zealand cultivar, and *H.* 'Devoniana Caerulea Multiflora'.

A second hybrid raised by Luscombe, "*Veronica decussata* var. *devoniana*", has a detailed and more accurate history of cultivation. This cultivar was first described by Anonymous (1857a) and then described and illustrated in colour by Planche (1858) (Fig. 1) and Anonymous (1857b). Moreover, the most detailed description is provided by Williams (1869), where it is characterised as "a fine variety of close compact habit; the leaves are larger than those of the species, and of a rich dark green. The flowers are freely produced in large terminal heads, and are pure white. A garden hybrid."

An examination of Luscombe's publications indicates that *Hebe* 'Devoniana' is likely to have been a selection of "second crosses from *decussata*" which were distinguished by "a far more floriferous habit" (Devonian, 1859). It is not recorded when these "second crosses" were made and what the second parent was. In comparison with the Luscombe *H. elliptica* x *H. speciosa* hybrid they are described as being "smaller plants" with "smaller leaves" (Devonian, 1859).

Hebe 'Devoniana' was distributed by the RHS in a plant ballot scheme on 21 June 1859 (31 plants) and 22 May 1860 (40 plants). In the 1860 distribution the applicant numbers exceeded the number of available plants, so the 40 successful applicants are listed (Anonymous, 1860). Also, it was offered for over 20 years by Veitch's Nursery, as they listed "*Veronica decussata* (*devoniana*)", without a description, in their *Catalogue of hardy trees, shrubs, coniferae, American plants etc.* for the years 1874–75, 1881–82, 1882–83, 1885–86, 1888–89, and 1895. Other references indicating that it was widely cultivated include Williams (1869) and Anonymous (1885).

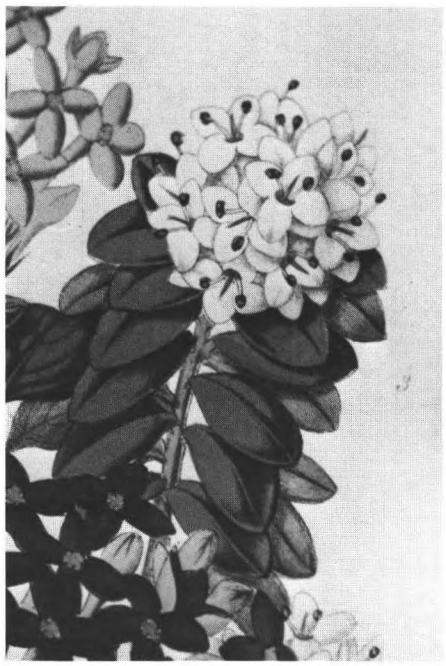

Fig. 1. *Hebe* 'Devoniana', raised by John Luscombe and not known to be in cultivation today. Photograph reproduced from the *Journal d'Horticulture Pratique de la Belgique,* n.s. ii, 2: 242–243 (1858).

Although the last known reference to *Hebe* 'Devoniana' was in Veitch's Nursery catalogue of 1895, the available evidence indicates that it was a widely cultivated plant before then, and it is therefore likely that it could still be in cultivation today. If it is cultivated today it is likely that it would be as *H. elliptica,* and that it would perhaps be recognised as a free-flowering form with a different habit of growth than is typical for the species.

The third cultivar raised by Luscombe was *Hebe* 'Kermesina', which is said to be "perfectly distinct from the parent", *H. speciosa* (Devonian, 1850). The flowers of this cultivar have been variously described as a rose-colour having mingled with the violet (Devonian, 1850); a rose colour (Anonymous, 1850a); and a deep purplish-crimson (Loudon, 1855). Loudon (1855) noted that plants of this cultivar blossom when young, which is not usually the case with *H. speciosa*, and that it was distributed by Lucombe, Pince and Co. of Exeter. Despite *H.* 'Kermesina' being listed in the Veitch Nursery catalogue of 1873–74 and being cultivated at the Adelaide Botanic Garden, Australia, in 1878 (Schomburgk, 1878), it does not appear to have become widely established in cultivation. It is not known to be in cultivation today.

Index Kewensis (Jackson, 1895) lists *Hebe* 'Kermesina' as a synonym of *H. speciosa*. However, as it is a gardener's selection with a distinctive flower colour and an early flowering habit on young plants, it is acceptable as a legitimate cultivar under the International Code of Nomenclature for Cultivated Plants (Brickell et al., 1980). Also, because of the significant difference in colour from typical *H. speciosa* it is likely that this is a hybrid, with *H. speciosa* as the female parent, and as such it should not be regarded as a cultivar of that species. The second parent remains unknown.

Luscombe was also a very keen cultivator of *Rhododendron,* and he raised several hybrids that were given cultivar names. His first hybrids were raised from *R. arboreum*, and were bred several years before 1863, as in that year he recorded that they "have not bloomed as freely as usual" (Devonian, 1863). These hybrids do not appear to have been given cultivar names and the other parent is not recorded.

John Luscombe was one of the first horticulturists to hybridise the *Rhododendron* species which were introduced to cultivation by J.D. Hooker from Sikkim, India, in 1850. He was fortunate to have received a collection of these plants from W.J. Hooker (Devonian, 1863). From a *R. griffithianum* cross he raised *R.* 'Coombe Royal', which received an Award of Merit from the RHS when shown by Veitch Nursery in 1900. He also crossed *R. thomsonii* with *R. fortunei* about 1880 to produce *R.* 'Luscombei' (Watson, 1892) and *R.* 'Devoniense' (Bean, 1976). As inferred by their name, at least three other cultivars are referable to Luscombe; these are *R.* 'Luscombe's Scarlet', *R.* 'Luscombe's Sanguineum' (Fletcher, 1958), and *R.* 'Luscombei Splendens' (Bean, 1976).

For an amateur enthusiast Luscombe's hybridising programme was an intensive and significant operation as in 1881 he had "some hundreds" of hybrid *Rhododendron* seedlings waiting to bloom (Mangles, 1881). A further indication of his hybridising thoughts, and intuition of what would make a good garden plant, is his suggestion to cross the free-flowering and hardy *R. blandfordiflorum* with orange and yellow flowers with a "free-seeding white or crimson variety" (Devonian, 1863). Luscombe is said to have used *R. hookeri* for hybridising (Millais, 1924), but no evidence exists to confirm this.

The cultivars raised by Luscombe have had a significant impact on the development of *Rhododendron* as a garden plant, as they have been used in subsequent breeding programmes. For example, *R.* 'Luscombei' is a parent of *R.* 'George Taylor', *R.* 'Betty King', *R.* 'Betty Royal', *R.* 'Right Royal', and *R.* 'Robert Keir'; and *R.* 'Coombe Royal' is a parent of *R.* 'Mrs

G.W. Leek' and *R.* 'Mrs Charles E. Pearson' (Fletcher, 1958).

Luscombe was the first to flower the Chinese *Rhododendron fortunei* in cultivation. The plant collector Fortune (1812–1880) introduced the seed of this species, which he gave to Glendennings Nursery and was raised by them in 1856. They auctioned their plants of *R. fortunei* in 1859, and Luscombe purchased one. This plant flowered in May 1866, and later that year a specimen provided by Luscombe was illustrated in the *Botanical Magazine* (Hooker, 1866).

Unfortunately, there appears to be some confusion in the literature as to the correct identity of John Luscombe in regard to his *Rhododendron* breeding efforts. Bean (1976, p. 872) gives the raiser of *R.* 'Luscombei' as a Thomas Luscombe, and Cox and Cox (1988) as T. Luscombe. However, Bean (1976, p. 824) has already credited John Luscombe as the raiser of this hybrid. The first use of T. Luscombe appears to have been by Millais (1924), where T. Luscombe of Combe Royal is acknowledged as having raised several hybrids.

Further confusion surrounds *Rhododendron* 'Luscombei', with Fletcher (1958) stating that it was bred by G. Luscombe, and Salley and Greer (1986) that it was displayed by G. Luscombe. It has not been determined who G. Luscombe is, but from the information presented in this paper it is almost certain that these hybrids were all raised by John Luscombe. These errors may have also been the result of faulty typesetting or transcription from the original manuscript.

In summary, from this review of Luscombe's *Hebe* and *Rhododendron* breeding, it is evident that he used very specific and clearly defined criteria in his breeding programmes. He was astute enough to recognise particular attributes and merits of putative parent plants, and he also had the foresight to envisage what the progeny of a particular cross would look like. Implicit in these qualities is the ability to recognise and utilise the aesthetic attributes that both species and cultivars offer the gardener.

Fig. 2. The house at Combe Royal, Kingsbridge, Devon, where John Luscombe resided, is used today as an old people's home. (Photograph P.B. Heenan.)

John Luscombe (11 Oct 1806 to 29 Oct 1888)

John Luscombe was the eldest of seven children born to Sarah (nee Hawker) and John Luscombe Luscombe. He was born John Manning, but in 1813 (Anonymous, 1831) his father assumed under the will of his uncle and by royal license the surname Luscombe (Burke and Burke, 1886).

It is likely that he developed a keen interest in gardening and horticulture at an early age, as his father was particularly interested in the cultivation of citrus fruits, and he had developed a practice for successfully raising lemons and oranges from cuttings (Hawkins, 1822). John Luscombe Luscombe was awarded the Banksian Medal by the RHS in April 1827 for an exhibition of oranges, lemons, and citrons (Anonymous, 1871a).

Upon the death of his father on 10 January 1831 John Luscombe became the proprietor of the family estate, Combe Royal, at Kingsbridge, Devon, England (Fig. 2). About 1840 he commissioned a plan for redevelopment of the house, but this does not seem to have been carried out as no alterations are apparent (P.B.H., personal observation, May 1992). Nevertheless, John Luscombe does appear to have begun the development of an extensive garden at about that time (Edridge, undated).

John Luscombe was a member of the Royal Horticultural Society, as he is on their list of members for 1851, and in the *Proceedings of the Royal Horticultural Society* for December 1865 it is recorded that his subscription of £3 had been brought forward. In 1862 he donated a guinea towards the purchase of "French fountains or bronzes" at the RHS garden. He was also the recipient of two awards at RHS shows. Firstly, at the Grand Autumn Meeting in November 1858 he was awarded two prizes for exotic fruits, *Eugenia ugni* and *Physelis edulis*. Later, at the Azalea show on 9 April 1862 he was awarded 2nd equal prize in the miscellaneous class for "cut blooms of *Rhododendrons*, hybrids of *arboreum* and *cinnamonium* grown in the open air." (Anonymous, 1862).

He was also active in the Ballot for Plants scheme that was operated by the RHS and the distribution of which was published in the *Proceedings* for the years 1859–1869. During this period John Luscombe received 36 plants (Appendix 1), the diversity of which indicates his wide gardening interests, including glasshouse/conservatory plants, conifers, flowering shrubs, and perennials.

Luscombe, writing under the pseudonym 'A Devonian', contributed several articles to the *Gardeners' Chronicle* between 1842 and 1863. However, much mystery and anonymity has surrounded the identity of 'A Devonian' (Chalk, 1987; Metcalf, 1988). Fortunately, when Anonymous (1857a), Anonymous (1857b), and Planche (1858) described "*Veronica decussata* var. *devoniana*" they noted that it was raised by John Luscombe of Combe Royal, near Kingsbridge, Devon. These references, when considered with the articles by Devonian (1850, 1856, 1859, 1863), Beaton (1852), and Anonymous (1871a) establish that 'A Devonian' is the pseudonym of Luscombe.

Although it is Luscombe's writings on *Hebe* that are most relevant to this paper, his first article was on the plants that grew at Salcombe (Devonian, 1842), 10 kilometres south of Kingsbridge. This article is significant for the horticultural observations that are made on the flowering of *Agave americana* and on plants that were grown at the residences of Woodville and the Moult. It also reflects the development of Luscombe's horticultural interests and the garden at Combe Royal, as in this article he was writing on other people's gardens and plants. It would seem that the Combe Royal garden and Luscombe's specialist interest in hybridising *Hebe* and *Rhododendron* had either not developed, or were only at an early stage. Supporting this view is the last sentence by Devonian (1842), which makes reference to Combe Royal having "fine specimens of orange, citron, shaddock, limes and lemons". These would have been established by his father, John

Luscombe Luscombe.

Several other articles were written by Luscombe, including brief notes on *Gelsemium sempervirens* (Devonian, 1848), the New Zealand lacebark (*Plagianthus regius*) and kakabeak (*Clianthus puniceus*) (Devonian, 1856a), and cut flowers for indoors (Devonian, 1856b). A short article describing the spring-flowering plants at Combe Royal includes astute observations on the rhododendrons he grew (Devonian, 1863).

By the 1870s the garden at Combe Royal had developed a fine reputation for growing a wide range of plants, in particular *Rhododendron*, and it was one of five Devon gardens described by Anonymous (1871a). This article was of such important local interest that it was included by Fox (1874) in a history of the Kingsbridge area. Edridge (undated) acknowledged Combe Royal as having one of the best collections of *Rhododendron* in Devon.

The *Kingsbridge Gazette* also published several articles that related to John Luscombe. Anonymous (1857c) recorded that at a meeting of the RHS in London on 13 October 1857 a paper was read from John Luscombe of the Lower Knowle at Combe Royal. To this meeting Luscombe had sent specimens of *Arundinaria falcata* that were nearly 20 feet in length, *Clerodendron foetidissimum*, and some blue-flowered *Hydrangea* specimens. Of particular interest was the technique Luscombe used to obtain the blue hydrangea flowers; they were pink-flowered varieties deliberately planted in acidic leaf mould produced by fir leaves. In 1868, at a show of the Cottage Garden Society, Luscombe exhibited *Gunnera scabra*, the stem of which measured 4 ft 3 inches high and the leaves 3 ft 2 inches by 4 ft 9 inches (Anonymous, 1868).

The Luscombes of Combe Royal were never ennobled, but Anonymous (1871a) observed on his visit that John Luscombe was of the "Devon gentry" as he was "civil, affable, kind, and courteous to strangers", and that the name Luscombe is "the grand old name of gentleman [sic]". The 1861 census for the Parish of West Alvington provides details of the Combe Royal residents and staff. At the time of the census John Luscombe (age 54, unmarried) the proprietor lived in the family home with his two sisters, Sarah (60, widowed) and Elizabeth (62, unmarried). They were assisted by five unmarried servants: a housekeeper, housemaid, cook, footman, and groom. In a lodge on the Combe Royal estate were an agricultural labourer and his wife and child. His employing a staff of five suggests that John Luscombe was of independent financial means.

Further evidence of Luscombe's financial position is provided in his will of 27 August 1886, where there is an extensive list of properties owned and leased out. The will lists "farms and lands called Wood, Farm Place, The Smith's Shop and all my cottages and gardens" of Woodleigh parish, and "all other . . . farmlands . . . in the said parishes of West Alvington . . . [and] . . . Charleton." John Luscombe also owned a house in Alvington, Torquay, to which he moved at an unknown date in his later life. This house may have been a family home, as on 8 December 1870 his sister Sally died in Torquay (from the will of Sally Luscombe, footnote of 11 February 1871). In November 1871 the Grand Duchess Marie of Russia, the Prince and Princess of Oldenberg, and their son Prince Peter rented the house for several weeks (Anonymous 1871b).

In later life John Luscombe's health deteriorated. When he made his last will and testament on 27 August 1886, over two years before his death, he could not sign the document "being unable from weakness in his hands to write his name" (from 27 August 1886 will). John Luscombe died of bronchitis and congestion of the lungs at Torquay, on 29 October 1888, aged 82. It is not known where he is buried, but it could be at Woodleigh, to the north of Kingsbridge, as that is where his father is probably buried (Anonymous, 1889). Further indication of a family plot at Woodleigh is provided in the will of Sally Luscombe, John's sister, dated 7 September 1859, when she requests to be buried at the churchyard of Woodleigh.

A death notice in the *Kingsbridge Gazette* (Anonymous, 1888) records something of his character: "The deceased gentleman took considerable interest in the collection of rare and tropical plants, and was also a collector of old china and other curiosities. He was very benevolent, being exceedingly kind to the poor, and a liberal supporter of all charitable and deserving institutions." From this statement it seems reasonable to assume that John Luscombe was a very humble, considerate, and kind person. Also, when it is considered that he wrote his gardening articles under the pseudonym 'A Devonian', he was probably a very shy and unassuming man who did not like undue attention. He was probably also a good employer, as in the 1861 census he had a footman by the name of John James Matthews, and when he wrote his final will in August 1886 Matthews was still in his employment as a valet. On Luscombe's death Matthews was to receive an annuity of sixty pounds.

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Appendix 1. Plants obtained by John Luscombe from the Royal Horticultural Society plant ballot lists, 1860–1868.

1860 *Glycine sinensis alba*
Gardenia florida var. *fortuniana*
Statice brassicaefolia

1861 *Gardenia* sp.
Begonia pallatantre
Goodia lotifolia
Spiraea callosa

1862 *Pleroma semidecandrum*
Aster (new double-crown two-coloured)
Abies nordmanniana
Amaryllis sp.
Cupressus goveniana

1863 *Gladiolus* sp.
Anemopoegma sp.
Manettia glabra
Pleroma sp.
Begonia sp.

1865 *Osmanthus ilicifolius*
Hippeastrum reticulatum
Peperomia sp.
Achimines sp.
Datura sp. (Weir No. 181)

1866 *Libonia floribunda*
Palicourea discolor
Peperomia arifolia
Philadelphus mexicanus
Saxifraga tricolor

1867 *Callixene radicans*
Cryptomeria elegans
Euonymus radicans variegata
Hedera canariensis folus aureus
Lastrea barnesh
Pelargonium 'The Rev. Joshua Dix'
Phoenix sylvestris

1868 *Thuja gigantea*

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Dracophyllums: Plants only for the Connoisseur?

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In most floras there are species that differ widely from their associates. They have special features that set them apart from the 'run of the mill' characteristics of the majority. For example, the long-lived and unusual form of Australia's grass trees or black boys (*Xanthorrhoea* spp.); the baobab (*Adansonia digitata*) of central southern Africa with its massive trunks up to 8 m in diameter; the fascinating, captivating Venus fly trap (*Dionaea muscipula*) from S.E. United States; and the distinctive, highly ornamental, but short lived silver tree (*Leucodendron argenteum*) of South Africa.

In my opinion New Zealand's representatives of atypical plants include most members of the near forty species of *Aciphylla*, commonly called speargrass or wild Spaniard. Their hummocks of rigid, sharply spine-tipped leaves are conspicuous in many areas of the alpine flora. In similar areas occur the equally unusual – indeed extraordinary-looking – vegetable sheep as seen in, for example, *Haastia pulvinaris* and *Raoulia eximia*. I am sure readers can think of other examples of 'out of the ordinary plants' of New Zealand. My final choice in this field is the subject of this article: I refer to our native dracophyllums, some called grass trees, others I call tree pineapples.

Dracophyllums are members of the Epacridaceae, a family of thirty-one genera and four hundred species centralised in Australasia. It is represented in New Zealand by six genera, including *Dracophyllum*. Usually leaves are small and ericoid, but in many *Dracophyllum* species they differ from the norm in having sizeable, long leaves. Also *Dracophyllum* leaves, to me, look more like those of monocotyledons, rather than their real category of dicotyledons.

In the *Flora of New Zealand* (Allan 1961) thirty-five species of *Dracophyllum* are described. Recent listings (unpublished) put the figure at twenty-four species plus nine infraspecific taxa. A few other species occur in temperate Australia and New Caledonia. Irrespective of the actual number of species involved, there is no doubt that the headquarters of the genus is New Zealand.

In nature, dracophyllums are found in moist lowland and montane forest and in subalpine/alpine scrub. They range from prostrate shrubs to medium-sized trees 10 m tall. Leaves vary from long and needle-like (hence 'grass trees') to those with a broad base (up to 3 cm) gradually narrowing over 50–60 cm to a slender tip. The latter are borne on rather widely spaced, candelabra-like branches and tend to be bunched at the terminals, akin to pineapple plants. In this form leaf colour ranges from green to dark red, the latter seen especially on young leaves. Light green, tinted pale orange, is seen in the leaves of some of the needle-like species.

Fig. 1. *Dracophyllum townsonii* (ex Paparoa Range, Nelson) was easy to establish and grew well. A tree of *D. longifolium* is in the background.

Fig. 2. A well established tree of *Dracophyllum browerii* at the Otari Plant Museum, Wellington.

Throughout the tribe individual flowers are small, but in some species these are slightly scented. Many flowers are cream, such as are seen on *D. longifolium,* whilst pale reddish flowers occur on the sizeable inflorescences of those with large leaves. My favourite for flower appeal is *D. strictum,* with its 8-cm-long pendulous, pink-flushed white racemes occurring at most times of the year. About 1 m tall, this species is very suitable for small home gardens. But this is not the only species of high garden potential, especially if one is looking for something out of the ordinary. Yet, throughout my thirty years spent in New Zealand, I have seen little evidence of their presence in parks and gardens. Is their absence due to difficulties in propagation, slow growth, plus unavailability through the trade? Conversely, am I alone in my view that dracophyllums offer good garden potential? Alas, from the growing aspect, there are difficulties.

When I arrived at the Otari Native Botanic Garden (previously Otari Native Plant Museum) in 1962 dracophyllums formed part of the collection. With all credit to Otari staff, when I retired twenty-nine years later the same specimens were still there. Once established, there would appear to be few difficulties in keeping them alive. Here is proof that, as small trees or shrubs, dracophyllums can be long-lived in gardens; and we know they can be exceptionally long-lived in nature, with *D. traversii* surviving in excess of 500 years. So, what facets of their cultivation present difficulties and seemingly limit their use in horticulture?

There appear to be two main impediments. Firstly, I found most species reluctant to grow from cuttings; the needle-like forms were easier in this respect. Aerial layering gave some success, though progress was slow. Terrestrial layering proved quicker, and a greater number took kindly to this method. However, although these vegetative methods of propagation may be useful where only small numbers of each type are required, for the trade larger quantities are needed, and therefore seed should be the answer.

Germination was achieved using seed collected from *D. latifolium, D. strictum,* and *D. traversii* as the capsules were splitting. The fine seed was sown

immediately in a substrate of equal parts soil, river sand, and peat. Shredded sphagnum moss was incorporated into the top 3 cm, and a thin layer of sphagnum covered the surface onto which the seed was sown. Drainage was plentiful, and the mixture was well watered before sowing.

After sowing, each pot was placed within a transparent plastic bag, with the top tied and kept taut above the pot. Subsequent condensation within the bag was able to run into the pot via the rim, and so to a certain extent the pots were self-watering. The containers stood on staging in a shade-house.

Most seed germinated within 40 to 60 days, but it was about 18 months before the seedlings were big enough to pot up. Now, 17 years on and growing in situ, the average maximum height of the tallest members of the trio (*D. traversii*) is about 1 m. Not fast growers; and this could be a reason (the second impediment) for their sparse appearance in commerce. However, even if this is the case, there are I feel compelling reasons to persevere with *Dracophyllum* plants for garden use.

As mentioned above, their longevity is an asset, and in the extensive period that specimens have been at Otari, in my time there, none of them showed symptoms of pests or diseases worth bothering about.

The old, fallen leaves of *D. traversii* were eagerly sought after by floral art enthusiasts. In fact, I recall on one occasion bundles of them being sold at a local horticultural show.

Given adequate light, dracophyllums rarely need pruning. Their form is usually compact and well balanced. Apart from a little dieback and removal of old flower trusses, specimens at Otari did not need any pruning throughout nearly 30 years. Low maintenance is certainly what is required by most home gardeners these days. Also in their favour is their ability to transplant well. Many dracophyllums have wiry, fibrous root systems facilitating easy transplanting of specimens, say, 1.5 m tall.

The older plants at Otari are located in a large rock garden exposed to sun and wind. However, associate plants shade and shelter their basal portions, which at the same time helps to provide a cool root run.

Most of the young specimens are growing in a partially cleared bush area. The understorey was removed, leaving mature rimu, tawa, and rewarewa as partial shade trees. The 0.2 hectare block was divided into sections by pathways, and the individual plots were built up to 30 cm deep using equal parts soil, river sand, and peat. In line with the montane habitat of most species, the substrate was kept moist throughout the year. The pH varied from 5.5 to 6.5. The Chatham Islands forget-me-not still forms a ground cover beneath the dracophyllums.

Fig. 3. *Dracophyllum recurvum*, a procumbent shrub about 60 cm in height, is confined to certain North Island mountains. The attractive reddish coloration of the foliage spreads and deepens in autumn. This species has been difficult to establish under Wellington conditions.

Species which performed well in the lowland garden at Otari in my time were *arboreum, latifolium, longifolium, sinclairii, strictum, townsonii,* and *traversii*. In colder, elevated, wetter districts species from higher montane/subalpine regions would be worth trying, for example, *menziesii* and *recurvum*.

I hope from what has been said that more people may become aware of and interested in growing some of these architecturally different New Zealand plants. Certainly, their varied height and form would allow them a place in rock gardens, shrubberies and the likes of woodland gardens. Although not tried by me, I would have little doubt that the bushy, erect forms (e.g., *longifolium* and *sinclairii*) would look well and do well in containers.

Of course, for most potential growers their only means of supply would be through the trade. Alas, from my experience of perusing nursery catalogues, as well as visiting many garden centres during the last five years, offerings of dracophyllums were sparse to nil. However, I did learn recently that a nursery in Tauranga offers *Dracophyllum* seedlings. I have no knowledge of the situation in the South Island.

I am aware that in the trade 'time is money' and a quick return is wanted on investments. Slow growers are costly to nurse along, and when eventually ready for sale are costly to buy, thus limiting sales. But how slow are some dracophyllums? A young specimen of *D. latifolium* growing in ideal conditions in the Otari Wild Garden put on about 15–23 cm of crown growth a year. *D. strictum* and a dwarf bush form of *D. longifolium* grew steadily, and produced up to 10 cm per season in their early years.

I think there is a misconception that many New Zealand woody plants are inherently slow growers. Yet recent reports speak of kauris in Auckland putting on over 1 m extension growth per year. I am aware of kahikatea in Wellington and on the Kapiti coast extending about 60 cm per season as young trees. Choosing the right spot is, of course, paramount to achieving these growth rates – plus, perhaps, the selection of faster-growing clones.

Hopefully someone, sometime, somewhere will carry out research into the propagation of dracophyllums and search out wild material that may hold promise of accelerated growth rates, especially in seedlings. I know there was variation in the growth rate of seedlings raised by me.

Failure to pursue these objectives may mean that appreciation of New Zealand's tribe of distinctive, dignified, and decorative dracophyllums (outside of native plant collections) may only be realised in nature's realm.

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Enhancing the Urban Environment: Enhancing the Quality of Life The Ian Galloway Memorial Lecture for 1993

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Public parks institutions throughout the world play a predominant role in providing certain intangible, often unheralded, but nevertheless highly evident elements in the urban environment. These make a community a pleasant place to live, an aspect in which every citizen takes abstract pride: one of the essential ingredients for what we know as 'the quality of life'.

I wish to share my perception of how public agencies have contributed to this quality of life through enhancement of the urban environment of New Plymouth. But, before doing so, let us look back a little.

Wherever man has created settlements, following his nomadic existence, he has had a need to recreate the great beauties of the natural environment he had enjoyed. I know something of that very urge, based on seeing several areas of unmodified natural beauty around the world. These include the rhododendron forests of Nepal, the wildflower meadows of Kashmir, the maple forests of Japan, and our natural forests of New Zealand. The emotional experience of these examples initiates a primitive urge to recreate some of the same environment at ones own home.

So, wherever man has developed communities and settlements, once primary needs of food, warmth, and shelter have been satisfied, he has set about recreating the environment he has known from previous experience. Trees, shrubs, and flowers have travelled the globe for centuries as a result of this.

With today's urban communities increasing in density – many of much greater density than we can ever imagine - the need to enhance the environment is very much a partnership between public agencies and property owners. Even those communities living in great poverty seek the chance to create shade and rest to improve the quality of life; for example, in the lowlands of Nepal every village has its chautara, complete with its shade-giving pipal and banyan trees.

There is also a correlation between the level of affluence and the extent of environmental enhancement. For example, any visitor to the teeming Indian town of Agra cannot but be surprised at the transformation of environment once you walk inside the gates of the Taj Mahal; to find such a revered monument set in a glorious garden, having seen the squalor of the town itself. Nearby Fatepur Sikri is just the same.

Some poorer communities make valiant efforts, such as a street in the city of Ina, where ginkgo trees line exceedingly narrow streets and paper blossoms celebrate the cherry flowering festival of Ohanami. Contrast this with nearby Takatoh Castle, with its cherries which draw 3 million visitors to sing, dance, and dine beneath the trees in the three-week flowering season of Ohanami.

So, wherever you go, you can see efforts made to enhance the urban environment. Probably the best example is Singapore, whose Greening Act has transformed its dense downtown areas and created microclimates which greatly enhance the quality of life, both aesthetically and in comfort terms.

New Zealand is no different. David Tannock, the 'father of New Zealand Parks', made this observation when presenting the Banks Lecture in Oamaru in 1941: "It is important that the Superintendent should show his skill and taste in gardening to as many of the citizens and visitors as possible. If they will not come to the gardens, the next best thing is to take the gardens to them and, in the squares, open spaces and odd corners to mass flowering plants so that everyone passing, in, out or through the town must see them. Everyone likes colour and the stronger, bolder and more striking the better. Planting trees adds further beauty to the streets . . ."

He advocated that a parks system should take its skills out into the streets and beyond the gates of the parks. It should tidy up weed-covered street corners and provide the community with beauty. Dunedin received its legacy of landscape charm from this far-seeing man. He lectured widely and inspired many of his successors. So was generated that too-rare phenomenon – community pride.

New Plymouth has been no less endowed with a succession of pioneer nurserymen and the desire of early settlers to recreate their 'piece of England' in their new home. This was aided by the movement of plants from the Pacific which were transported by missionaries and senior government officials to the gentry of the growing town. Today survivors of these introductions are the living monuments of our city.

Since 1876 it has also been enormously influenced by a succession of Parks people: Briedeker, Claffey, Smith, Horton, and Goodwin. Each of these men has made his contributions to urban enhancement in features we accept as part of the city landscape today.

So, what are the components which make up the matrix of elements collectively known as the 'urban landscape'?

To begin with, there are all those natural endowments which make up the landscape character of any site. New Plymouth is dominated by the windswept coast of the North Taranaki Bight and the cone of Mt Taranaki (Egmont) and its adjoining ranges, Pouakai and Kaitake. It receives ample rainfall from the north, from 1500 mm increasing as the land rises. There is a radial system of streams and valleys rising off the mountain and flowing swiftly to the sea, and ample fresh and even strong, salt-laden winds blow in from the west.

So, a landscape of many elevated sites, with views to the ever-changing sea and equally magnificent views of the mountain. Windswept ridges contrast with sheltered valleys. Generally, arterial street systems follow the ridges and, as a consequence, the valley system has created spaces for lineal areas of parkland – a different version of the green belt system.

Add to all this the free-draining, andesitic soils of New Plymouth, ample rainfall year-round, and only minor frost patterns and you can see that New Plymouth has been endowed with all the ingredients for a lush and rich vegetation which is evident in both natural and man-made plantings today.

The next component of the matrix of the urban landscape is our heritage of historic trees which survive from the efforts of our forefathers. For example, a pohutukawa was brought to New Plymouth in 1873 and now dominates the landscape (and one of our busiest lateral roads). Trees such as this are included in the District Plan, and New Plymouth has three hundred such trees registered in this way.

Whilst the District Plan provides three levels of protection, the success of this programme is based on the need to be responsive to the concerns of individual owners who live with these trees. Where problems arise, we must try to alleviate them and maintain the support and acceptance of the owner that the tree is of community value. Without this

understanding an owner may well decide to remove it, and "to hell with the District Scheme!" Once on the ground, no amount of redress will ever bring it back.

However, these historic trees do enhance the urban skyline from many points, and so must be encouraged and preserved. To this end we plan $10,000-worth of maintenance work under our Heritage Maintenance Programme in the coming year.

Another most important element in the matrix of the urban landscape is something which undoubtedly evolved over the last 150 years of experience in growing trees in New Plymouth. It illustrates the maxim of any landscape in any area: "do what you do well – and do it again."

The pohutukawa is a good example; it does not occur naturally in New Plymouth, but as the tree from 1873 shows, it has great potential for longevity and for dealing with our coastal winds. Successive generations have found this, and our coastal parks now feature notable groves of pohutukawa. Plantings in the 1920s by local park committees, planting of the late 30s and early 40s by Thomas Horton, plantings of the 1950s by John Goodwin in streets and parks, and plantings continuing to this day on many coastal and exposed sites. The only difference today is that we are using cuttings grown from selected clones of what we believe are the best, to achieve better form and the impact of identical flowering time.

It is not the only tree, and is joined by others, such as the Norfolk pine and evergreen magnolia, as notable exotic trees in our landscape. With these come the Australian *Banksia integrifolia* and the ever-useful *Agapanthus*.

But from our own endemic resource the mamaku, *Cyathea medullaris*, is one of New Plymouth's most distinctive plants, and perhaps distinguishes New Plymouth more than any other. Equally the puriri, *Vitex lucens*, retains much importance in our landscape. So the maxim "do what you do well – and do it often" is the cornerstone of public plantings, and provides the sense of unity and scale ever important in urban landscapes.

Using David Tannock's concept of bringing beauty to urban landscapes through planting is the next important aspect of our subject. This can be done in numerous ways.

The planting of street trees is one widely used mechanism, and was very common in early subdivisions with wide grass verges and with few services to bother the trees. Today this is becoming increasingly difficult because of the narrower street reserves and increased services under the grass verge. However, if you look at the record of such community pride programmes as 'Street of the Year', most winning streets have cared-for trees in the street itself.

Fig. 1. Mature trees have a major impact in the streetscape. Many such older trees are regarded as historic, and are registered under the District Scheme.

Where street trees are unable to be featured there arises a heavy reliance on the frontages of residential properties to provide trees and scale to the streetscape. In the days of Austin Mitchell's "quarter acre, half gallon, pavlova paradise" this was no problem, as many properties had room for trees of scale. As we see redevelopment of residential areas, with cross-leasing of property to create town housing lots, so the trees and the scale of the street landscape are progressively changing. There is thus more pressure on public spaces to fill the void.

Street reserves become important in providing trees of scale to enhance landscapes. So, too, does the need to ensure that the frontages of parks and reserves play their part.

Industrial sites and motorways have the potential to greatly enhance urban landscapes. Here are opportunities to convert what can be strictly utilitarian sites into useful features in a landscape. In many instances District Plan development permission requires a prescribed amount of landscape enhancement treatment. Sometimes this is woefully inadequate, as planners seek to extract the maximum utility area out of a site; but on the other hand many site owners take pride in their setting, acknowledging how important the image of their business is. Again, pride-promoting schemes such as 'Commercial Frontage of the Year' heighten awareness and recognise achievement in this area.

Fig. 2. Street beautification with tree planting softens the impact of new commercial development.

Fig. 3. The tree fern mamaku (*Cyathea medullaris*) is a dominant feature of the New Plymouth landscape.

Arterial roads and motorways can also become important urban landscape features which provide the visitor's first impression of a community. In these landscapes a broad scale is needed for form to register from a moving vehicle. So, large groups of subjects are required, rather than an anonymous mixture.

In the past the National Roads Board willingly contributed to costs of establishing and developing these plantings. But the advent of Transit New Zealand has meant that fewer resources are put into maintaining existing plantings, let alone enhancing them. Our Northgate entrance is an example of six months neglect because weeding of highway plantings is very low on the agenda. My Department cannot contract, even for the maintenance work. Environmental works are low on the funds agenda under new Transit New Zealand rules.

However, Transit New Zealand has no objection to local communities taking over and completing maintenance and beautification, provided that TNZ does not pay. Regrettably our pride and the importance of these spaces to communities will probably see another cost devolved onto local authorities where it used to be a fruitful bipartisan effort.

In recent years another upsurge in significant streetscape enhancement has taken place in the inner city and commercial areas. Traffic flows have been so planned that key inner areas are more pedestrian-friendly, rather than vehicle-dominated. While debate rages between retailers and planners about this change, no-one can doubt the transformation of inner city environment which has been achieved.

In New Plymouth a parallel arterial system running east and west on either side of the central business district has enabled a gradual change, with raised planters and the introduction of small trees into the streetscape. To provide an illusion of subtropical comfort we have introduced the *Kentia* palm which, though slow to establish, provides an ideal tree in the landscape. It is salt- and wind-hardy, elegant, and eventually has a crown which will stand above shop verandahs. Again, we have had to identify our strengths and build on them.

The final elements of the streetscape I wish to talk about are the views one gets from them. Many of our arterial streets follow the ridges above valleys, and whenever you go from ridge to ridge you inevitably cross a valley.

By and large our park system is situated in valleys, and many homes and streets look into, down, up, or across them. So, the urban landscape is continuously enhanced by the Parks system.

If you look across the New Plymouth Racecourse, the Pukekura and Brooklands Park sites provide a variable but continuing horizon of vegetation. If you look southwards up Liardet Street from the District Council building, the landscape is dominated by the trees of Pukekura Park.

On the other hand, across from Huatoki Street you look down upon a magnificent remnant of tawa forest. The Henui Walkway extends from the sea to the southern edge of residential development, and not only provides a wonderful 'oasis' within the city for all to enjoy but also, in turn, becomes the front room view of many houses which are on sites above the valley.

Our sportsgrounds too provide the opportunity not only for open space but for tree-enhanced views across the city to other public spaces and landscapes. So, while the primary reason for planting terraces is to beautify a park's own setting, there is a much wider community landscape benefit which results.

You can, therefore, see what an important role parks play, as one element of public spaces, in enhancing the urban landscape. Equally in the valley- and ridge-featured landscape of New Plymouth, as in Wellington, the views of residential sites assume much importance. Never has this been more emphasised than in those areas which have sea views; these are the most valued sites in the property market, and look over our most valued coastal public real estate.

Views for home owners are paramount, but quality tree plantings and development of our coastal estate are paramount for the community. Despite our endeavours to continue the coastal enhancement of foreshore parks, I can see growing pressure for such trees to be topped. In the future much stronger policies will have to be in place to protect the greater public interest, rather than the homes which have views.

It is, however, as with historic trees, a matter of discussion, education, responsiveness, and sometimes compromise. If not, the law will be taken into someone else's hands and trees removed or topped.

David Tannock, in his Banks Lecture, said "Everyone likes colour and the stronger, bolder and more striking, the better." I would agree; the use of display bedding in the streetscape brings the strongest element of reaction and support from your community. This is the one element which lightens the day and has much impact on sometimes drab landscapes. In my experience it is the single element on which community perception of a public parks system is based, so from a purely political point of view this is an area every parks person must pay attention to. For every complaint a Council has from its community that rates are too high, I have never heard one raised against the cost of urban landscape beautification that each community undertakes.

Over the course of this lecture I have tried to paint a picture of my community, and to highlight what is there for every other community – and that is that public agencies have a totally accepted and expected role to play in urban community landscapes. No other agency plays a more significant role in affecting the environments in which we live.

Each community must develop its own character. This is determined by its geography, climate, and location. Each community must build on its strengths to achieve the impact it needs to enhance the environment. Such impacts are not achieved overnight, but are a result of time, and of one generation building on the strengths of its predecessors.